

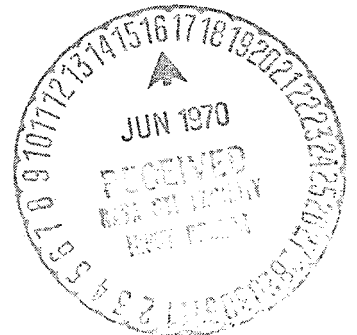
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**NONISENTROPIC  
FINITE-AMPLITUDE  
WAVE GENERATION**

***FINAL REPORT***



**Space Division**  
North American Rockwell

Prepared for  
George C. Marshall Space Flight Center  
Huntsville, Alabama 35812

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NONISENTROPIC FINITE-AMPLITUDE  
WAVE GENERATION  
FINAL REPORT

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## FOREWORD

The current extension of the subject relating to the study of nonisentropic finite amplitude wave generation was conducted by the Space Division of North American Rockwell Corporation for the National Aeronautics and Space Administration, Marshall Space Flight Center (MSFC), Huntsville, Alabama, under Contract NAS8-21406.

This report and the previous analytical studies of the subject matter were performed under the technical direction of G.A. Wilhold, Deputy Chief, Unsteady Gas Dynamics Branch, NASA MSFC.



### ABSTRACT

The problem of entropic gas flow effects is further extended, using the J-function theory, by means of the  $J_p$  and  $J_v$  processes and their respective work representations. It is shown that the classical gas constant  $R$  becomes an entropic variable, with a resulting degradation of a perfect gas, when subjected to high entropy gradients under specified conditions. Thermodynamic equations for initial as well as developed gas flows are also derived.

Application of the results above to the case of adiabatic duct flows indicates that subsonic frictional flows are governed by the developed-flow equations, except in the initial stages of flow development. It is also shown within the framework of the present theory that supersonic frictional duct flows do not admit of continuous decelerations, and transition must take place through shock formation exclusively.



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## NOMENCLATURE

a	Isentropic speed of sound
$c_p$	Specific heat at constant pressure
$c_v$	Specific heat at constant volume
D	Nozzle diameter
$E_p$	$e^{-\frac{s - s_0}{c_p}}$
$E_v$	$e^{-\frac{s - s_0}{c_v}}$
$E_\nu$	$e^{-\frac{s - s_0}{c_\nu}} \quad (\nu = p, v)$
F	Friction function, as defined $F = \int_0^L \left(4 \frac{f}{D}\right) dx$
f	Friction coefficient
$J_\nu$	Thermodynamic function as defined ( $\nu = p, v$ )
M	Mach number
p	Pressure
$P_\nu$	Nondimensional process function ( $\nu = p, v$ )
R(s)	Gas degradation function
R(s <sub>0</sub> )	Gas constant
s	Entropy
T	Temperature
u	Velocity in the x-direction

## NOMENCLATURE (CONT)

x	Space coordinate
$\alpha_p$	Entropic propagation speed for the $J_p$ -process
$\beta_v^2$	Process function as defined ( $v = p, v$ )
$\gamma$	Adiabatic exponent $\left[ \frac{c_p}{c_v} \right]$
$\Delta$	Finite increment
$\lambda$	Function as defined $\lambda = \left[ 1 + \frac{\gamma - 1}{2} M^2 \right]$
$\rho$	Density

## INTRODUCTION

The present development of the subject of basic entropic phenomena is a recapitulation as well as a sequel to the previous work concerning non-isentropic wave generation.

It was through the study of the sound generation mechanism that the basic aspects of entropic flow processes were conceived and formulated in terms of the thermodynamic J-functions. Initial efforts on the subject were confined to the mathematical modeling of acoustic shock emission (Reference 1). It called for an engineering application of the J-process theory to construct an acoustic analogy treating the noise generated by an exhaust shock of a high-speed nozzle. This initial formulation was based upon a semi-empirical distribution function which triggered acoustic shock emission from the dissipative region. However, in subsequent studies it became apparent that a more rigorous approach to the problem was intimately connected with entropic processes and phenomena, which so far have not been studied either from the standpoint of pure thermodynamics or as a specific application to fluid flows. It thus became necessary to digress from the subject of acoustic wave generation to better understand the physical aspects related to the nature and phenomena of entropic processes in dissipative regions. As a consequence, an extension of the J-process theory from shock transition to continuous frictional duct flows was initiated and published by this author in the previous report on the subject (Reference 2).

At present, more basic work concerning the formulation of the problem from a purely thermodynamic point of view was attempted and resulted in the entropic work concepts based upon  $J_p$  and  $J_v$  processes as well as that of a degradation of a perfect gas when subjected to entropy gradients. It is also shown that the natural tendency of the system to eliminate finite entropy gradients, after the initial flow pattern has been formed, results in the variation of the process functions in such a way, as to dispose of those finite entropy gradients in terms of developed flow conditions.

An application of the J-function theory to the case of frictional adiabatic duct flows indicates also that, within the framework of the current approach, subsonic flows are governed by developed-flow equations, except in the initial stages of frictional flow development, whereas supersonic frictional duct flows do not admit of a continuous flow pattern and transition can only take place by means of shock formation.



## ADDITIONAL ASPECTS OF THE J-PROCESS THEORY

The initial derivation of the thermodynamic J-function constituted an attempt to represent local dissipative processes in terms of an entropic wave equation (Reference 1) in accordance with the stipulated objective of studying finite amplitude wave generation and propagation mechanisms. As a consequence, this initial formulation was restricted to the representation of the "vdp" entropic work phenomena. However, the subsequent extension of the theory to continuous frictional flow effects rather, than unsteady shock emission, involved the investigation of additional physical processes, and it became necessary to extend the existing formulation to include also the "pdv" entropic work representation in the overall physical treatment of the subject. The inclusion of the latter quantity within the confines of the thermodynamic J-functions necessitated a slight change in the mathematical representation of the two J-processes. Accordingly, the subscripts "p" and "v" were introduced in order to characterize the "vdp" and "pdv" entropic work terms and their respective J-functions (Reference 3). In addition, the factor  $(-\rho)$  has been adjoined to the differential  $dJ_p$ . This, however, merely changes the dimensions of the  $J_p$ -function to those of energy (per unit mass) without affecting the overall structure and/or results of the previous derivations.

As a consequence, the two corresponding thermodynamic J-functions are given by the following equations:

$$dJ_p = \frac{\beta_p^2}{c_p} ds + \frac{dp}{\rho} \quad (1)$$

and

$$dJ_v = \frac{\beta_v^2}{c_p} ds + p d\left(\frac{1}{\rho}\right) \quad (2)$$

It is now noted that the two functions  $J_p$  and  $J_v$  have identical dimensions and are of a similar form. It is also apparent that for any isentropic processes:

$$dJ_p = \left( \frac{dp}{\rho} \right) \text{ isentropic:} \quad (3a)$$

and

$$dJ_v = p \, d \left( \frac{1}{\rho} \right) \text{ isentropic} \quad (3b)$$

On the other hand, for any entropic processes we must have

$$dJ_p = dJ_v = 0$$

so that:

$$\frac{dp}{\rho} = - \frac{\beta_p^2}{c_p} \, ds \quad (\text{when the } J_p \text{ process occurs}) \quad (4)$$

and in a similar manner

$$p \, d \left( \frac{1}{\rho} \right) = - \frac{\beta_v^2}{c_p} \, ds \quad (\text{when the } J_v \text{ process occurs}) \quad (5)$$

The case of the  $J_p$  process has been discussed by this author in previous publications\* (Reference 1). In particular it was shown how Equation 4 may be integrated by using the equation of state in the form  $\rho = \rho(p, s)$ , while treating the quantity  $\beta_p^2$  as a parameter. The resulting expression:

$$\frac{dp}{\rho} = - \frac{a_0^2}{\gamma - 1} \left[ \frac{\frac{T}{E_p} \frac{T_0}{T_0} - 1}{E_p - 1} \right] \frac{ds}{c_p} \quad (6)$$

where the subscript zero refers to the initial isentropic condition from which the  $J_p$ -process starts, has been applied to both shock transition as well as frictional duct flow phenomena of a perfect gas.\*\*

\*For the case of a calorically perfect gas.

\*\*The latter subject is also treated in succeeding sections.



Now, in an exactly analogous manner it can be shown that when the  $J_v$ -process takes place, so that Equation 5 holds true:

$$p \, d\left(\frac{1}{\rho}\right) = \frac{a_0^2}{\gamma-1} \left[ \frac{E_v \frac{T}{T_0} - 1}{E_v - 1} \right] \frac{ds}{c_p}; \quad (7)$$

Considering next the physical significance of these equations, it is noted that both Equations 6 and 7 indicate that it is the historical effects of dissipation which magnify the entropy gradients. Thus, for any temperature change in the medium, due to an entropic conversion of caloric into mechanical energy and/or vice versa, the entropy function changes continuously, but it is the finite temperature ratio ( $T/T_0$ ), appearing in the numerator, which determines the functional variation of the process functions and, therefore, also the nature of the entropic work differentials. It thus became clear that any change in the initial isentropic reference point will effect the total history of the process in question, since it certainly makes a difference whether the effects of such energy conversions are referred to the beginning of the dissipative process in question, or to local conditions only. In the first case, the total past history is included in the mathematical expression and the total entropic energy conversion is accounted for. On the other hand, in the second case, the total previous "memory" of dissipative flow effects is blotted out and cannot be retrieved in a consistent mathematical form.

It should also be noted that such increasing entropy gradients cannot sustain themselves indefinitely, due to the natural tendency of the system to eliminate these gradients with a consequent maximization of the entropy function. But it is precisely for this reason that the parameterization of the process functions  $\beta_v^2$  ( $v = p, v$ ) constitute a physically consistent first approximation. This is because this parametric representation of the process functions  $\beta_v^2$  linearize the entropy gradients in the neighborhood of the initial isentropic states. Obviously, if these entropy gradients could develop indefinitely and sustain themselves in the system, Equations 6 and 7 would become less and less valid in the course of entropic work development. It is also precisely for this reason that after the initial flow (work) pattern has been formed, as evidenced by the duct entrance effects in frictional adiabatic flows, the natural tendency of the flow, characterized by the elimination of these finite entropy gradients forming within, would call for the variation the process functions  $\beta_v^2$  in such a way as to dispose of those finite entropy gradients in terms of local conditions.

We can thus make use of this physical tendency of the system by differentiating the respective process functions with respect to their independent variable (entropy) and maximizing them in favor of local differentials.

The result of such operations yields the two equations analogous to Equations 6 and 7, given by:

$$\left(\frac{dp}{\rho}\right)_m = \left[-T + c_p \frac{dT}{ds}\right] ds: \quad (8)$$

and

$$p d\left(\frac{1}{\rho}\right)_m = \left[T - c_v \frac{dT}{ds}\right] ds: \quad (9)$$

where the subscript "m" on the left indicates that the finite entropy gradients have been eliminated in accordance with the physical requirement of flow development in the systems.

It should be noted that all references to the initial isentropic conditions have been eliminated from Equations 8 and 9. This comes as a direct consequence of the elimination of the finite entropy gradients from these equations in accordance with the spontaneous tendency of the flow mechanism to maximize the entropy function. It is for this reason that Equations 8 and 9 will be referred to as the developed-flow equations.

It will be shown in the preceding sections, that one of the direct consequences of flow development, is an increase in the overall frictional fluid properties with a corresponding increase in its rate of energy dissipation.

This increase of frictional fluid properties in developed flows comes above and beyond that caused by the entrance effects and initial flow development, as represented by Equations 6 and 7. It is also of interest to note that the mechanism of initial flow development, while increasing the frictional fluid characteristics, tends at the same time to suppress variations of the conjugate thermodynamic variables in their respective work equations. Thus in the "vdp" developed-work equation, variations in density are suppressed to the first approximation, while the pressure function is constant in the "pdv" work equation (also to the first approximation).

In the current study we are concerned with the application of the above theory to frictional duct flows, to which the "vdp" work equation applies. It is then an immediate consequence of such an application that, to the first approximation, density variations will be suppressed and the physical aspects of the flow will be similar to that of incompressible media.

To illustrate this property of entropic flows mechanism, we consider the representation of the "vdp" work as given by Equation 6, while noting that

$$E_p \left( \frac{T}{T_0} \right) = \left( \frac{p}{p_0} \right)^{\frac{\gamma-1}{\gamma}} \quad (10)$$

by the properties of a calorically perfect gas. Equation 6 now yields:

$$\frac{dp}{p} = -\frac{a_0^2}{\gamma-1} \left[ \frac{\left( \frac{p}{p_0} \right)^{\frac{\gamma-1}{\gamma}} - 1}{E_p - 1} \right] \frac{ds}{c_p} \quad (11)$$

and we must expand this equation in terms of small entropy gradients. Thus let:

$$\frac{p}{p_0} \approx 1 + \frac{dp}{p_0} ; (s-s_0) \approx ds \quad (12)$$

Using these quantities in Equation 11 it can readily be shown that to the first approximation:

$$\frac{dp}{p} = \frac{1}{\rho_0} \left( \frac{dp}{ds} \right) ds \quad (13)$$

when the  $J_p$ -process takes place.

It thus appears that whenever entropic "vdp" work is being implemented\*, the mechanism of initial flow development tends to suppress compressibility effects while, at the same time, increasing the frictional dissipation rate.

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\*No entropic "pdv" expansion work is admissible.



## DEGRADATION OF A CALORICALLY PERFECT GAS

Presently, some more general aspects of the current theoretical formulation will be considered. Thus, referring to the developed flow Equations 8 and 9 for "vdp" and "pdv" entropic work respectively, it is apparent that these equations still satisfy the perfect gas law. Obviously, this comes as a natural consequence of the current development and its basic assumptions.

On the other hand, it is also of interest to investigate what happens if initially both "pdv" and "vdp" entropic works are performed by the thermodynamic system. Evidently, from Equations 6 and 7, it is apparent that in this case:

$$d \left( \frac{P}{\rho} \right) = \left[ \frac{(E_p - E_v)(T - T_0)}{(E_p - 1)(E_v - 1)} \right] ds \quad (14)$$

Moreover if, in accordance with requirement of the elimination of finite entropy gradients from the system, a procedure similar to the above is followed, the resultant equation takes on the form:

$$d \left( \frac{P}{\rho} \right)_m = \left[ \frac{(E_p - E_v)^2}{(E_v - 1)^2 \frac{E_p}{c_p} - (E_p - 1)^2 \frac{E_v}{c_v}} \right] \frac{dT}{ds} ds \quad (15)$$

Equation 15 constitutes a departure of the gas from the perfect gas law. It indicates that the gas constant R becomes an entropic variable when a perfect gas is subjected to high entropy gradients in the manner described above. As a matter of fact, the physical interpretation of Equation 15 calls for the introduction of the concept of a degradation of a perfect gas under the conditions stipulated above, in exact analogy to the degradation of energy of a thermodynamic system which is subjected to finite entropy gradients. In this connection it is of interest to note that the degradation of the perfect gas given by Equation 15 is exactly due to the fact that the finite entropy gradients were not eliminated from the system and the total "memory" of previous dissipative processes cannot be blotted out in a simple physical manner, as in the case of separate "vdp" or "pdv" entropic work processes.

If we now define an entropic function  $R(s)$  such that:

$$R(s) = \left[ \frac{(E_p - E_v)^2}{(E_v - 1)^2 \frac{E_p}{c_p} - (E_p - 1)^2 \frac{E_v}{c_v}} \right] \quad (16)$$

then  $R(s)$  tends to zero with increasing entropy gradients. Moreover,  $R(s)$  is an even function of entropy.

To show these characteristics, we can express the right hand side of Equation 16 in terms of infinite series, as a result of which the following relation is obtained:

$$R(s) = (c_p - c_v) \left[ \frac{\sum_{n=1}^{\infty} \left[ (\gamma - 1)^{2n-1} \left[ \frac{1}{(2n)!} \right] \left( \frac{\Delta s}{c_p} \right)^{2n-2} \right]}{\sum_{n=1}^{\infty} \left[ (\gamma^{2n} - 1) \left[ \frac{1}{(2n)!} \right] \left( \frac{\Delta s}{c_p} \right)^{2n-2} \right]} \right] \quad (17)$$

where  $(c_p - c_v) = R(s_0)$  is the zeroth term of the expansion and represents the classical perfect gas constant and  $\gamma$  is the ratio of the specific heats.

Some numerical aspects of these relations will be considered in the following sections.

## APPLICATION OF THE J-FUNCTION THEORY - FRICTIONAL DUCT FLOWS

The current study of frictional, adiabatic flow effects is a direct sequel to the initial formulation of the problem (Reference 2) in which the subject has been attacked by means of the J-function theory. Specifically, it was shown that the classical fluid dynamic equations governing the adiabatic frictional duct flow of a calorically perfect gas, coincided with those obtained from the application of the  $J_p$ -process, when the initial isentropic Mach number (from which the entropic  $J_p$ -process starts) was identically zero. For any other finite initial Mach number the results differed due to the nature of duct entrance phenomena, which were shown to be a direct consequence of the "memory" effects of fluid particles in dissipative flows. It was also shown that another condition for the analogies between the two approaches was the use of an isentropic speed of sound (appearing as an initial condition in the process function) to form a Mach number term of the equation.

Likewise, the previous study indicated that in order to construct a supersonic flow analogy, it was necessary to employ a direction of integration, which was opposite to that used in classical approaches. As a result, a reexamination of the problem of frictional duct flows was necessary in order to pinpoint the physical consequences implied by these differences. The current study was mainly concerned with this latter aspect of the problem.

It will now be demonstrated that, within the framework of the present approach, subsonic frictional duct flows are governed by both the initial and developed flow equations\*, whereas supersonic frictional duct flows do not admit of a continuous flow pattern and transition can only take place by means of shock formation.

### BASIC THEORETICAL DEVELOPMENT

To discuss the entropic formulation of adiabatic frictional duct flow of a calorically perfect gas, it will be useful to recapitulate in a concise manner the previous derivations on the subject (Reference 2) in the light of the current approach.

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\*Discussed in the preceding section

Considering the momentum equation for this simple flow given by (Reference 4):

$$\frac{1}{2} du^2 + \frac{dp}{\rho} + \frac{2f}{D} u^2 dx = 0 \quad (18)$$

it is noted that it can be written in view of Equation 1

$$\frac{1}{2} du^2 + dJ_p - \frac{\beta^2}{c_p} ds + \frac{2f}{D} u^2 dx = 0 \quad (19)$$

Now, if we choose the thermodynamic variables  $J_p$  and  $s$  to be independent so that  $J_p$  does not depend on  $s$ , we can write:

$$dJ_p = \frac{\gamma R}{\gamma - 1} dT \quad (20)$$

in accordance with Equation 3 and the isentropic pressure density relations. It then follows that Equation 19 reduces to the form:

$$\frac{\beta^2}{c_p} ds = \frac{2f}{D} u^2 dx \quad (21)$$

under all conditions, due to the fact that in steady adiabatic flows of a perfect gas the stagnation enthalpy is conserved, whether or not the flow is reversible or irreversible (Reference 5).

Now let

$$\lambda = \left[ 1 + \frac{\gamma - 1}{2} M^2 \right] \quad (22)$$

so that, in view of the adiabatic relations of one dimensional compressible flow, we may write:

$$(a) \frac{T}{T_0} = \frac{\lambda_0}{\lambda} \quad (23)$$



$$\begin{aligned}
 \text{(b)} \quad \frac{p}{p_o} &= \left[ \frac{M_o}{M} \right] \left[ \frac{\lambda_o}{\lambda} \right]^{\frac{1}{2}} \\
 \text{(c)} \quad \frac{\rho}{\rho_o} &= \left[ \frac{M_o}{M} \right] \left[ \frac{\lambda}{\lambda_o} \right]^{\frac{1}{2}} \\
 \text{(d)} \quad E_p &= \left[ \frac{M_o}{M} \right]^{\frac{\gamma-1}{\gamma}} \left[ \frac{\lambda}{\lambda_o} \right]^{\frac{\gamma+1}{2\gamma}} \\
 \text{(e)} \quad dp &= -\frac{1}{2} p_o \left[ \frac{M_o}{M} \right] \left[ \frac{\lambda_o}{\lambda} \right]^{\frac{1}{2}} \left[ \frac{1 + (\gamma-1) M^2}{\lambda M^2} \right] dM^2 \\
 \text{(f)} \quad \frac{ds}{c_p} &= \frac{\gamma-1}{2\gamma} \left[ \frac{1 - M^2}{\lambda M^2} \right] dM^2 \tag{24}
 \end{aligned}$$

where the subscript zero denotes some initial isentropic state.

It should be noted that in the current formulation the conceptual meaning of the speed of sound is not the same as in the routine classical approaches. For it has been shown (Reference 1) that in a region governed by the  $J_p$ -process

$$\frac{\rho}{\gamma p} = \frac{1}{\alpha_p^2} - \frac{1}{\beta_p^2} \tag{25}$$

where

$$\alpha_p^2 = \left( \frac{\partial p}{\partial \rho} \right)_J \tag{26}$$

was defined to be the entropic propagation speed. It follows from Equation 25 and the perfect gas relation that:

$$\gamma R T = a_o^2 \left( \frac{p}{p_o} \right)^{\frac{\gamma-1}{\gamma}} E_p^{-1} \tag{27}$$

which is an entropic quantity and only reduces to the isentropic speed of sound when no  $J_p$ -process took place, i. e.,  $s = s_0$  throughout.

Presently, in view of Equations 6 and 24, Equation 21 may be written:

$$a_0^2 \left[ \frac{\left( \frac{M_0^2}{M^2} \right)^{\frac{\gamma-1}{2\gamma}} \left( \frac{\lambda_0}{\lambda} \right)^{\frac{\gamma-1}{2\gamma}} - 1}{\left( \frac{M_0^2}{M^2} \right)^{\frac{\gamma-1}{2\gamma}} \left( \frac{\lambda}{\lambda_0} \right)^{\frac{\gamma+1}{2\gamma}} - 1} \right] \left[ \frac{1 - M^2}{\gamma \lambda M^2} \right] dM^2 = \frac{4f}{D} u^2 dx \quad (28)$$

Now, rather than forming the Mach number on the right of Equation 28 by using the initial isentropic sound speed  $a_0^2$ , a procedure which is only approximately valid even in the initial stages of flow development, we write in accordance with Equation 24a:

$$a_0^2 = \left[ \frac{\lambda}{\lambda_0} \right] a^2; \quad (29)$$

where now  $a^2 = \gamma RT$  is given by Equation 27. Hence, Equation 28 may now be written:

$$\left[ \frac{\left( \frac{M_0}{M} \right)^{\frac{\gamma-1}{2\gamma}} \left( \frac{\lambda_0}{\lambda} \right)^{\frac{\gamma-1}{2\gamma}} - 1}{\left( \frac{M_0}{M} \right)^{\frac{\gamma-1}{2\gamma}} \left( \frac{\lambda}{\lambda_0} \right)^{\frac{\gamma+1}{2\gamma}} - 1} \right] \left[ \frac{1 - M^2}{\gamma \lambda_0 M^4} \right] dM^2 = \frac{4f}{D} dx \quad (30)$$

Then, in this more exact form, the condition for initial stagnation flow does not reduce to the classical case, since when  $M_0 = 0$  we obtain:

$$\left[ \frac{1 - M^2}{\gamma M^4} \right] = \frac{4f}{D} dx \quad (31)$$

which differs from the classical equation by the factor

$$\lambda = \left[ 1 + \frac{\gamma-1}{2} M^2 \right]; \quad (32)$$

But, in accordance with the previous theoretical considerations, the linear approximation of Equation 30 is valid only in the immediate neighborhood of the initial state  $M_0$ . For as the flow develops, the finite entropy gradients (characterized here by the differences between the local versus the initial Mach numbers) will invoke the natural tendency of the system to proceed in the direction of minimization of those gradients, i. e., the maximization of entropy. As a consequence, after the initial flow development is effected in accordance with Equation 30, flow adjustment will take place downstream in such a way as to eliminate those finite entropy gradients, which is exactly analogous to the elimination of the historical effects of the fluid particles. Mathematically this requirement implies that we maximize the left hand side of Equation 30 as to solve for the finite quantities in terms of local differentials, so that all references to initial conditions are eliminated. This, obviously, is consistent with the original parameterization of the process function  $\beta_p^2$ , which now must satisfy such an extremum condition by the very nature of its derivation.

When the above procedure is affected, the resulting differential equation becomes:

$$\left[ \frac{1 + (\gamma-1) M^2}{\gamma M^{4\lambda}} \right] dM^2 = \left[ \frac{4f}{D} \right] dx \quad (33)$$

and it is seen that all references to the initial conditions have been eliminated from this equation.

Obviously the physical aspect of Equation 33 is exactly analogous to that obtained in Equation 8 and, as such, it represents the developed flow equation for steady one-dimensional frictional flow of a calorically perfect gas.

It is now necessary to discuss the limitations of Equations 30 and 33 within the framework of the present derivation. It should be apparent that the mechanism of flow as represented by these two equations is only valid within the framework of the second law, which guided their derivation. However, both equations indicate that for any finite friction coefficient  $f$ , only expanding flow is possible.\*

For, in contrast to the classical formulation, both Equations 30 and 33 remain positive when supersonic conditions are attained. Thus, in the case of Equation 30, it was shown in previous developments (Reference 6) that the process function of this equation becomes negative for initial supersonic conditions. However, this behavior is counteracted by the entropy differential (which multiplies the process function in entropic work representation),

\* $f$  is positive definite

whose factor  $(1-M^2)$  also turns negative at supersonic conditions. The net effect of this behavior is no change of sign for the case of transition to supersonic flows, as can be seen from the form of Equation 30.

In a similar manner, Equation 33 behaves in a like fashion, when supersonic conditions are attained, as it is readily perceived due to its simpler mathematical form.

It then immediately follows that, if the friction coefficient be kept positive definite in the increasing direction of the space coordinate  $x$ , only expanding flow is admissible within the framework of the present approach for both, subsonic as well as supersonic conditions.

However, whereas subsonic expansion is admissible within the realm of thermodynamic laws, a supersonic expansion is ruled out by the nature of the entropy function for the adiabatic flow considered. For since the entropy function decreases under the conditions specified, neither of the two equations can be applied to this case. It then follows that a contradiction exists in which the second law, reflecting the physical mechanism governing the system, must take precedence.

Obviously, the only physical possibility which is compatible with both conditions is a breakdown of the continuous flow regimes in such a way that the second law is satisfied. It is thus deduced from the present theory that for the case of supersonic flows, no continuous deceleration is possible and transition must take place by means of shock wave formation exclusively.

## NUMERICAL RESULTS

In this section numerical results, relating to the previously derived functions as well as the relevant differential equations and their solutions, will be considered.

Figure 1 represents the normalized degradation function of a calorically perfect gas as given in Equation 16. Here the ordinate  $R(s)/R(s_0)$  is plotted as a function of entropy. It is evident that the degradation function tends to zero in an asymptotic manner with increasing entropy. Thus, if for the sake of argument, we define two entropic variables  $c_p(s)$  and  $c_v(s)$  such that

$$R(s) = c_p(s) - c_v(s) \quad (34)$$

then the diminishing characteristic of the degradation function could be interpreted in the sense, that some fictitious adiabatic exponent  $\gamma(s)$ , tends to unity with increasing entropy gradients.

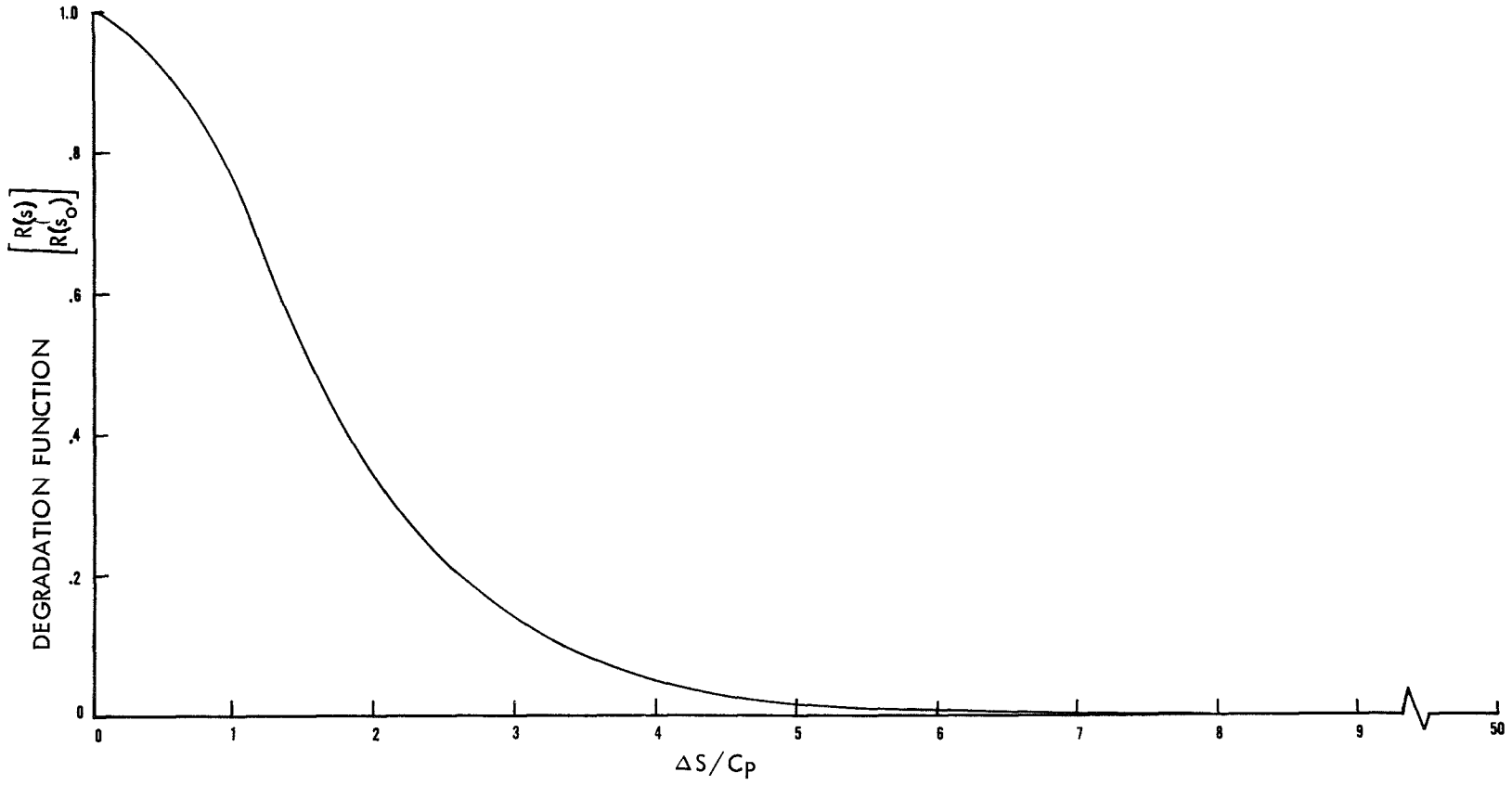


Figure 1. Degradation Characteristics of a Perfect Gas

In this connection, it is of interest to plot the degradation effects of a perfect gas for the case of shock transition. The results of such a procedure are shown in Figure 2. Here the independent variable  $M_0$  is the free stream Mach number of the gas entering the shock region.

Figure 3 represents a plot of the two process functions  $\beta_p^2$  and  $\beta_v^2$  (nondimensional) for the case of adiabatic duct entrance conditions. The two graphs are denoted in the drawing by P and V respectively. The plot represents an initial isentropic Mach number of 0.40. Its independent variable is the local entropic Mach number and the abscissa scans both subsonic and supersonic flow regimes up to and including  $M = 3.0$ .

Figure 4 represents the same two process functions for the case of developed flow conditions. The plot starts with local Mach number 0.40. The respective magnification properties of these functions, especially as sonic conditions are approached, should be noted. The large increases in the respective contributions of the developed flow process functions as compared to the previous case should also be noted.

From previous derivations, it is also evident that the supersonic regimes of these two functions do not represent continuous flow, since a breakdown takes place at sonic conditions. Thus, the supersonic regimes of these functions are not physically attainable under normal flow conditions.

Figure 5 shows the values of the friction functions:

$$F = \int_0^L \left[ 4 \frac{f}{D} \right] dx \quad (35)$$

based upon Equation 31. (Here  $L$  is such, that the local Mach number reaches unity when  $x = L$ ). The solution of this equation integrated over the interval  $(M^2, 1)$  is given by:

$$F_S = \frac{1}{\gamma} \ln M^2 + \frac{1-M^2}{\gamma M^2} \quad (36)$$

where the subscript S implies that the value of the friction function is based upon initial isentropic stagnation conditions in accordance with Equation 31. The classical solution is also plotted for comparison, and it is seen that the overall differences in frictional characteristics are indeed small.

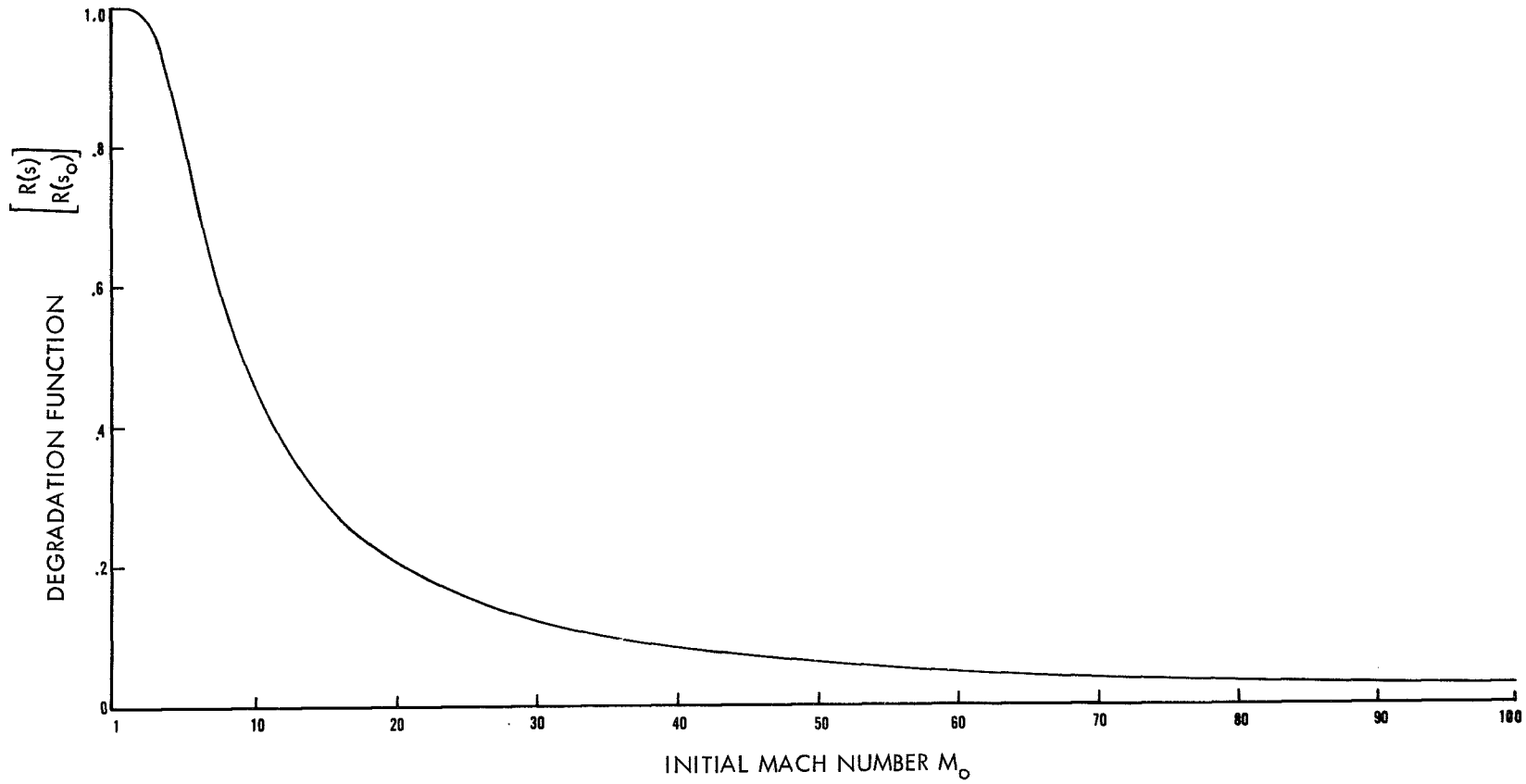


Figure 2. Degradation Characteristics During Shock Transition

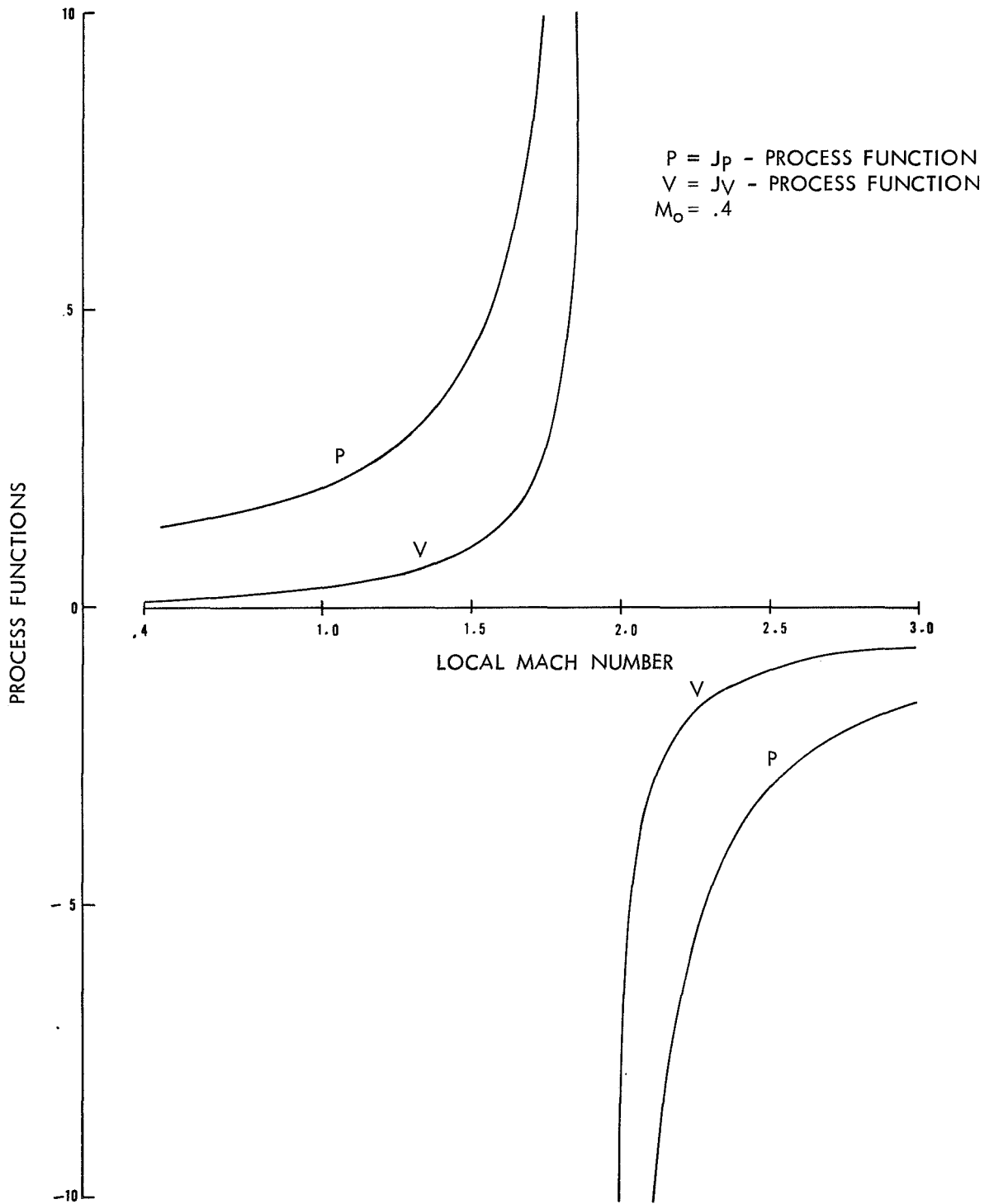


Figure 3. Process Functions - Entrance Conditions



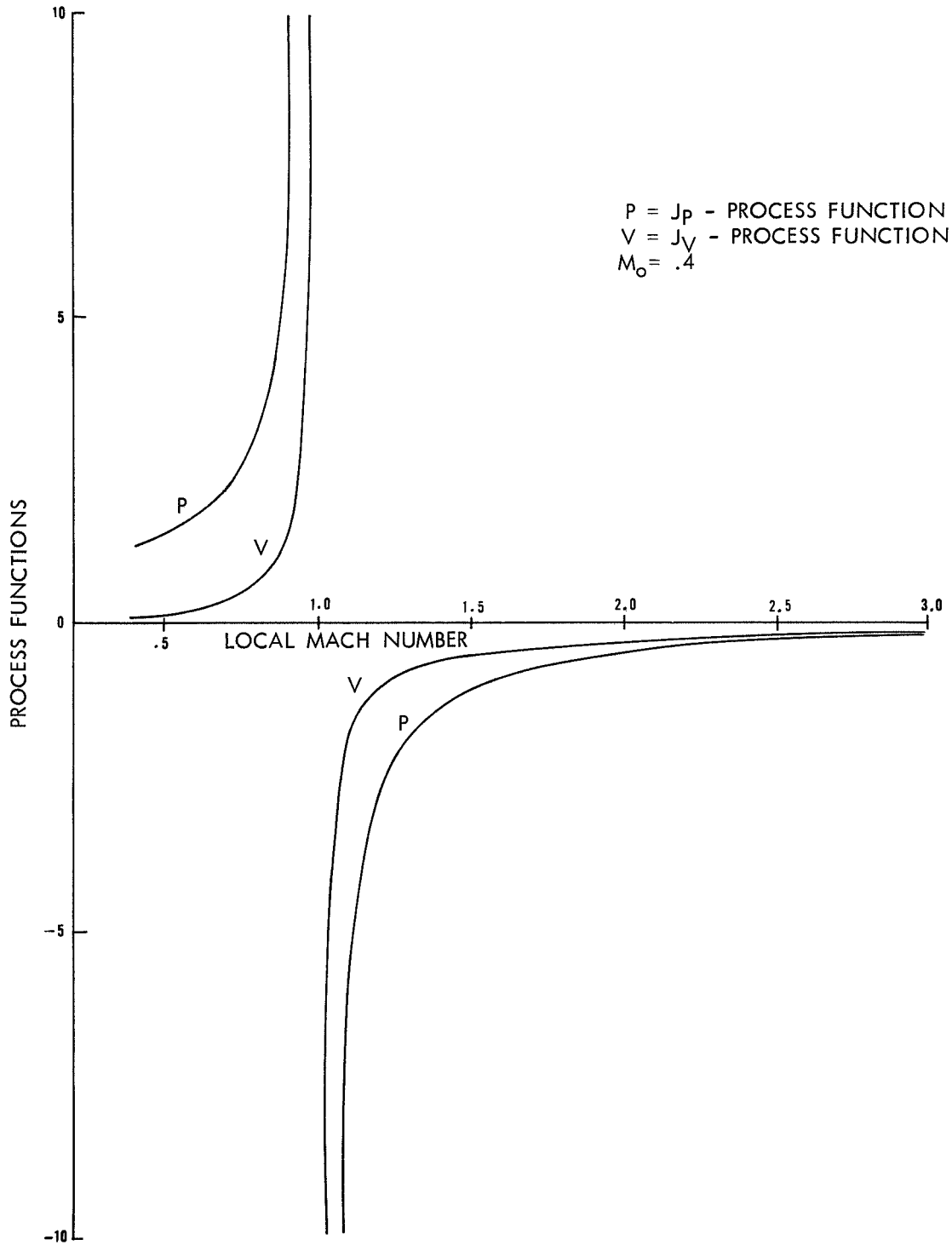


Figure 4. Process Functions - Developed Flow Conditions

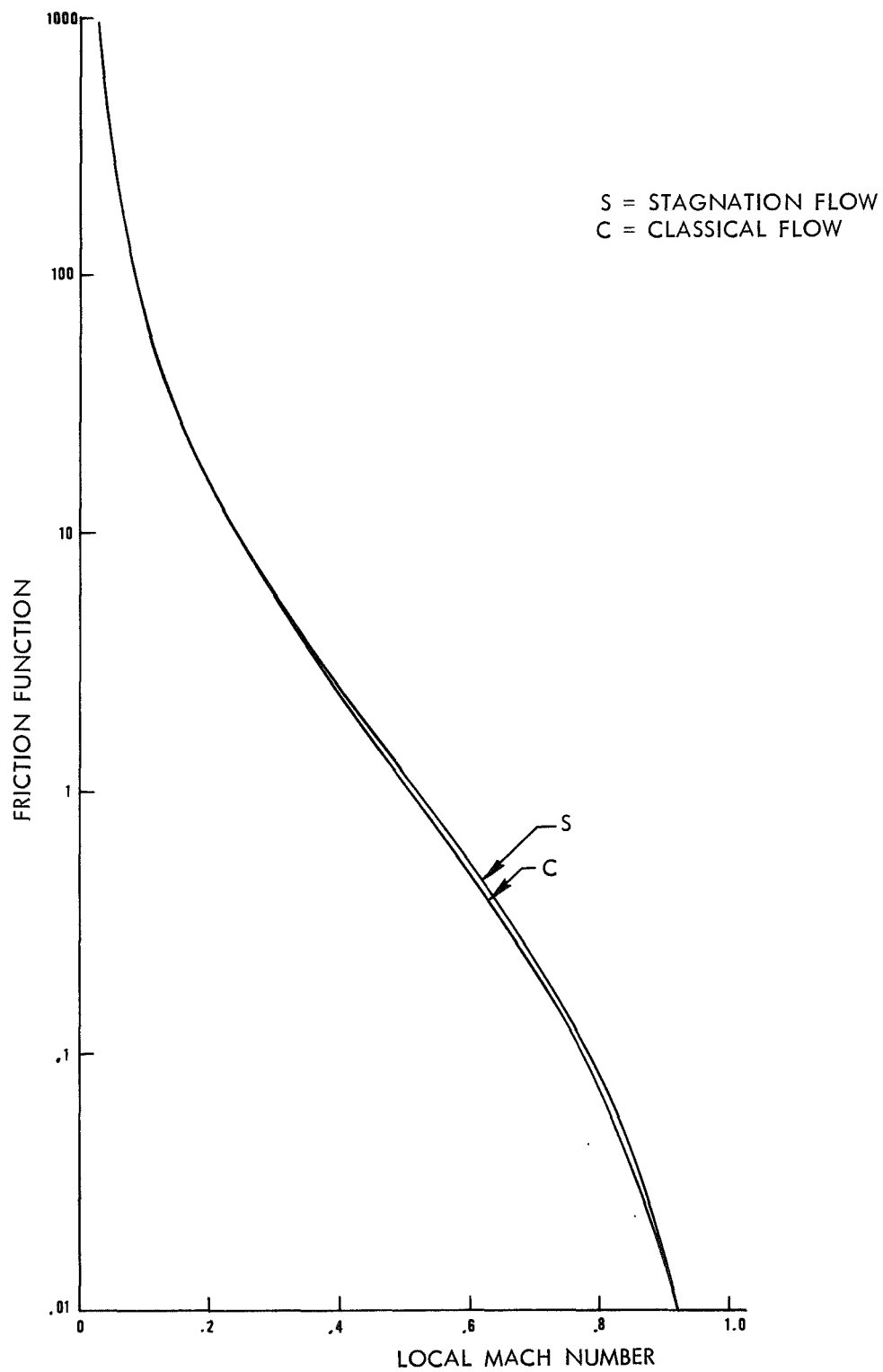


Figure 5. Stagnation Flow

Figure 6 reflects the behavior of the friction function  $F$  based upon the developed-flow Equation 33. The integral of this equation on the interval  $(M^2, 1)$  is given by:

$$F_D = \frac{1-M^2}{M^2} + \frac{\gamma-1}{2\gamma} \ln \left[ \frac{1 + \frac{\gamma-1}{2} M^2}{\frac{\gamma+1}{2} M^2} \right] \quad (37)$$

Here the subscript  $D$  implies that the value of the friction function is based upon the developed flow Equation 33. As in the previous case, the classical solution is also shown for comparison, and it is evident that a considerable increase in frictional characteristics is attained, especially as sonic conditions are approached.

Figure 7 represents a comparison between the frictional values of developed flow, stagnation flow, and classical flow for the case of higher subsonic Mach number ranges.

Figure 8 shows a comparison between the frictional values of duct flows based upon the initial entrance effects of Equation 30 and those of the developed flow Equation 33. The initial isentropic Mach numbers of various entrance conditions are shown.

It should be noted that these entrance-effects curves are valid only in the neighborhood of the initial isentropic Mach numbers, since a flow adjustment must take place down-stream, in accordance with the preceding considerations. Nevertheless the curves are plotted for the whole range of their subsonic values for illustrative purposes.

Figure 9 represents also a comparison between the entrance-effects curves and those based upon the developed flow equation, but for case of near sonic conditions. Here the classical solution is also plotted for comparison of its frictional values with these obtained from the current formulation. As in the previous case, the entrance-effects curves are shown for the whole range of the subsonic values.

Appendix A contains tabulated values of frictional flow variables as a function of selected initial isentropic Mach numbers. These subsonic flow tables are valid in the initial stages of flow development, but the tabulation spans the whole subsonic flow region.

The following functional values are displayed in these tables:

1. The process function for the  $J_p$ -process as given by Equation 39.
2. The classical function, which represents the integrand of the classical differential equation for frictional adiabatic duct flow of

a perfect gas. This function does not depend on initial isentropic conditions, but it is tabulated for comparison purposes.

3. The product function, which represents the integrand of the differential equation based upon Equation 30.
4. The friction function, which is the integrated product function. Its value represents the product of the average friction coefficient and the nondimensional maximum duct length.

Appendix B contains tabulated values of the friction function  $F$  as given by Equation 35. The values of  $F$  are listed, as a function of local Mach number for the following cases:

1. Classical flow - based upon the classical frictional adiabatic duct flow tables (Reference 4).
2. Stagnation flow - based upon initial isentropic stagnation conditions as in Equation 36.
3. Developed flow - based upon the developed flow conditions as represented by Equation 37.

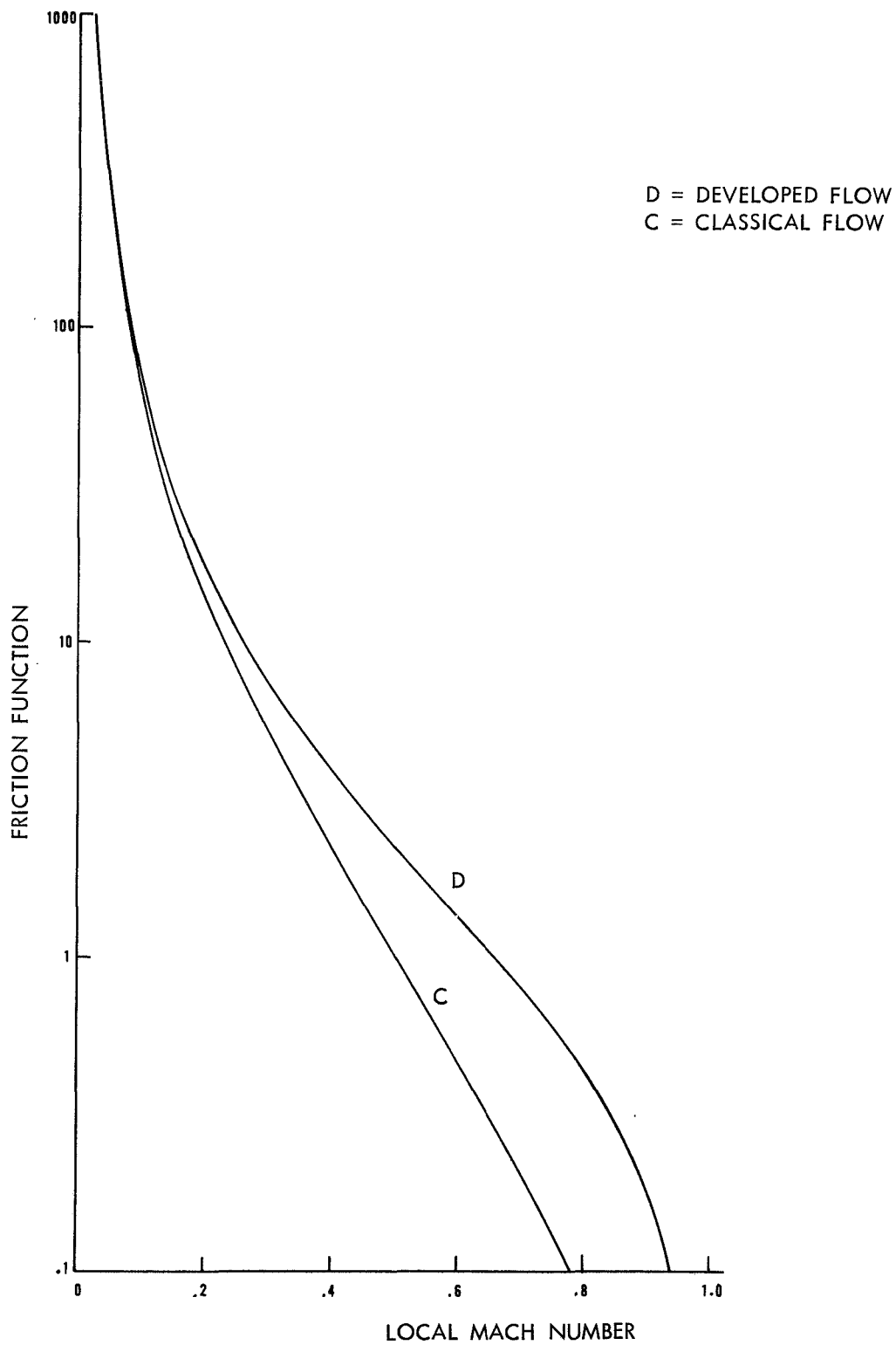


Figure 6. Developed Flow

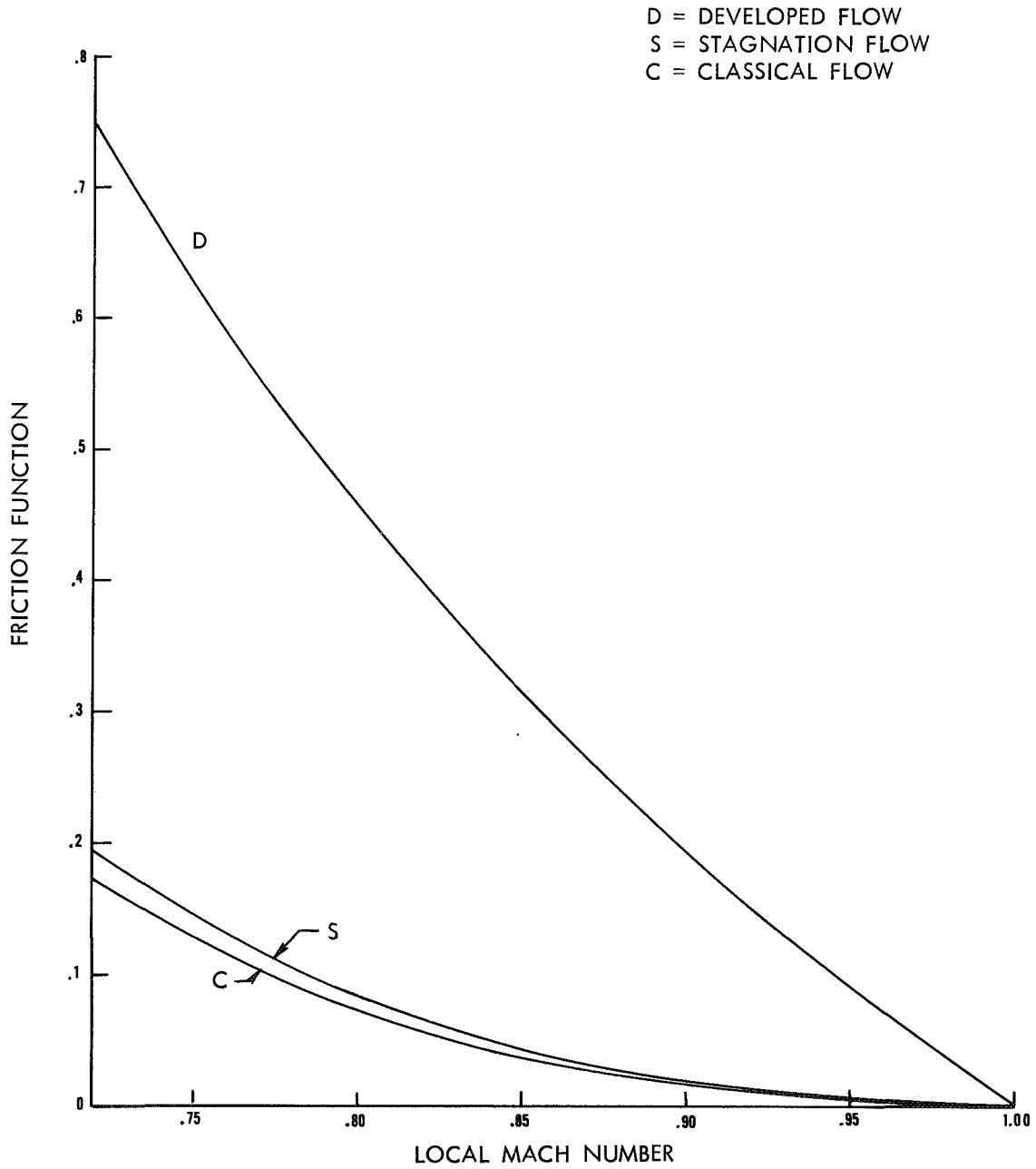


Figure 7. Developed and Stagnation Flows - Near-Sonic Conditions

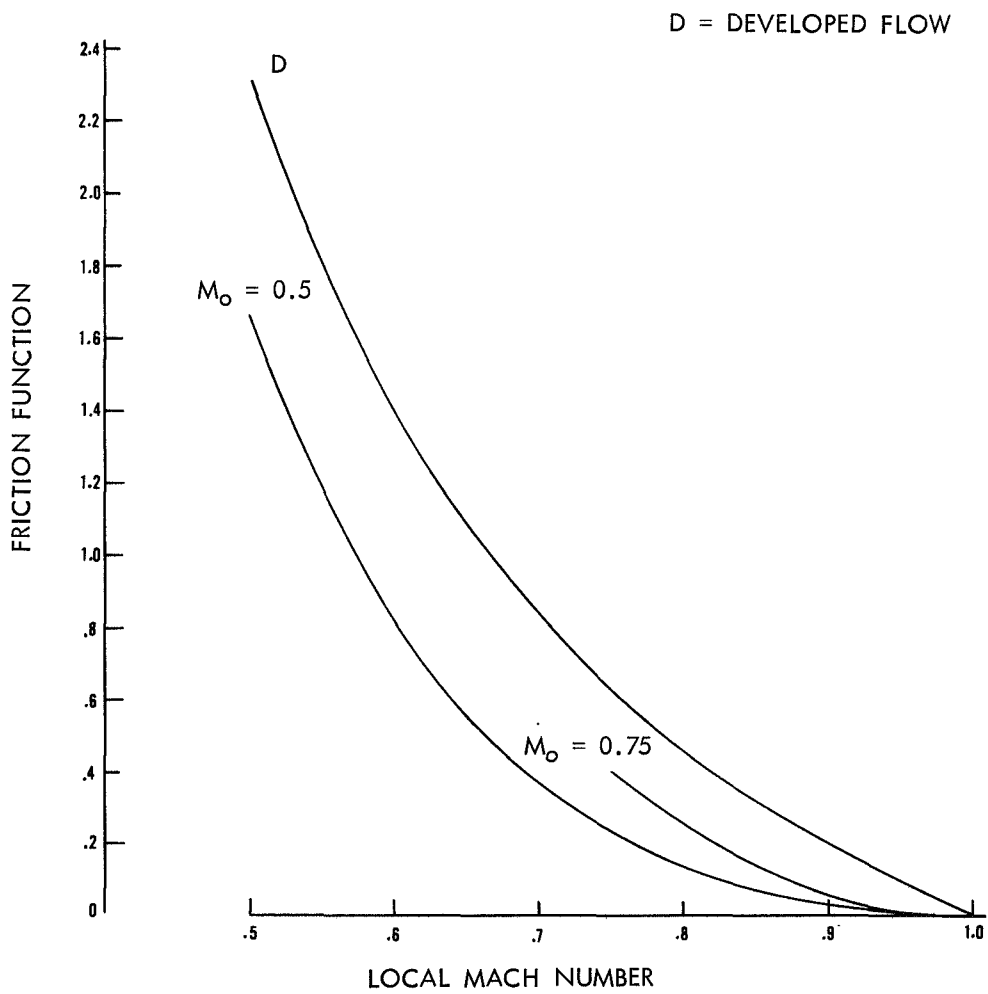


Figure 8. Developed and Initial Flows

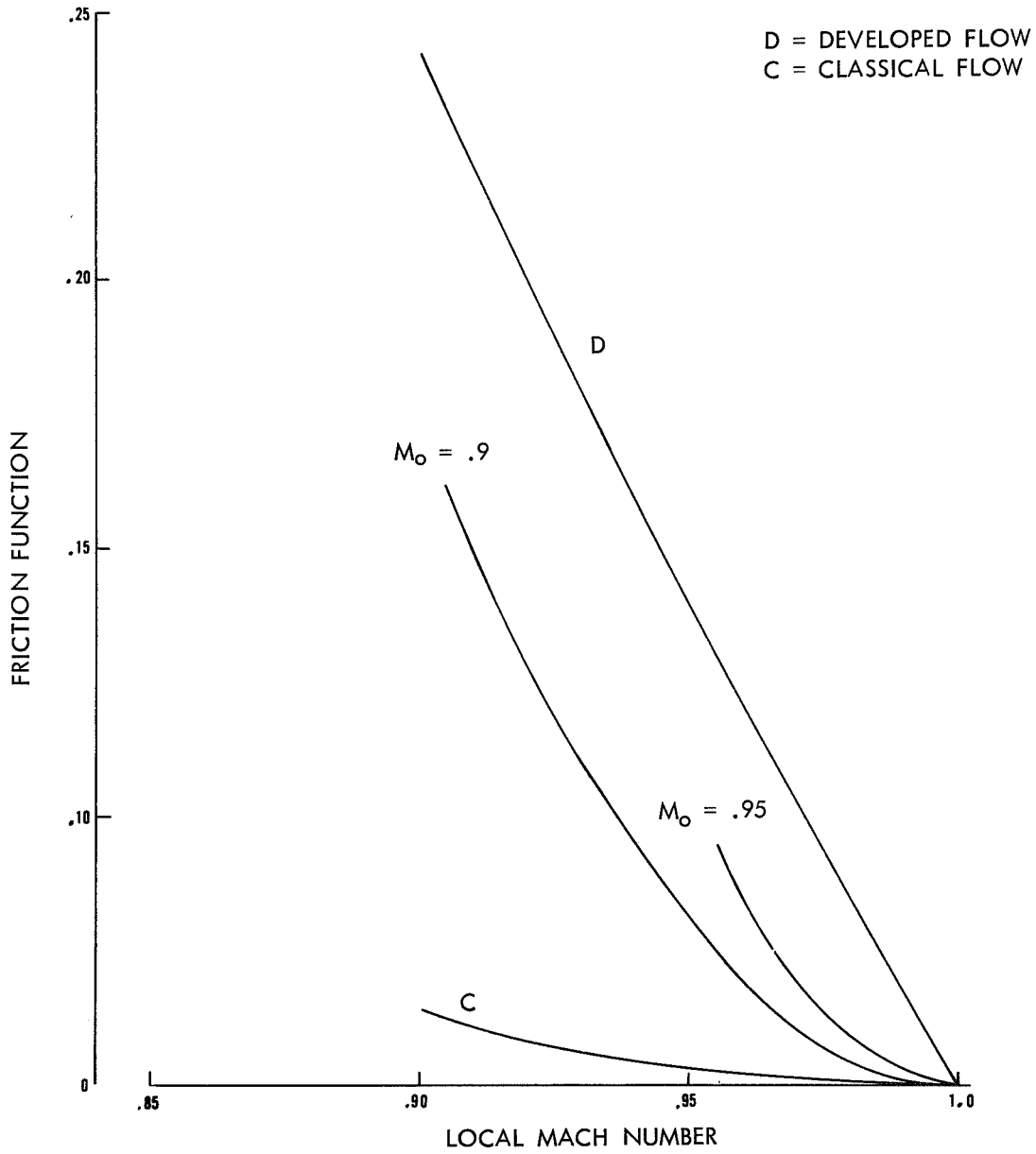


Figure 9. Developed and Initial Flows -  
Near-Sonic Conditions



## ADDITIONAL CONSIDERATIONS

The current theoretical aspects of the thermodynamic J-function indicate that entropic effects, induced by irreversible physical phenomena, may play a decisive role in prescribing the mechanism of thermodynamic processes and their historical as well as local development. From the formulation of the entropic J-processes, it is evident that any dissipative motion of continuous media induces in its wake finite temperature gradients and, as a consequence, also finite entropy gradients. This is evidenced, for instance, by the nondimensional process function  $P_\nu(s)$  related to the entropic  $J_\nu$ -processes:

$$P_\nu(s) = \left[ \frac{E_\nu \left( \frac{T}{T_0} \right) - 1}{E_\nu - 1} \right] \quad (38)$$

where ( $\nu = p, v$ ).

It is evident from this equation that any variation of the entropy function  $E_\nu$  will not contribute to the process in question, provided the temperature ratio between the local and initial isentropic temperatures is unity. Thus, only finite temperature gradients can cause a departure of Equation 38 from its equilibrium value of unity. But it is inherent in the J-process formulation, that temperature variations are induced locally through the medium of entropy and, as a consequence, within the framework of present approach, any change in the temperature carries with itself a corresponding entropy change.

In the light of the above arguments, it becomes clear that the assumption of initial isentropic stagnation condition in adiabatic duct flows is exactly analogous to the assumption of constant\* temperature flows. It is also exactly this assumption which blots out the past dissipative history of the fluid particles, with a corresponding decrease in successive contribution of the entropic terms of the equation. For it was shown in the preceding sections, that initial isentropic stagnation conditions for adiabatic duct flows reduce the value of  $P(s)$  in Equation 38 to unity.

This can also be seen from the adiabatic equivalent of Equation 38 as applied to duct flows and given by the expression:

---

\*Constant with respect to entropy. Isentropic temperature variations are admissible.

$$P_p (M_o, M) = \frac{\left[ \left( \frac{M_o^2}{M^2} \right)^{\frac{\gamma-1}{2\gamma}} \left( \frac{\lambda_o}{\lambda} \right)^{\frac{\gamma-1}{2\gamma}} - 1 \right]}{\left[ \frac{M_o^2}{M^2} \frac{\gamma-1}{2\gamma} \left( \frac{\lambda}{\lambda_o} \right)^{\frac{\gamma+1}{2\gamma}} - 1 \right]} \quad (39)$$

On the other hand, under conditions of finite initial isentropic motion the mathematical form of Equation 38 is preserved and the historical effects cannot be eliminated.

Moreover, the actual magnitude of the initial isentropic motion may take on any numerical value in the neighborhood of  $M_o = 0$ . Thus, it may be as small as desired, provided it never actually reaches stagnation conditions, and still the historical effects will contribute, as can readily be observed from Equation 39.

But this is exactly the reason why an a priori assumption of "smallness" of the entropic effects with a subsequent neglect of relevant terms can be deceiving. For Equation 39 reduces to unity when  $M_o = 0$ . For any other finite initial Mach number we obtain that, as the local Mach number  $M$  tends to  $M_o$ , Equation 39 reduces in the limit to

$$M \xrightarrow{\text{lim}} M_o \left[ P_p (M_o, M) \right] = \left[ \frac{1 + (\gamma-1)M_o^2}{1 - M_o^2} \right] \quad (40)$$

an equation which causes the previously discussed "entrance effects" in a frictional duct. And no matter how small we choose the initial isentropic Mach number to be, subsequent motion starts building up those initially infinitesimal temperature (or entropy) gradients, with the subsequent magnification of entropic effects.

It is also a direct consequence of this dissipative historical buildup of entropy gradients that the natural tendency of the system to eliminate those gradients comes into effect. Thus, as discussed previously, a physical readjustment of the thermodynamic system must take place, in which the finite entropy gradients are eliminated in favor of local differentials so that all historical effects are obliterated. It was this phenomenon which, in terms of fluid motion, was referred to as the developed-flow condition.

However, when both entropic flow work as well as expansion work are implemented, so that these historical dissipative effects cannot be eliminated by a physical readjustment of the thermodynamic system, the net result is a degradation of the physical properties of the medium as shown in the preceding sections.

From the standpoint of fluid properties it can also be inferred from Equations 38 and 39 that the mechanism of entropic flow development is inherently related to the adiabatic nature of local conditions. In essence, it is the inability of the moving fluid particles to dissipate finite temperature gradients (arising as a consequence of dissipative motion) which triggers the mechanism of flow development. It is also apparent from Equation 38 that, could the fluid particles eliminate their temperature change by some extraneous method, the net effect would be an elimination of the influence of past historical effects, since the entropic function  $P_v(s)$  in Equation 38 would not depart from its equilibrium value of unity. But it was already shown that, in fluids, this value coincides with isentropic stagnation conditions. Thus, it is indeed the local adiabatic environment of the moving fluid which triggers the entropic effects and their resultant flow adjustment, in accordance with the current theoretical considerations.



## CONCLUDING REMARKS

The present study constitutes a continuation of the author's previous work, related to the subject of the J-function theory and its application to acoustic shock emissions as well as adiabatic duct phenomena. The basic motivation for both, the previous as well as the current theoretical derivations, was a search for an analytical representation of the mechanism of entropic wave generation and its physical characteristics as related to the problem of aerodynamic noise.

In this connection it should be noted that, within the framework of the current study, the problem of aerodynamic noise generation is viewed as a by-product of energy degradation in dissipative compressible flow fields. This being the case, it is not surprising that one of the basic results of the current developments is an analogous degradation of a calorically perfect gas, when it is subjected to high entropy gradients under the conditions specified.

In a similar manner, the result of the current application of the J-function theory, with a resultant inadmissibility of continuous supersonic decelerations in ducts, spotlights the physical mechanism of shock formation. Moreover, the fact that a shock process also activates the mechanism of gas degradation is another important consequence of the current development.

It is also hoped that the conceptual formulation of the equations relating to the entrance as well as developed flow conditions may constitute an initial step in the study of the mechanism of dissipative fluid motions and their related characteristics from the standpoint of entropic thermodynamics.

In general, it is felt that further studies concerning these, as well as other entropic phenomena, should proceed in two possible directions. The first is an extension of the current applications to unsteady continuous flows with a consequent close look at the problems of entropic waves. The second involves an extension of these applications to variable geometries. Both studies are necessary in the overall identification of the dissipative flow mechanisms and their application to noise problems.

On the other hand, a third alternative involving a study of basic aspects of entropic thermodynamics also exists, but it is presently in the realm of pure rather than applied sciences.



## REFERENCES

1. Peter, A. C. and J. W. Cottrell. An Investigation to Define the Propagation Characteristics of a Finite Amplitude Pressure Wave. NASA-CR-735 (1967)
2. Peter, A. C. Non-Isentropic Finite Amplitude Wave Generation, SD 69-108 April 1969
3. Peter, A. C. Entropic Effects in Noise Generation, Basic Noise Research Conference, NASA, July 1969
4. Shapiro, A. H. The Dynamic and Thermodynamic of Compressible Fluid Flow, Ronald Press, 1953
5. Howarth, L. Modern Developments in Fluid Dynamics, Oxford Clarendon Press, 1956
6. Peter, A. C. Non-Isentropic Acoustic Wave Generation, J. Acoust. Soc. Amer. 45: 339(A) (1968)

## BIBLIOGRAPHY

- Biot, M.A. J. Appl. Phys., 25, (1954)
- Biot, M.A. J. Appl. Phys., 27, (1956)
- Callen, H.B. Thermodynamics, John Wiley and Sons, New York, 1960
- De Groot, S.R. Thermodynamics of Irreversible Processes, Interscience Publishing Co., 1952
- Eringen, A.C. Irreversible Thermodynamics and Continuum Mechanics, Physical Review (1961), 117
- Fowler and Guggenheim. Statistical Thermodynamics, Cambridge University Press, 1960

Lanczos, Cornelius. Variational Principles of Mechanics, University of Toronto Press, Toronto 1949

Lanczos, Cornelius. Applied Analysis, Prentice Hall, New York, 1956

Lanczos, Cornelius. Linear Differential Operators, P. Van Nostrand Company, New York, 1961

Morse, P.M. Thermal Physics, W.A. Benjamin, Inc., 1964

Onsager, L. Phys. Rev. 37, No. 4 (1931)

Onsager, L. Phys. Rev. 38, No. 12 (1931)

Onsager, L., and Machlup, S. Phys. Rev. 91, No. 6 (1953)

Prigogine, I. Introduction to Thermodynamics of Irreversible Processes. Interscience Publishers, 1955

Schroedinger, E. Statistical Thermodynamics, Cambridge University Press, 1960

Shapery, R.A. Irreversible Thermodynamics and Variational Principles with Application to Viscoelasticity, Doctoral Dissertation, Cal. Inst. of Techn. 1962

Sommerfeld, A. Thermodynamics and Statistical Mechanics, Academic Press, 1950

Tolman, Principles of Statistical Mechanics, Oxford University Press, 1938



APPENDIX A

FRictional ADIABATIC DUCT FLOW OF A CALORICALLY  
PERFECT GAS - ENTROPIC INITIAL FLOW EFFECTS

INITIAL MACH NUMBER IS  
0.000001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.000001	0.0	*****	0.0	82324.667118
0.005001	1.000000	11421434.482595	11421439.976305	53771.067178
0.010001	1.000002	1428000.489083	1428002.704277	3801.729436
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0.020001	1.000005	178473.269165	178474.165066	1732.031378
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0.035001	1.000013	33275.788346	33276.220283	575.330510
0.040001	1.000016	22284.047227	22284.410167	440.007957
0.045001	1.000020	15644.266560	15644.577839	346.998811
0.050001	1.000024	11399.317991	11399.589307	280.386245
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0.070001	1.000042	4144.346044	4144.520884	141.213506
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0.080001	1.000053	2772.217778	2772.364573	107.268726
0.085001	1.000059	2309.301997	2309.437573	94.619192
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0.185001	1.000221	217.899204	217.947308	17.753585
0.190001	1.000231	200.754934	200.801313	16.707534
0.195001	1.000241	185.334031	185.378785	15.742802

FRICITIONAL ADIABATIC DUCT FLOW OF A CALORICALLY  
PERFECT GAS - ENTROPIC INITIAL FLOW EFFECTS

APPENDIX A



A-1

SD 69-722

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0.225001	1.000308	119.065604	119.102291	11.270965
0.230001	1.000320	111.200959	111.236529	10.695425
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0.245001	1.000356	91.309210	91.341735	9.182468
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A-2

SD 69-722

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0.540001	1.001365	6.426822	6.435594	0.856284
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0.595001	1.001608	4.380906	4.387952	0.562488
0.600001	1.001631	4.232776	4.239681	0.540921
0.605001	1.001654	4.089829	4.096595	0.520083
0.610001	1.001678	3.951847	3.958476	0.499947
0.615001	1.001701	3.818625	3.825120	0.480490
0.620001	1.001724	3.689968	3.696331	0.461689
0.625001	1.001748	3.565691	3.571923	0.443520
0.630001	1.001772	3.445615	3.451719	0.425962
0.635001	1.001795	3.329573	3.335551	0.408996
0.640001	1.001819	3.217403	3.223257	0.392600
0.645001	1.001843	3.108953	3.114684	0.376757
0.650001	1.001868	3.004077	3.009687	0.361448
0.655001	1.001892	2.902634	2.908126	0.346655
0.660001	1.001916	2.804493	2.809867	0.332361
0.665001	1.001941	2.709525	2.714784	0.318551

0.670001	1.001966	2.617611	2.622756	0.305206
0.675001	1.001990	2.528634	2.533667	0.292313
0.680001	1.002015	2.442483	2.447406	0.279867
0.685001	1.002040	2.359054	2.363867	0.267840
0.690001	1.002066	2.278244	2.282950	0.256224
0.695001	1.002091	2.199957	2.204557	0.245006
0.700001	1.002116	2.124101	2.128596	0.234174
0.705001	1.002142	2.050586	2.054978	0.223716
0.710001	1.002168	1.979329	1.983620	0.213621
0.715001	1.002193	1.910248	1.914438	0.203876
0.720001	1.002219	1.843266	1.847356	0.194473
0.725001	1.002245	1.778307	1.782300	0.185400
0.730001	1.002271	1.715301	1.719197	0.176647
0.735001	1.002298	1.654178	1.657979	0.168205
0.740001	1.002324	1.594874	1.598580	0.160064
0.745001	1.002350	1.537325	1.540938	0.152216
0.750001	1.002377	1.481471	1.484992	0.144652
0.755001	1.002404	1.427254	1.430685	0.137363
0.760001	1.002431	1.374618	1.377959	0.130342
0.765001	1.002458	1.323509	1.326762	0.123581
0.770001	1.002485	1.273878	1.277043	0.117072
0.775001	1.002512	1.225673	1.228751	0.110803
0.780001	1.002539	1.178847	1.181841	0.104782
0.785001	1.002567	1.133356	1.136265	0.098988
0.790001	1.002594	1.089155	1.091980	0.093418
0.795001	1.002622	1.046202	1.048945	0.088066
0.800001	1.002650	1.004456	1.007118	0.082926
0.805001	1.002677	0.963879	0.966460	0.077993
0.810001	1.002705	0.924433	0.926934	0.073260
0.815001	1.002733	0.886082	0.888504	0.068722
0.820001	1.002762	0.848791	0.851135	0.064373
0.825001	1.002790	0.812526	0.814793	0.060206
0.830001	1.002818	0.777256	0.779446	0.056223
0.835001	1.002847	0.742948	0.745064	0.052412
0.840001	1.002876	0.709574	0.711615	0.048771
0.845001	1.002904	0.677105	0.679071	0.045295
0.850001	1.002933	0.645512	0.647405	0.041979
0.855001	1.002962	0.614768	0.616589	0.038819
0.860001	1.002991	0.584848	0.586598	0.035812
0.865001	1.003021	0.555727	0.557406	0.032952
0.870001	1.003050	0.527381	0.528990	0.030236
0.875001	1.003079	0.499786	0.501325	0.027661
0.880001	1.003109	0.472921	0.474391	0.025222
0.885001	1.003138	0.446762	0.448164	0.022916
0.890001	1.003168	0.421290	0.422625	0.020739
0.895001	1.003198	0.396484	0.397752	0.018688
0.900001	1.003228	0.372325	0.373527	0.016761

0.905001	1.003258	0.348794	0.349930	0.014952
0.910001	1.003288	0.325873	0.326944	0.013260
0.915001	1.003318	0.303543	0.304550	0.011682
0.920001	1.003349	0.281788	0.282732	0.010214
0.925001	1.003379	0.260592	0.261473	0.008853
0.930001	1.003410	0.239939	0.240757	0.007598
0.935001	1.003441	0.219813	0.220569	0.006445
0.940001	1.003471	0.200200	0.200895	0.005392
0.945001	1.003502	0.181084	0.181718	0.004435
0.950001	1.003533	0.162452	0.163026	0.003574
0.955001	1.003564	0.144291	0.144806	0.002804
0.960001	1.003596	0.126588	0.127043	0.002125
0.965001	1.003627	0.109329	0.109726	0.001533
0.970001	1.003658	0.092504	0.092842	0.001027
0.975001	1.003690	0.076099	0.076379	0.000604
0.980001	1.003722	0.060103	0.060327	0.000262
0.985001	1.003753	0.044506	0.044673	0.0

INITIAL MACH NUMBER IS

0.025001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.025001	0.0	91349.065664	0.0	984.956485
0.030001	1.001029	52850.552358	52904.957362	852.694092
0.035001	1.001190	33271.629064	33311.233374	576.738047
0.040001	1.001358	22281.261849	22311.525546	441.261990
0.045001	1.001533	15642.311117	15666.291425	348.131812
0.050001	1.001715	11397.893141	11417.435195	281.420986
0.055001	1.001903	8558.945358	8575.229456	232.025429
0.060001	1.002097	6588.794941	6602.611976	194.443154
0.065001	1.002298	5179.034910	5190.935314	165.193011
0.070001	1.002505	4143.828025	4154.207139	141.986383
0.075001	1.002718	3366.640629	3375.790056	123.269020
0.080001	1.002937	2771.871267	2780.011040	107.955616
0.085001	1.003161	2309.013347	2316.312795	95.269840
0.090001	1.003392	1943.451009	1950.042693	84.644547
0.095001	1.003628	1650.919417	1656.908698	75.657642
0.100001	1.003870	1414.066614	1419.538361	67.989759
0.105001	1.004117	1220.260929	1225.284328	61.395667
0.110001	1.004369	1060.158451	1064.790511	55.684547

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0.115001	1.004627	926.746548	931.034705	50.706125
0.120001	1.004890	814.692624	818.676692	46.340762
0.125001	1.005159	719.892740	723.606410	42.492257
0.130001	1.005432	639.153679	642.625664	39.082548
0.135001	1.005711	569.965651	573.220594	36.047755
0.140001	1.005994	510.337587	513.396762	33.335204
0.145001	1.006283	458.676269	461.558152	30.901144
0.150001	1.006577	413.696608	416.417329	28.708996
0.155001	1.006875	374.354317	376.928027	26.727987
0.160001	1.007178	339.794881	342.234052	24.932080
0.165001	1.007486	309.314526	311.630197	23.299124
0.170001	1.007799	282.330089	284.532072	21.810179
0.175001	1.008117	258.355587	260.452634	20.448975
0.180001	1.008439	236.983842	238.983788	19.201472
0.185001	1.008766	217.871968	219.781850	18.055502
0.190001	1.009093	200.729841	202.556001	17.000481
0.195001	1.009434	185.310866	187.059034	16.027164
0.200001	1.009774	171.404548	173.079918	15.127449
0.205001	1.010120	158.830478	160.437767	14.294212
0.210001	1.010469	147.433431	148.976938	13.521167
0.215001	1.010823	137.079367	138.563017	12.802753
0.220001	1.011182	127.652128	129.079513	12.134035
0.225001	1.011545	119.050721	120.425136	11.510619
0.230001	1.011912	111.187059	112.511531	10.928586
0.235001	1.012284	103.984076	105.261394	10.384430
0.240001	1.012660	97.374153	98.606890	9.875007
0.245001	1.013040	91.297797	92.488330	9.397492
0.250001	1.013425	85.702521	86.853053	8.949340
0.255001	1.013814	80.541906	81.654477	8.528253
0.260001	1.014207	75.774793	76.851301	8.132154
0.265001	1.014604	71.364605	72.406814	7.759158
0.270001	1.015006	67.278763	68.288317	7.407556
0.275001	1.015411	63.488184	64.466615	7.075792
0.280001	1.015821	59.966851	60.915593	6.762450
0.285001	1.016235	56.691447	57.611839	6.466234
0.290001	1.016653	53.641028	54.534326	6.185963
0.295001	1.017076	50.796750	51.664132	5.920553
0.300001	1.017502	48.141630	48.984200	5.669011
0.305001	1.017932	45.660328	46.479124	5.430426
0.310001	1.018367	43.338971	44.134971	5.203958
0.315001	1.018805	41.164990	41.939114	4.988834
0.320001	1.019248	39.126979	39.880095	4.784343
0.325001	1.019695	37.214572	37.947499	4.589827
0.330001	1.020145	35.418335	36.131846	4.404677
0.335001	1.020600	33.729668	34.424494	4.229332
0.340001	1.021058	32.140720	32.817554	4.060268
0.345001	1.021521	30.644319	31.303816	3.900004

0.350001	1.021983	29.233897	29.876679	3.747089
0.355001	1.022458	27.903438	28.530094	3.601105
0.360001	1.022932	26.647422	27.258512	3.461663
0.365001	1.023411	25.460776	26.056833	3.328406
0.370001	1.023893	24.338838	24.920367	3.200990
0.375001	1.024379	23.277313	23.844795	3.079103
0.380001	1.024869	22.272243	22.826137	2.962449
0.385001	1.025363	21.319976	21.860719	2.850754
0.390001	1.025861	20.417138	20.945146	2.743760
0.395001	1.026363	19.560609	20.076279	2.641226
0.400001	1.026868	18.747503	19.251215	2.542925
0.405001	1.027378	17.975144	18.467260	2.448646
0.410001	1.027891	17.241051	17.721918	2.358190
0.415001	1.028408	16.542922	17.012872	2.271368
0.420001	1.028929	15.878618	16.337967	2.188005
0.425001	1.029453	15.246150	15.695202	2.107935
0.430001	1.029982	14.643666	15.082712	2.031003
0.435001	1.030514	14.069443	14.498762	1.957061
0.440001	1.031050	13.521873	13.941732	1.885971
0.445001	1.031590	12.999456	13.410112	1.817602
0.450001	1.032134	12.500793	12.902493	1.751831
0.455001	1.032681	12.024575	12.417555	1.688540
0.460001	1.033233	11.569579	11.954067	1.627620
0.465001	1.033788	11.134662	11.510875	1.568966
0.470001	1.034346	10.718750	11.086900	1.512480
0.475001	1.034909	10.320839	10.681128	1.458067
0.480001	1.035475	9.939988	10.292611	1.405640
0.485001	1.036045	9.575314	9.920457	1.355114
0.490001	1.036619	9.225986	9.563830	1.306410
0.495001	1.037196	8.891224	9.221945	1.259452
0.500001	1.037777	8.570297	8.894061	1.214167
0.505001	1.038362	8.262514	8.579483	1.170489
0.510001	1.038951	7.967226	8.277558	1.128352
0.515001	1.039543	7.683823	7.987667	1.087694
0.520001	1.040139	7.411728	7.709230	1.048456
0.525001	1.040739	7.150398	7.441700	1.010583
0.530001	1.041343	6.899321	7.184558	0.974022
0.535001	1.041950	6.658014	6.937316	0.938722
0.540001	1.042561	6.426019	6.699515	0.904633
0.545001	1.043175	6.202905	6.470717	0.871712
0.550001	1.043794	5.988263	6.250510	0.839912
0.555001	1.044415	5.781709	6.038506	0.809193
0.560001	1.045041	5.582876	5.834335	0.779514
0.565001	1.045670	5.391418	5.637647	0.750837
0.570001	1.046303	5.207009	5.448111	0.723126

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0.575001	1.046940	5.029337	5.265415	0.696345
0.580001	1.047580	4.858108	5.089259	0.670461
0.585001	1.048225	4.693043	4.919363	0.645442
0.590001	1.048872	4.533877	4.755458	0.621258
0.595001	1.049524	4.380358	4.597289	0.597878
0.600001	1.050179	4.232247	4.444616	0.575276
0.605001	1.050837	4.089317	4.297208	0.553423
0.610001	1.051500	3.951353	4.154846	0.532295
0.615001	1.052166	3.818148	4.017324	0.511867
0.620001	1.052836	3.689507	3.884444	0.492114
0.625001	1.053509	3.565245	3.756018	0.473015
0.630001	1.054186	3.445185	3.631865	0.454547
0.635001	1.054867	3.329157	3.511817	0.436690
0.640001	1.055551	3.217001	3.395709	0.419422
0.645001	1.056239	3.108565	3.283388	0.402726
0.650001	1.056931	3.003701	3.174704	0.386583
0.655001	1.057626	2.902271	3.069518	0.370973
0.660001	1.058325	2.804142	2.967694	0.355882
0.665001	1.059028	2.709187	2.869104	0.341291
0.670001	1.059734	2.617284	2.773625	0.327186
0.675001	1.060444	2.528318	2.681140	0.313550
0.680001	1.061158	2.442178	2.591536	0.300369
0.685001	1.061875	2.358759	2.504707	0.287630
0.690001	1.062596	2.277959	2.420550	0.275318
0.695001	1.063321	2.199682	2.338968	0.263420
0.700001	1.064049	2.123835	2.259865	0.251924
0.705001	1.064781	2.050330	2.183153	0.240818
0.710001	1.065517	1.979082	2.108745	0.230089
0.715001	1.066256	1.910010	2.036559	0.219727
0.720001	1.066999	1.843035	1.966517	0.209720
0.725001	1.067746	1.778085	1.898542	0.200058
0.730001	1.068496	1.715086	1.832563	0.190731
0.735001	1.069250	1.653971	1.768509	0.181729
0.740001	1.070008	1.594674	1.706314	0.173043
0.745001	1.070769	1.537133	1.645914	0.164663
0.750001	1.071534	1.481286	1.587248	0.156581
0.755001	1.072303	1.427075	1.530257	0.148788
0.760001	1.073075	1.374446	1.474884	0.141276
0.765001	1.073851	1.323344	1.421075	0.134036
0.770001	1.074631	1.273718	1.368777	0.127062
0.775001	1.075415	1.225519	1.317941	0.120346
0.780001	1.076202	1.178700	1.268519	0.113881
0.785001	1.076992	1.133214	1.220463	0.107659

0.790001	1.077787	1.089019	1.173730	0.101674
0.795001	1.078585	1.046071	1.128277	0.095919
0.800001	1.079387	1.004331	1.084062	0.090389
0.805001	1.080193	0.963759	1.041045	0.085077
0.810001	1.081002	0.924318	0.999189	0.079977
0.815001	1.081815	0.885971	0.958457	0.075083
0.820001	1.082632	0.848685	0.918813	0.070390
0.825001	1.083452	0.812425	0.880223	0.065893
0.830001	1.084277	0.777159	0.842655	0.061586
0.835001	1.085105	0.742856	0.806076	0.057465
0.840001	1.085936	0.709486	0.770456	0.053524
0.845001	1.086772	0.677020	0.735766	0.049759
0.850001	1.087611	0.645431	0.701978	0.046165
0.855001	1.088453	0.614691	0.669063	0.042738
0.860001	1.089300	0.584775	0.636996	0.039473
0.865001	1.090150	0.555658	0.605751	0.036366
0.870001	1.091004	0.527315	0.575303	0.033414
0.875001	1.091862	0.499724	0.545630	0.030612
0.880001	1.092724	0.472862	0.516707	0.027956
0.885001	1.093589	0.446706	0.488513	0.025444
0.890001	1.094458	0.421238	0.461027	0.023070
0.895001	1.095331	0.396435	0.434228	0.020832
0.900001	1.096208	0.372279	0.408095	0.018727
0.905001	1.097088	0.348751	0.382610	0.016750
0.910001	1.097973	0.325832	0.357754	0.014900
0.915001	1.098861	0.303505	0.333510	0.013172
0.920001	1.099752	0.281753	0.309859	0.011564
0.925001	1.100648	0.260560	0.286785	0.010072
0.930001	1.101548	0.239909	0.264271	0.008695
0.935001	1.102451	0.219786	0.242303	0.007429
0.940001	1.103358	0.200175	0.220864	0.006271
0.945001	1.104269	0.181061	0.199940	0.005219
0.950001	1.105183	0.162432	0.179517	0.004271
0.955001	1.106102	0.144273	0.159581	0.003423
0.960001	1.107024	0.126572	0.140118	0.002674
0.965001	1.107950	0.109316	0.121116	0.002021
0.970001	1.108881	0.092492	0.102563	0.001462
0.975001	1.109814	0.076089	0.084445	0.000995
0.980001	1.110752	0.060095	0.066751	0.000617
0.985001	1.111694	0.044500	0.049470	0.000327
0.990001	1.112639	0.029292	0.032592	0.000122
0.995001	1.113589	0.014461	0.016104	0.0

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INIT MACH NUMBER IS

0.030001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.030001	0.0	52847.645998	0.0	700.756608
0.035001	1.001445	33269.799389	33317.879959	617.461908
0.040001	1.001636	22280.036557	22316.493125	441.443253
0.045001	1.001834	15641.450914	15670.144823	348.291258
0.050001	1.002040	11397.266348	11420.512523	281.563246
0.055001	1.002252	8558.474684	8577.745039	232.153796
0.060001	1.002470	6588.432610	6604.708049	194.560051
0.065001	1.002696	5178.750104	5192.709887	165.300272
0.070001	1.002927	4143.600147	4155.729899	142.085430
0.075001	1.003165	3366.455491	3377.111887	123.360977
0.080001	1.003410	2771.718836	2781.169955	108.041387
0.085001	1.003660	2308.886370	2317.337757	95.350164
0.090001	1.003917	1943.344135	1950.956156	84.720033
0.095001	1.004180	1650.828629	1657.728335	75.728803
0.100001	1.004448	1413.988851	1420.278278	68.057027
0.105001	1.004722	1220.193825	1225.955917	61.459411
0.110001	1.005002	1060.100150	1065.403075	55.745085
0.115001	1.005288	926.695584	931.595916	50.763731
0.120001	1.005579	814.647822	819.192934	46.395677
0.125001	1.005876	719.853152	724.083040	42.544693
0.130001	1.006178	639.118530	643.067212	39.132690
0.135001	1.006486	569.934307	573.630914	36.095769
0.140001	1.006799	510.309522	513.779157	33.381238
0.145001	1.007117	458.651046	461.915469	30.945329
0.150001	1.007441	413.673858	416.752034	28.751452
0.155001	1.007770	374.333730	377.242267	26.768822
0.160001	1.008104	339.776195	342.529707	24.971391
0.165001	1.008443	309.297516	311.908920	23.337000
0.170001	1.008787	282.314563	284.795321	21.846700
0.175001	1.009136	258.341380	260.701702	20.484216
0.180001	1.009491	236.970809	239.219824	19.235501
0.185001	1.009850	217.859986	220.005882	18.088381
0.190001	1.010214	200.718802	202.768945	17.032268
0.195001	1.010583	185.300675	187.261717	16.057912
0.200001	1.010957	171.395122	173.273082	15.157208
0.205001	1.011336	158.821743	160.622085	14.323027
0.210001	1.011719	147.425324	149.153019	13.549082

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0.215001	1.012107	137.071829	138.731411	12.829807
0.220001	1.012500	127.645108	129.240724	12.160265
0.225001	1.012898	119.044174	120.579623	11.536060
0.230001	1.013301	111.180945	112.659714	10.953270
0.235001	1.013708	103.978358	105.403655	10.408388
0.240001	1.014119	97.368798	98.743583	9.898269
0.245001	1.014536	91.292776	92.619779	9.420084
0.250001	1.014957	85.697808	86.979557	8.971287
0.255001	1.015382	80.537477	81.776312	8.549579
0.260001	1.015812	75.770626	76.968722	8.152881
0.265001	1.016247	71.360681	72.520057	7.779309
0.270001	1.016686	67.275064	68.397601	7.427151
0.275001	1.017129	63.484693	64.572144	7.094850
0.280001	1.017577	59.963554	61.017556	6.780989
0.285001	1.018030	56.688329	57.710412	6.484272
0.290001	1.018487	53.638078	54.629673	6.203516
0.295001	1.018948	50.793957	51.756407	5.937637
0.300001	1.019414	48.138982	49.073546	5.685642
0.305001	1.019884	45.657817	46.565676	5.446617
0.310001	1.020358	43.336588	44.218854	5.219722
0.315001	1.020837	41.162726	42.020447	5.004186
0.320001	1.021321	39.124827	39.958989	4.799294
0.325001	1.021808	37.212526	38.024058	4.604390
0.330001	1.022300	35.416388	36.206168	4.418863
0.335001	1.022796	33.727813	34.496671	4.242151
0.340001	1.023296	32.138953	32.887675	4.073732
0.345001	1.023801	30.642634	31.371961	3.913122
0.350001	1.024310	29.232289	29.942927	3.759870
0.355001	1.024823	27.901904	28.594519	3.613560
0.360001	1.025341	26.645956	27.321183	3.473802
0.365001	1.025862	25.459376	26.117816	3.340234
0.370001	1.026388	24.337500	24.979724	3.212517
0.375001	1.026918	23.276033	23.902586	3.090337
0.380001	1.027453	22.271019	22.882417	2.973393
0.385001	1.027991	21.318804	21.915542	2.861426
0.390001	1.028534	20.416015	20.998563	2.754161
0.395001	1.029081	19.559534	20.128338	2.651363
0.400001	1.029632	18.746472	19.301962	2.552806
0.405001	1.030187	17.974155	18.516739	2.458276
0.410001	1.030746	17.240103	17.770170	2.367575
0.415001	1.031310	16.542013	17.059937	2.280515
0.420001	1.031877	15.877745	16.383884	2.196920
0.425001	1.032449	15.245312	15.740006	2.116623

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0.430001	1.033025	14.642861	15.126438	2.039470
0.435001	1.033605	14.068669	14.541443	1.965312
0.440001	1.034189	13.521129	13.983400	1.894011
0.445001	1.034777	12.998741	13.450797	1.825436
0.450001	1.035369	12.500105	12.942223	1.759464
0.455001	1.035965	12.023914	12.456360	1.695977
0.460001	1.036566	11.568943	11.991972	1.634865
0.465001	1.037170	11.134049	11.547906	1.576024
0.470001	1.037779	10.718160	11.123081	1.519354
0.475001	1.038392	10.320272	10.716483	1.464763
0.480001	1.039008	9.939442	10.327162	1.412161
0.485001	1.039629	9.574787	9.954226	1.361464
0.490001	1.040254	9.225478	9.596839	1.312593
0.495001	1.040883	8.890735	9.254212	1.265472
0.500001	1.041516	8.569825	8.925606	1.220028
0.505001	1.042152	8.262059	8.610325	1.176194
0.510001	1.042793	7.966788	8.307714	1.133904
0.515001	1.043438	7.683400	8.017155	1.093097
0.520001	1.044087	7.411320	7.738067	1.053714
0.525001	1.044741	7.150005	7.469900	1.015698
0.530001	1.045398	6.898942	7.212138	0.978997
0.535001	1.046059	6.657648	6.964291	0.943560
0.540001	1.046724	6.425665	6.725897	0.909339
0.545001	1.047393	6.202563	6.496522	0.876287
0.550001	1.048066	5.987934	6.275751	0.844360
0.555001	1.048743	5.781391	6.063195	0.813516
0.560001	1.049425	5.582569	5.858485	0.783715
0.565001	1.050110	5.391122	5.661270	0.754918
0.570001	1.050799	5.206722	5.471219	0.727090
0.575001	1.051492	5.029060	5.288018	0.700195
0.580001	1.052189	4.857841	5.111369	0.674199
0.585001	1.052891	4.692785	4.940990	0.649071
0.590001	1.053596	4.533628	4.776612	0.624779
0.595001	1.054305	4.380117	4.617980	0.601295
0.600001	1.055018	4.232014	4.464853	0.578591
0.605001	1.055736	4.089092	4.317001	0.556638
0.610001	1.056457	3.951135	4.174204	0.535412
0.615001	1.057182	3.817938	4.036256	0.514888
0.620001	1.057911	3.689304	3.902957	0.495042
0.625001	1.058645	3.565049	3.774120	0.475851
0.630001	1.059382	3.444995	3.649566	0.457294
0.635001	1.060123	3.328974	3.529123	0.439349
0.640001	1.060869	3.216824	3.412628	0.421996

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0.645001	1.061618	3.108394	3.299926	0.405216
0.650001	1.062371	3.003536	3.190870	0.388991
0.655001	1.063128	2.902112	3.085317	0.373302
0.660001	1.063890	2.803988	2.983134	0.358132
0.665001	1.064655	2.709038	2.884190	0.343465
0.670001	1.065424	2.617140	2.783364	0.329285
0.675001	1.066198	2.528179	2.695538	0.315576
0.680001	1.066975	2.442044	2.605599	0.302325
0.685001	1.067756	2.358629	2.518441	0.289516
0.690001	1.068542	2.277834	2.433960	0.277136
0.695001	1.069331	2.199561	2.352059	0.265172
0.700001	1.070124	2.123718	2.272643	0.253611
0.705001	1.070922	2.050217	2.195623	0.242442
0.710001	1.071723	1.978973	2.120912	0.231651
0.715001	1.072529	1.909905	2.048428	0.221229
0.720001	1.073338	1.842934	1.978092	0.211163
0.725001	1.074152	1.777987	1.909828	0.201444
0.730001	1.074969	1.714992	1.843564	0.192062
0.735001	1.075791	1.653880	1.779230	0.183006
0.740001	1.076617	1.594587	1.716759	0.174266
0.745001	1.077446	1.537048	1.656087	0.165835
0.750001	1.078280	1.481204	1.597153	0.157703
0.755001	1.079118	1.426997	1.539898	0.149861
0.760001	1.079960	1.374370	1.484265	0.142301
0.765001	1.080806	1.323271	1.430199	0.135015
0.770001	1.081656	1.273648	1.377649	0.127996
0.775001	1.082510	1.225452	1.326564	0.121237
0.780001	1.083368	1.178635	1.276895	0.114729
0.785001	1.084230	1.133152	1.228597	0.108465
0.790001	1.085096	1.088959	1.181625	0.102440
0.795001	1.085966	1.046014	1.135936	0.096647
0.800001	1.086841	1.004276	1.091488	0.091079
0.805001	1.087719	0.963706	1.048241	0.085730
0.810001	1.088602	0.924267	1.006159	0.080595
0.815001	1.089489	0.885923	0.965202	0.075667
0.820001	1.090379	0.848638	0.925337	0.070941
0.825001	1.091274	0.812380	0.886529	0.066412
0.830001	1.092173	0.777116	0.848745	0.062074
0.835001	1.093076	0.742815	0.811953	0.057922
0.840001	1.093984	0.709447	0.776123	0.053953
0.845001	1.094895	0.676983	0.741225	0.050160
0.850001	1.095810	0.645395	0.707231	0.046539
0.855001	1.096730	0.614658	0.674113	0.043086

0.860001	1.097654	0.584743	0.641846	0.039796
0.865001	1.098582	0.555627	0.610402	0.036666
0.870001	1.099514	0.527286	0.579759	0.033691
0.875001	1.100450	0.499696	0.549891	0.030867
0.880001	1.101391	0.472836	0.520777	0.028191
0.885001	1.102335	0.446682	0.492393	0.025658
0.890001	1.103284	0.421214	0.464719	0.023266
0.895001	1.104237	0.396413	0.437734	0.021010
0.900001	1.105194	0.372258	0.411418	0.018887
0.905001	1.106155	0.348731	0.385751	0.016895
0.910001	1.107121	0.325814	0.360715	0.015029
0.915001	1.108091	0.303488	0.336293	0.013267
0.920001	1.109065	0.281738	0.312465	0.011665
0.925001	1.110043	0.260546	0.289217	0.010161
0.930001	1.111025	0.239896	0.266531	0.008772
0.935001	1.112012	0.219774	0.244391	0.007495
0.940001	1.113003	0.200164	0.222783	0.006327
0.945001	1.113998	0.181051	0.201691	0.005266
0.950001	1.114998	0.162423	0.181101	0.004309
0.955001	1.116001	0.144265	0.161000	0.003454
0.960001	1.117009	0.126565	0.141374	0.002698
0.965001	1.118022	0.109310	0.122211	0.002040
0.970001	1.119038	0.092487	0.103496	0.001476
0.975001	1.120059	0.076085	0.085220	0.001004
0.980001	1.121084	0.060092	0.067368	0.000623
0.985001	1.122114	0.044498	0.049931	0.000330
0.990001	1.123148	0.029291	0.032898	0.000123
0.995001	1.124186	0.014460	0.016256	0.0

INITIAL MACH NUMBER IS  
0.050001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.050001	0.0	11393.620958	0.0	263.302306
0.055001	1.003814	8555.737275	8588.370449	241.831380
0.060001	1.004127	6586.325314	6613.505591	195.023994
0.065001	1.004447	5177.093692	5200.114377	165.723891
0.070001	1.004774	4142.274826	4162.048974	142.474869
0.075001	1.005108	3365.378737	3382.569129	123.721067
0.080001	1.005449	2770.832308	2785.931645	108.376000
0.085001	1.005798	2308.147878	2321.530061	95.662444
0.090001	1.006153	1942.722561	1954.676493	85.012572
0.095001	1.006515	1650.300615	1661.053102	76.003761

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0.100001	1.006885	1413.536590	1423.268212	68.316224
0.105001	1.007260	1219.803549	1228.659907	61.704394
0.110001	1.007643	1059.761080	1067.860908	55.977179
0.115001	1.008032	926.399183	933.840302	50.984084
0.120001	1.008428	814.387259	821.251010	46.605285
0.125001	1.008830	719.622908	725.977505	42.744429
0.130001	1.009239	638.914110	644.817202	39.323322
0.135001	1.009654	569.752015	575.252672	36.277979
0.140001	1.010076	510.146301	515.286562	33.555630
0.145001	1.010504	458.504347	463.320450	31.112446
0.150001	1.010938	413.541546	418.064902	28.911779
0.155001	1.011378	374.214001	378.471981	26.922796
0.160001	1.011825	339.667519	343.684089	25.119408
0.165001	1.012278	309.198588	312.994828	23.479419
0.170001	1.012736	282.224265	285.818797	21.983848
0.175001	1.013201	258.258750	261.668088	20.616392
0.180001	1.013672	236.895015	240.133861	19.362977
0.185001	1.014149	217.790304	220.871792	18.211410
0.190001	1.014632	200.654603	203.590503	17.151079
0.195001	1.015120	185.241407	188.042305	16.172719
0.200001	1.015615	171.340302	174.015743	15.268208
0.205001	1.016115	158.770944	161.329561	14.430403
0.210001	1.016621	147.378170	149.827790	13.653004
0.215001	1.017133	137.027986	139.375726	12.930432
0.220001	1.017651	127.604281	129.856624	12.257740
0.225001	1.018174	119.006098	121.168969	11.630522
0.230001	1.018704	111.145384	113.224203	11.044849
0.235001	1.019238	103.945100	105.944841	10.497204
0.240001	1.019779	97.337655	99.262889	9.984433
0.245001	1.020325	91.263576	93.118512	9.503704
0.250001	1.020877	85.670398	87.458919	9.052462
0.255001	1.021434	80.511717	82.237412	8.628404
0.260001	1.021997	75.746391	77.412582	8.229444
0.265001	1.022565	71.337856	72.947624	7.853694
0.270001	1.023139	67.253546	68.809750	7.499437
0.275001	1.023719	63.464387	64.969688	7.165112
0.280001	1.024304	59.944374	61.401250	6.849298
0.285001	1.024894	56.670197	58.080959	6.550696
0.290001	1.025490	53.620922	54.987727	6.268119
0.295001	1.026091	50.777711	52.102577	6.000480
0.300001	1.026698	48.123585	49.408402	5.746782
0.305001	1.027310	45.643213	46.889750	5.506109
0.310001	1.027928	43.322727	44.532645	5.277621

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0.315001	1.028551	41.149560	42.324422	5.060540
0.320001	1.029179	39.112313	40.253586	4.854152
0.325001	1.029813	37.200624	38.309689	4.657797
0.330001	1.030452	35.405060	36.483220	4.470864
0.335001	1.031097	33.717025	34.765508	4.292787
0.340001	1.031746	32.128673	33.148639	4.123044
0.345001	1.032401	30.632833	31.625377	3.961148
0.350001	1.033062	29.222940	30.189099	3.806648
0.355001	1.033727	27.892979	28.833735	3.659125
0.360001	1.034398	26.637434	27.553715	3.518187
0.365001	1.035074	25.451233	26.343921	3.383472
0.370001	1.035756	24.329715	25.199647	3.254641
0.375001	1.036443	23.268588	24.116559	3.131376
0.380001	1.037135	22.263895	23.090658	3.013382
0.385001	1.037832	21.311985	22.118259	2.900382
0.390001	1.038534	20.409485	21.195954	2.792117
0.395001	1.039242	19.553278	20.320591	2.688345
0.400001	1.039955	18.740476	19.489255	2.588839
0.405001	1.040673	17.968406	18.699241	2.493385
0.410001	1.041397	17.234589	17.948044	2.401783
0.415001	1.042125	16.536722	17.233337	2.313845
0.420001	1.042859	15.872667	16.552956	2.229393
0.425001	1.043598	15.240436	15.904891	2.148262
0.430001	1.044342	14.638178	15.287270	2.070294
0.435001	1.045092	14.064170	14.698349	1.995342
0.440001	1.045846	13.516804	14.136502	1.923266
0.445001	1.046606	12.994584	13.600212	1.853935
0.450001	1.047371	12.496107	13.088063	1.787225
0.455001	1.048141	12.020068	12.598731	1.723017
0.460001	1.048917	11.565243	12.130977	1.661202
0.465001	1.049697	11.130488	11.683643	1.601674
0.470001	1.050483	10.714732	11.255644	1.544334
0.475001	1.051274	10.316971	10.845962	1.489087
0.480001	1.052070	9.936263	10.453644	1.435845
0.485001	1.052871	9.571725	10.077793	1.384524
0.490001	1.053678	9.222528	9.717571	1.335042
0.495001	1.054489	8.887892	9.372186	1.287324
0.500001	1.055306	8.567084	9.040895	1.241297
0.505001	1.056128	8.259417	8.723000	1.196893
0.510001	1.056955	7.964240	8.417843	1.154046
0.515001	1.057787	7.680943	8.124803	1.112694
0.520001	1.058625	7.408950	7.843297	1.072779
0.525001	1.059467	7.147718	7.572773	1.034243

0.530001	1.060315	6.896735	7.312712	0.997034
0.535001	1.061168	6.655518	7.062623	0.961100
0.540001	1.062026	6.423610	6.822042	0.926392
0.545001	1.062889	6.200580	6.590531	0.892864
0.550001	1.063758	5.986019	6.367675	0.860472
0.555001	1.064632	5.779542	6.153083	0.829174
0.560001	1.065511	5.580783	5.946383	0.798929
0.565001	1.066395	5.389397	5.747224	0.769698
0.570001	1.067284	5.205057	5.555274	0.741444
0.575001	1.068178	5.027452	5.370215	0.714134
0.580001	1.069078	4.856287	5.191750	0.687731
0.585001	1.069983	4.691284	5.019594	0.662206
0.590001	1.070893	4.532178	4.853477	0.637526
0.595001	1.071808	4.378716	4.693144	0.613661
0.600001	1.072729	4.230661	4.538351	0.590585
0.605001	1.073654	4.087785	4.388868	0.568269
0.610001	1.074585	3.949872	4.244474	0.546688
0.615001	1.075521	3.816717	4.104961	0.525816
0.620001	1.076463	3.688124	3.970129	0.505631
0.625001	1.077410	3.563909	3.839789	0.486108
0.630001	1.078361	3.443893	3.713762	0.467226
0.635001	1.079319	3.327909	3.591874	0.448963
0.640001	1.080281	3.215796	3.473962	0.431300
0.645001	1.081249	3.107400	3.359871	0.414217
0.650001	1.082221	3.002575	3.249451	0.397695
0.655001	1.083200	2.901183	3.142561	0.381717
0.660001	1.084183	2.803091	3.039064	0.366264
0.665001	1.085172	2.708171	2.938831	0.351321
0.670001	1.086166	2.616303	2.841739	0.336871
0.675001	1.087165	2.527370	2.747669	0.322899
0.680001	1.088170	2.441263	2.656508	0.309389
0.685001	1.089180	2.357875	2.568149	0.296329
0.690001	1.090195	2.277105	2.482489	0.283703
0.695001	1.091216	2.198857	2.399428	0.271500
0.700001	1.092242	2.123039	2.318872	0.259705
0.705001	1.093273	2.049562	2.240730	0.248307
0.710001	1.094310	1.978340	2.164916	0.237294
0.715001	1.095352	1.909294	2.091348	0.226654
0.720001	1.096399	1.842345	2.019945	0.216377
0.725001	1.097452	1.777418	1.950631	0.206451
0.730001	1.098510	1.714443	1.883333	0.196867
0.735001	1.099573	1.653351	1.817981	0.187615
0.740001	1.100642	1.594077	1.754508	0.178684

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0.745001	1.101717	1.536557	1.692850	0.170067
0.750001	1.102796	1.480730	1.632944	0.161753
0.755001	1.103882	1.426540	1.574732	0.153734
0.760001	1.104972	1.373931	1.518155	0.146003
0.765001	1.106069	1.322848	1.463160	0.138550
0.770001	1.107170	1.273241	1.409694	0.131369
0.775001	1.108277	1.225060	1.357706	0.124451
0.780001	1.109390	1.178258	1.307148	0.117789
0.785001	1.110508	1.132790	1.257972	0.111377
0.790001	1.111631	1.088611	1.210134	0.105207
0.795001	1.112760	1.045679	1.163590	0.099274
0.800001	1.113895	1.003954	1.118300	0.093569
0.805001	1.115035	0.963398	1.074222	0.088089
0.810001	1.116181	0.923971	1.031319	0.082825
0.815001	1.117332	0.885639	0.989553	0.077773
0.820001	1.118489	0.848367	0.948889	0.072923
0.825001	1.119652	0.812120	0.909292	0.068283
0.830001	1.120820	0.776867	0.870728	0.063833
0.835001	1.121993	0.742577	0.833167	0.059574
0.840001	1.123173	0.709220	0.796576	0.055500
0.845001	1.124358	0.676766	0.760928	0.051607
0.850001	1.125548	0.645189	0.726192	0.047889
0.855001	1.126745	0.614461	0.692341	0.044343
0.860001	1.127947	0.584556	0.659348	0.040964
0.865001	1.129154	0.555450	0.627189	0.037748
0.870001	1.130368	0.527118	0.595837	0.034691
0.875001	1.131587	0.499537	0.565269	0.031789
0.880001	1.132812	0.472684	0.535462	0.029037
0.885001	1.134042	0.446539	0.506394	0.026433
0.890001	1.135279	0.421080	0.478043	0.023972
0.895001	1.136521	0.396286	0.450388	0.021651
0.900001	1.137769	0.372139	0.423409	0.019467
0.905001	1.139023	0.348620	0.397086	0.017416
0.910001	1.140283	0.325710	0.371401	0.015495
0.915001	1.141548	0.303391	0.346336	0.013701
0.920001	1.142819	0.281648	0.321872	0.012031
0.925001	1.144097	0.260462	0.297994	0.010481
0.930001	1.145380	0.239819	0.274684	0.009050
0.935001	1.146669	0.219703	0.251927	0.007734
0.940001	1.147964	0.200099	0.229707	0.006530
0.945001	1.149265	0.180993	0.208009	0.005436
0.950001	1.150571	0.162371	0.186820	0.004449
0.955001	1.151884	0.144219	0.166124	0.003567

0.960001	1.153203	0.126525	0.145909	0.002787
0.965001	1.154528	0.109275	0.126161	0.002107
0.970001	1.155859	0.092457	0.106868	0.001524
0.975001	1.157196	0.076061	0.088017	0.001037
0.980001	1.158539	0.060073	0.069597	0.000643
0.985001	1.159888	0.044483	0.051596	0.000341
0.990001	1.161243	0.029281	0.034003	0.000127
0.995001	1.162604	0.014456	0.016806	0.0

INITIAL MACH NUMBER IS  
0.075001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.075001	0.0	3363.277708	0.0	118.547722
0.080001	1.008379	2769.102458	2792.304740	111.566961
0.085001	1.008846	2306.706885	2327.111513	96.053838
0.090001	1.009320	1941.509705	1959.604825	85.377750
0.095001	1.009802	1649.270321	1665.436486	76.345705
0.100001	1.010291	1412.654109	1427.192305	68.637434
0.105001	1.010788	1219.042017	1232.193389	62.006989
0.110001	1.011293	1059.099463	1071.059467	56.262967
0.115001	1.011804	925.820825	936.749553	51.254621
0.120001	1.012323	813.878831	823.908664	46.861921
0.125001	1.012850	719.173642	728.415005	42.988340
0.130001	1.013384	638.515231	647.060964	39.555542
0.135001	1.013925	569.396315	577.325053	36.499418
0.140001	1.014473	509.827813	517.206604	33.767096
0.145001	1.015029	458.218100	465.104472	31.314658
0.150001	1.015591	413.283369	419.726969	29.105381
0.155001	1.016161	373.980376	380.024279	27.108368
0.160001	1.016738	339.455462	345.137228	25.297471
0.165001	1.017322	309.005553	314.358089	23.650444

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0.170001	1.017913	282.048070	297.100332	22.148265
0.175001	1.018511	258.097517	262.875087	20.774590
0.180001	1.019116	236.747120	241.272690	19.515314
0.185001	1.019727	217.654336	221.948108	18.358211
0.190001	1.020346	200.529332	204.609350	17.292644
0.195001	1.020972	185.125759	189.008193	16.309325
0.200001	1.021604	171.233333	174.932720	15.400108
0.205001	1.022244	158.671823	162.201268	14.557833
0.210001	1.022890	147.286161	150.657511	13.776181
0.215001	1.023543	136.942439	140.166433	13.049560
0.220001	1.024202	127.524617	130.611012	12.373006
0.225001	1.024869	118.931802	121.889486	11.742102
0.230001	1.025542	111.075995	113.913080	11.152906
0.235001	1.026222	103.880207	106.604116	10.601891
0.240001	1.026908	97.276886	99.894423	10.085895
0.245001	1.027601	91.206600	93.724014	9.602073
0.250001	1.028301	85.616913	88.039957	9.147866
0.255001	1.029007	80.461453	82.795428	8.720961
0.260001	1.029720	75.699102	77.948906	8.319266
0.265001	1.030440	71.293320	73.463483	7.940885
0.270001	1.031166	67.211559	69.306279	7.584097
0.275001	1.031899	63.424766	65.447939	7.247336
0.280001	1.032638	59.906951	61.862196	6.929175
0.285001	1.033384	56.634818	58.525504	6.628309
0.290001	1.034136	53.587446	55.416713	6.343549
0.295001	1.034895	50.746010	52.516789	6.073802
0.300001	1.035660	48.093541	49.808569	5.818068
0.305001	1.036432	45.614718	47.276556	5.575429
0.310001	1.037210	43.295680	44.906727	5.345038
0.315001	1.037995	41.123870	42.686375	5.126118
0.320001	1.038786	39.087895	40.603970	4.917950
0.325001	1.039584	37.177399	38.649028	4.719870
0.330001	1.040388	35.382956	36.812005	4.531267
0.335001	1.041199	33.695975	35.084203	4.351572
0.340001	1.042016	32.108615	33.457678	4.180259
0.345001	1.042839	30.613708	31.925169	4.016841
0.350001	1.043669	29.204695	30.480030	3.860865
0.355001	1.044505	27.875566	29.116169	3.711908
0.360001	1.045348	26.620804	27.827996	3.569579
0.365001	1.046197	25.435344	26.610374	3.433513
0.370001	1.047052	24.314526	25.458579	3.303368
0.375001	1.047914	23.254062	24.368259	3.178826
0.380001	1.048782	22.249996	23.335403	3.059591

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0.385001	1.049657	21.298680	22.356308	2.945384
0.390001	1.050538	20.396743	21.427555	2.835945
0.395001	1.051425	19.541070	20.545979	2.731031
0.400001	1.052319	18.728776	19.708653	2.630413
0.405001	1.053220	17.957189	18.912861	2.533877
0.410001	1.054126	17.223829	18.156088	2.441220
0.415001	1.055039	16.526398	17.435996	2.352256
0.420001	1.055958	15.862757	16.750413	2.266804
0.425001	1.056884	15.230921	16.097321	2.184698
0.430001	1.057816	14.629039	15.474838	2.105780
0.435001	1.058755	14.055389	14.881213	2.029902
0.440001	1.059700	13.508366	14.314815	1.956924
0.445001	1.060651	12.986471	13.774117	1.886712
0.450001	1.061609	12.488306	13.257698	1.819143
0.455001	1.062573	12.012564	12.764228	1.754097
0.460001	1.063544	11.558023	12.292463	1.691465
0.465001	1.064521	11.123539	11.841238	1.631139
0.470001	1.065504	10.708043	11.409464	1.573020
0.475001	1.066494	10.310530	10.996117	1.517014
0.480001	1.067490	9.930059	10.600241	1.463030
0.485001	1.068493	9.565749	10.220934	1.410984
0.490001	1.069502	9.216770	9.857353	1.360795
0.495001	1.070517	8.882343	9.508703	1.312386
0.500001	1.071539	8.561736	9.174238	1.265685
0.505001	1.072568	8.254260	8.853254	1.220622
0.510001	1.073603	7.959268	8.545092	1.177131
0.515001	1.074644	7.676147	8.249127	1.135151
0.520001	1.075692	7.404324	7.964772	1.094621
0.525001	1.076746	7.143256	7.691474	1.055485
0.530001	1.077807	6.892430	7.428709	1.017689
0.535001	1.078874	6.651363	7.175985	0.981181
0.540001	1.079948	6.419600	6.932835	0.945913
0.545001	1.081028	6.196709	6.698818	0.911838
0.550001	1.082115	5.982282	6.473518	0.878911
0.555001	1.083209	5.775933	6.256541	0.847089
0.560001	1.084309	5.577299	6.047513	0.816332
0.565001	1.085415	5.386033	5.846081	0.786601
0.570001	1.086528	5.201808	5.651910	0.757859
0.575001	1.087648	5.024313	5.464682	0.730071
0.580001	1.088774	4.853255	5.284097	0.703202
0.585001	1.089907	4.688355	5.109869	0.677219
0.590001	1.091046	4.529348	4.941727	0.652093
0.595001	1.092192	4.375983	4.779413	0.627792

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0.600001	1.093344	4.228020	4.622682	0.604290
0.605001	1.094504	4.085233	4.471302	0.581557
0.610001	1.095670	3.947406	4.325052	0.559568
0.615001	1.096842	3.814334	4.183722	0.538298
0.620001	1.098071	3.685822	4.047111	0.517723
0.625001	1.099207	3.561684	3.915029	0.497820
0.630001	1.100400	3.441743	3.787294	0.478566
0.635001	1.101599	3.325831	3.663734	0.459940
0.640001	1.102805	3.213788	3.544183	0.441922
0.645001	1.104018	3.105460	3.428484	0.424492
0.650001	1.105238	3.000701	3.316488	0.407631
0.655001	1.106464	2.899372	3.208052	0.391321
0.660001	1.107697	2.801341	3.103038	0.375545
0.665001	1.108937	2.706480	3.001317	0.360285
0.670001	1.110184	2.614669	2.902764	0.345526
0.675001	1.111438	2.525792	2.807261	0.331252
0.680001	1.112698	2.439738	2.714693	0.317449
0.685001	1.113966	2.356403	2.624951	0.304101
0.690001	1.115240	2.275683	2.537933	0.291195
0.695001	1.116521	2.197485	2.453538	0.278717
0.700001	1.117809	2.121714	2.371671	0.266655
0.705001	1.119104	2.048282	2.292241	0.254996
0.710001	1.120406	1.977105	2.215160	0.243729
0.715001	1.121715	1.908102	2.140346	0.232841
0.720001	1.123031	1.841194	2.067718	0.222322
0.725001	1.124354	1.776309	1.997199	0.212160
0.730001	1.125684	1.713373	1.928716	0.202346
0.735001	1.127021	1.652319	1.862198	0.192870
0.740001	1.128365	1.593082	1.797577	0.183721
0.745001	1.129716	1.535597	1.734789	0.174891
0.750001	1.131074	1.479806	1.673771	0.166370
0.755001	1.132440	1.425650	1.614463	0.158151
0.760001	1.133812	1.373073	1.556807	0.150223
0.765001	1.135192	1.322022	1.500749	0.142580
0.770001	1.136579	1.272446	1.446235	0.135213
0.775001	1.137973	1.224295	1.393215	0.128115
0.780001	1.139375	1.177523	1.341639	0.121279
0.785001	1.140783	1.132082	1.291461	0.114696
0.790001	1.142199	1.087931	1.242634	0.108362
0.795001	1.143622	1.045026	1.195115	0.102268
0.800001	1.145053	1.003328	1.148863	0.096408
0.805001	1.146491	0.962796	1.103837	0.090777
0.810001	1.147936	0.923394	1.059998	0.085368
0.815001	1.149389	0.885086	1.017308	0.080175
0.820001	1.150849	0.847837	0.975732	0.075193
0.825001	1.152316	0.811613	0.935235	0.070416
0.830001	1.153791	0.776382	0.895783	0.065839
0.835001	1.155274	0.742114	0.857344	0.061457

0.840001	1.156764	0.708777	0.819888	0.057264
0.845001	1.158261	0.676344	0.783383	0.053256
0.850001	1.159766	0.644786	0.747801	0.049429
0.855001	1.161279	0.614077	0.713115	0.045777
0.860001	1.162799	0.584191	0.679297	0.042296
0.865001	1.164327	0.555103	0.646322	0.038982
0.870001	1.165863	0.526789	0.614163	0.035832
0.875001	1.167406	0.499225	0.582798	0.032839
0.880001	1.168958	0.472389	0.552203	0.030002
0.885001	1.170516	0.446260	0.522355	0.027316
0.890001	1.172083	0.420817	0.493232	0.024778
0.895001	1.173657	0.396039	0.464814	0.022383
0.900001	1.175240	0.371907	0.437080	0.020128
0.905001	1.176830	0.348402	0.410010	0.018011
0.910001	1.178428	0.325506	0.383586	0.016027
0.915001	1.180034	0.303202	0.357788	0.014174
0.920001	1.181648	0.281472	0.332601	0.012448
0.925001	1.183270	0.260300	0.308005	0.010847
0.930001	1.184900	0.239670	0.283984	0.009367
0.935001	1.186538	0.219566	0.260524	0.008006
0.940001	1.188184	0.199975	0.237607	0.006761
0.945001	1.189838	0.180880	0.215218	0.005629
0.950001	1.191501	0.162270	0.193345	0.004608
0.955001	1.193171	0.144129	0.171971	0.003695
0.960001	1.194850	0.126446	0.151084	0.002888
0.965001	1.196537	0.109207	0.130670	0.002183
0.970001	1.198232	0.092400	0.110716	0.001580
0.975001	1.199936	0.076013	0.091211	0.001075
0.980001	1.201648	0.060035	0.072141	0.000667
0.985001	1.203368	0.044456	0.053496	0.000353
0.990001	1.205097	0.029263	0.035265	0.000132
0.995001	1.206834	0.014447	0.017435	0.0

INITIAL MACH NUMBER IS  
0.100001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.100001	0.0	1411.420491	0.0	66.585027
0.105001	1.014759	1217.977473	1235.953174	63.495144
0.110001	1.015384	1058.174591	1074.453020	56.554584
0.115001	1.016016	925.012341	939.827577	51.530080



0.120001	1.016657	813.168101	826.712981	47.122691
0.125001	1.017305	718.545615	730.980402	43.235700
0.130001	1.017962	637.957640	649.416609	39.790612
0.135001	1.018626	568.899083	579.495575	36.723182
0.140001	1.019299	509.382600	519.212938	33.980427
0.145001	1.019979	457.817955	466.964525	31.518331
0.150001	1.020667	412.922464	421.456144	29.300088
0.155001	1.021362	373.653793	381.635894	27.294728
0.160001	1.022066	339.159028	346.642860	25.476042
0.165001	1.022777	308.735710	315.767843	23.821731
0.170001	1.023496	281.801768	288.423071	22.312725
0.175001	1.024223	257.872130	264.118614	20.932637
0.180001	1.024958	236.540377	242.443903	19.667327
0.185001	1.025700	217.464267	223.053124	18.504536
0.190001	1.026450	200.354218	205.653616	17.433599
0.195001	1.027208	184.964096	189.996573	16.445199
0.200001	1.027973	171.083801	175.869569	15.531171
0.205001	1.028746	158.533260	163.090500	14.684333
0.210001	1.029527	147.157541	151.502653	13.898346
0.215001	1.030315	136.822852	140.970668	13.167603
0.220001	1.031111	127.413254	131.377224	12.487124
0.225001	1.031915	118.827943	122.620292	11.852479
0.230001	1.032726	110.978996	114.610861	11.259713
0.235001	1.033544	103.789492	107.271041	10.705287
0.240001	1.034371	97.191938	100.532477	10.186029
0.245001	1.035204	91.126952	94.335011	9.699085
0.250001	1.036046	85.542147	88.625561	9.241887
0.255001	1.036894	80.391189	83.357170	8.812114
0.260001	1.037751	75.632997	78.488194	8.407667
0.265001	1.038615	71.231062	73.981614	8.026644
0.270001	1.039486	67.152866	69.804452	7.667316
0.275001	1.040365	63.369379	65.927262	7.328112
0.280001	1.041251	59.854636	62.323697	7.007598
0.285001	1.042145	56.585361	58.970136	6.704468
0.290001	1.043046	53.540650	55.845360	6.417524
0.295001	1.043955	50.701695	52.930274	6.145673
0.300001	1.044871	48.051543	50.207659	5.887908
0.305001	1.045795	45.574884	47.661965	5.643308
0.310001	1.046726	43.257871	45.279124	5.411023
0.315001	1.047664	41.087958	43.046383	5.190272
0.320001	1.048610	39.053761	40.952173	4.980333
0.325001	1.049564	37.144933	38.985973	4.780541
0.330001	1.050525	35.352057	37.138205	4.590280
0.335001	1.051493	33.666550	35.400139	4.408980
0.340001	1.052469	32.080576	33.763803	4.236112
0.345001	1.053452	30.586975	32.221909	4.071187
0.350001	1.054443	29.179192	30.767786	3.913750
0.355001	1.055441	27.851223	29.395318	3.763376
0.360001	1.056446	26.597557	28.098894	3.619672

0.365001	1.057459	25.413132	26.873357	3.482271
0.370001	1.058480	24.293293	25.713965	3.350830
0.375001	1.059508	23.233755	24.616348	3.225030
0.380001	1.060543	22.230566	23.576480	3.104572
0.385001	1.061586	21.280080	22.590642	2.989177
0.390001	1.062637	20.378932	21.655401	2.878583
0.395001	1.063695	19.524006	20.767579	2.772545
0.400001	1.064760	18.712421	19.924236	2.670834
0.405001	1.065833	17.941507	19.122646	2.573234
0.410001	1.066913	17.208788	18.360281	2.479543
0.415001	1.068001	16.511966	17.634795	2.389571
0.420001	1.069096	15.848905	16.944005	2.303136
0.425001	1.070199	15.217620	16.285884	2.220077
0.430001	1.071310	14.616264	15.658543	2.140229
0.435001	1.072427	14.043115	15.060223	2.063444
0.440001	1.073553	13.496569	14.489282	1.989582
0.445001	1.074686	12.975130	13.944191	1.918509
0.450001	1.075827	12.477400	13.423519	1.850100
0.455001	1.076975	12.002074	12.925930	1.784236
0.460001	1.078131	11.547929	12.450175	1.720805
0.465001	1.079294	11.113825	11.995084	1.659700
0.470001	1.080465	10.698692	11.559560	1.600822
0.475001	1.081643	10.301526	11.142578	1.544074
0.480001	1.082830	9.921388	10.743173	1.489367
0.485001	1.084024	9.557396	10.360442	1.436615
0.490001	1.085225	9.208721	9.993535	1.385737
0.495001	1.086434	8.874586	9.641654	1.336655
0.500001	1.087651	8.554259	9.304050	1.289297
0.505001	1.088876	8.247052	8.980015	1.243592
0.510001	1.090108	7.952317	8.668884	1.199475
0.515001	1.091348	7.669444	8.370033	1.156883
0.520001	1.092596	7.397858	8.082869	1.115756
0.525001	1.093851	7.137018	7.806836	1.076036
0.530001	1.095115	6.886411	7.541409	1.037670
0.535001	1.096386	6.645555	7.286092	1.000605
0.540001	1.097665	6.413994	7.040414	0.964793
0.545001	1.098951	6.191297	6.803935	0.930186
0.550001	1.100246	5.977057	6.576234	0.896739
0.555001	1.101548	5.770889	6.356914	0.864410
0.560001	1.102859	5.572428	6.145602	0.833157
0.565001	1.104177	5.381329	5.941940	0.802941
0.570001	1.105503	5.197265	5.745593	0.773725
0.575001	1.106837	5.019926	5.556241	0.745474

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0.580001	1.108179	4.849017	5.373581	0.718152
0.585001	1.109529	4.684261	5.197325	0.691727
0.590001	1.110887	4.525393	5.027202	0.666169
0.595001	1.112253	4.372161	4.862951	0.641446
0.600001	1.113628	4.224327	4.704327	0.617530
0.605001	1.115010	4.081665	4.551096	0.594393
0.610001	1.116400	3.943959	4.403035	0.572010
0.615001	1.117798	3.811003	4.259933	0.550355
0.620001	1.119205	3.682603	4.121587	0.529403
0.625001	1.120619	3.558574	3.987807	0.509132
0.630001	1.122042	3.438738	3.858409	0.489518
0.635001	1.123473	3.322927	3.733220	0.470541
0.640001	1.124913	3.210981	3.612073	0.452179
0.645001	1.126360	3.102748	3.494811	0.434413
0.650001	1.127816	2.998080	3.381283	0.417225
0.655001	1.129280	2.896840	3.271344	0.400595
0.660001	1.130752	2.798895	3.164857	0.384506
0.665001	1.132233	2.704117	3.061691	0.368941
0.670001	1.133722	2.612386	2.961720	0.353883
0.675001	1.135220	2.523586	2.864825	0.339318
0.680001	1.136726	2.437608	2.770892	0.325230
0.685001	1.138240	2.354345	2.679810	0.311605
0.690001	1.139763	2.273696	2.591475	0.298428
0.695001	1.141295	2.195566	2.505787	0.285686
0.700001	1.142835	2.119861	2.422650	0.273366
0.705001	1.144383	2.046493	2.341973	0.261455
0.710001	1.145940	1.975379	2.263666	0.249942
0.715001	1.147506	1.906435	2.187647	0.238815
0.720001	1.149081	1.839587	2.113834	0.228062
0.725001	1.150664	1.774757	2.042149	0.217673
0.730001	1.152256	1.711877	1.972520	0.207637
0.735001	1.153857	1.650876	1.904875	0.197944
0.740001	1.155466	1.591690	1.839144	0.188585
0.745001	1.157084	1.534256	1.775264	0.179550
0.750001	1.158712	1.478514	1.713171	0.170829
0.755001	1.160348	1.424405	1.652805	0.162415
0.760001	1.161993	1.371874	1.594107	0.154299
0.765001	1.163647	1.320868	1.537023	0.146471
0.770001	1.165310	1.271335	1.481499	0.138926
0.775001	1.166982	1.223226	1.427482	0.131654
0.780001	1.168663	1.176494	1.374925	0.124649
0.785001	1.170353	1.131094	1.323779	0.117902
0.790001	1.172052	1.086981	1.273998	0.111409

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0.795001	1.173760	1.044114	1.225539	0.105160
0.800001	1.175478	1.002451	1.178360	0.099151
0.805001	1.177205	0.961955	1.132419	0.093375
0.810001	1.178941	0.922588	1.087677	0.087825
0.815001	1.180687	0.884313	1.044097	0.082496
0.820001	1.182442	0.847097	1.001642	0.077382
0.825001	1.184206	0.810904	0.960278	0.072478
0.830001	1.185980	0.775704	0.919969	0.067777
0.835001	1.187763	0.741466	0.880685	0.063276
0.840001	1.189556	0.708158	0.842393	0.058969
0.845001	1.191358	0.675753	0.805064	0.054851
0.850001	1.193170	0.644223	0.768668	0.050917
0.855001	1.194991	0.613541	0.733176	0.047163
0.860001	1.196822	0.583681	0.698563	0.043584
0.865001	1.198663	0.554618	0.664801	0.040176
0.870001	1.200514	0.526329	0.631865	0.036934
0.875001	1.202375	0.498789	0.599731	0.033856
0.880001	1.204245	0.471977	0.568376	0.030936
0.885001	1.206125	0.445870	0.537776	0.028171
0.890001	1.208016	0.420449	0.507909	0.025557
0.895001	1.209916	0.395693	0.478755	0.023090
0.900001	1.211826	0.371582	0.450293	0.020768
0.905001	1.213747	0.348098	0.422503	0.018586
0.910001	1.215677	0.325222	0.395365	0.016542
0.915001	1.217618	0.302937	0.368862	0.014632
0.920001	1.219569	0.281226	0.342975	0.012852
0.925001	1.221530	0.260072	0.317686	0.011201
0.930001	1.223502	0.239460	0.292980	0.009674
0.935001	1.225484	0.219374	0.268840	0.008270
0.940001	1.227476	0.199800	0.245250	0.006985
0.945001	1.229479	0.180722	0.222195	0.005817
0.950001	1.231493	0.162128	0.199660	0.004762
0.955001	1.233517	0.144003	0.177631	0.003819
0.960001	1.235551	0.126335	0.156094	0.002985
0.965001	1.237597	0.109111	0.135036	0.002258
0.970001	1.239653	0.092319	0.114443	0.001634
0.975001	1.241720	0.075947	0.094305	0.001112
0.980001	1.243797	0.059983	0.074607	0.000690
0.985001	1.245886	0.044417	0.055338	0.000366
0.990001	1.247986	0.029237	0.036488	0.000136
0.995001	1.250096	0.014434	0.018044	0.0

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INITIAL MACH NUMBER IS  
0.125001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.125001	0.0	717.739763	0.0	42.268686
0.130001	1.023002	637.242167	651.900245	40.638936
0.135001	1.023790	568.261060	581.780275	36.953051
0.140001	1.024587	508.811325	521.321466	34.199322
0.145001	1.025392	457.304510	468.916325	31.727083
0.150001	1.026205	412.459370	423.267917	29.499438
0.155001	1.027027	373.234739	383.322068	27.485339
0.160001	1.027857	338.778660	348.215955	25.658511
0.165001	1.028695	308.389461	317.238778	23.996594
0.170001	1.029542	281.485727	289.801409	22.480469
0.175001	1.030397	257.582925	265.412767	21.093703
0.180001	1.031261	236.275096	243.661295	19.822117
0.185001	1.032133	217.220380	224.200336	18.653417
0.190001	1.033014	200.129520	206.736497	17.576907
0.195001	1.033902	184.756658	191.020343	16.583244
0.200001	1.034800	170.891930	176.838897	15.664235
0.205001	1.035705	158.355465	164.009578	14.812677
0.210001	1.036619	146.992503	152.375252	14.022213
0.215001	1.037542	136.669405	141.800192	13.287216
0.220001	1.038472	127.270360	132.166751	12.602691
0.225001	1.039412	118.694677	123.372614	11.964192
0.230001	1.040359	110.854533	115.328514	11.367752
0.235001	1.041315	103.673092	107.956337	10.809820
0.240001	1.042279	97.082937	101.187525	10.287211
0.245001	1.043252	91.024753	94.961740	9.797064
0.250001	1.044233	85.446211	89.225739	9.336800
0.255001	1.045222	80.301030	83.932419	8.904089
0.260001	1.046220	75.548174	79.040006	8.496825
0.265001	1.047226	71.151176	74.511365	8.113098
0.270001	1.048241	67.077553	70.313410	7.751174
0.275001	1.049263	63.298310	66.416600	7.409474
0.280001	1.050295	59.787509	62.794499	7.086561
0.285001	1.051334	56.521900	59.423407	6.781121
0.290001	1.052382	53.480604	56.282035	6.491953
0.295001	1.053439	50.644833	53.351220	6.217957
0.300001	1.054503	47.997653	50.613684	5.958126
0.305001	1.055576	45.523772	48.053821	5.711531
0.310001	1.056658	43.209357	45.657512	5.477321
0.315001	1.057748	41.041878	43.411961	5.254710
0.320001	1.058846	39.009962	41.305552	5.042974
0.325001	1.059953	37.103275	39.327728	4.841445

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0.330001	1.061068	35.312410	37.468874	4.649503
0.335001	1.062192	33.628793	35.720227	4.466576
0.340001	1.063324	32.044597	34.073783	4.292133
0.345001	1.064464	30.552671	32.522227	4.125683
0.350001	1.065613	29.146468	31.058861	3.966767
0.355001	1.066771	27.819988	29.677545	3.814960
0.360001	1.067936	26.567727	28.372644	3.669866
0.365001	1.069111	25.384631	27.138983	3.531117
0.370001	1.070294	24.266048	25.971797	3.398368
0.375001	1.071485	23.207698	24.866700	3.271297
0.380001	1.072685	22.205634	23.819647	3.149606
0.385001	1.073893	21.256215	22.826905	3.033012
0.390001	1.075110	20.356077	21.885025	2.921253
0.395001	1.076336	19.502110	20.990816	2.814084
0.400001	1.077570	18.691435	20.141324	2.711272
0.405001	1.078812	17.921386	19.333812	2.612602
0.410001	1.080064	17.189488	18.565740	2.517869
0.415001	1.081323	16.493448	17.834751	2.426883
0.420001	1.082592	15.831130	17.138654	2.339464
0.425001	1.083869	15.200554	16.475410	2.255443
0.430001	1.085155	14.599872	15.843122	2.174659
0.435001	1.086449	14.027366	15.240022	2.096964
0.440001	1.087752	13.481433	14.664462	2.022214
0.445001	1.089064	12.960579	14.114905	1.950276
0.450001	1.090385	12.463407	13.589912	1.881025
0.455001	1.091714	11.988613	13.088142	1.814339
0.460001	1.093053	11.534978	12.608338	1.750107
0.465001	1.094399	11.101361	12.149324	1.688222
0.470001	1.095755	10.686693	11.710000	1.628582
0.475001	1.097120	10.289973	11.289334	1.571091
0.480001	1.098493	9.910261	10.886356	1.515659
0.485001	1.099876	9.546677	10.500158	1.462200
0.490001	1.101267	9.198394	10.129887	1.410631
0.495001	1.102667	8.864633	9.774739	1.360876
0.500001	1.104076	8.544666	9.433962	1.312860
0.505001	1.105494	8.237803	9.106844	1.266514
0.510001	1.106921	7.943398	8.792718	1.221771
0.515001	1.108358	7.660843	8.490953	1.178566
0.520001	1.109803	7.389562	8.200955	1.136842
0.525001	1.111257	7.129013	7.922165	1.096538
0.530001	1.112720	6.878688	7.654055	1.057602
0.535001	1.114193	6.638102	7.396124	1.019981
0.540001	1.115674	6.406801	7.147903	0.983625
0.545001	1.117165	6.184354	6.908944	0.948487
0.550001	1.118665	5.970354	6.678827	0.914521
0.555001	1.120174	5.764417	6.457152	0.881685
0.560001	1.121693	5.566179	6.243543	0.849936
0.565001	1.123221	5.375294	6.037641	0.819237

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0.570001	1.124758	5.191436	5.839108	0.789546
0.575001	1.126304	5.014296	5.647623	0.760834
0.580001	1.127860	4.843579	5.462880	0.733060
0.585001	1.129425	4.679008	5.284591	0.706194
0.590001	1.131000	4.520318	5.112480	0.680204
0.595001	1.132584	4.367258	4.946288	0.655060
0.600001	1.134178	4.219590	4.785767	0.630732
0.605001	1.135782	4.077087	4.630681	0.607193
0.610001	1.137394	3.939535	4.480805	0.584417
0.615001	1.139017	3.806729	4.335928	0.562377
0.620001	1.140649	3.678473	4.195847	0.541050
0.625001	1.142291	3.554583	4.060367	0.520411
0.630001	1.143942	3.434881	3.929306	0.500439
0.635001	1.145604	3.319200	3.802489	0.481111
0.640001	1.147275	3.207380	3.679747	0.462407
0.645001	1.148956	3.099268	3.560922	0.444307
0.650001	1.150647	2.994718	3.445862	0.426792
0.655001	1.152347	2.893591	3.334423	0.409842
0.660001	1.154058	2.795756	3.226465	0.393442
0.665001	1.155779	2.701084	3.121856	0.377572
0.670001	1.157510	2.609456	3.020470	0.362218
0.675001	1.159250	2.520756	2.922188	0.347362
0.680001	1.161001	2.434874	2.826892	0.332991
0.685001	1.162762	2.351704	2.734473	0.319089
0.690001	1.164534	2.271146	2.644826	0.305642
0.695001	1.166315	2.193103	2.557849	0.292636
0.700001	1.168107	2.117483	2.473447	0.280059
0.705001	1.169909	2.044198	2.391525	0.267897
0.710001	1.171721	1.973163	2.311997	0.256140
0.715001	1.173544	1.904297	2.234777	0.244774
0.720001	1.175377	1.837523	2.159784	0.233788
0.725001	1.177221	1.772767	2.086939	0.223172
0.730001	1.179076	1.709957	2.016168	0.212915
0.735001	1.180941	1.649025	1.947400	0.203007
0.740001	1.182816	1.589905	1.880566	0.193438
0.745001	1.184702	1.532536	1.815599	0.184199
0.750001	1.186600	1.476856	1.752436	0.175279
0.755001	1.188507	1.422807	1.691017	0.166671
0.760001	1.190426	1.370335	1.631283	0.158366
0.765001	1.192356	1.319386	1.573178	0.150356
0.770001	1.194296	1.269909	1.516647	0.142632
0.775001	1.196248	1.221854	1.461640	0.135187
0.780001	1.198210	1.175175	1.408106	0.128013
0.785001	1.200184	1.129825	1.355998	0.121103

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0.790001	1.202168	1.085762	1.305269	0.114451
0.795001	1.204164	1.042943	1.255874	0.108048
0.800001	1.206172	1.001327	1.207772	0.101890
0.805001	1.208190	0.960877	1.160922	0.095969
0.810001	1.210220	0.921553	1.115282	0.090279
0.815001	1.212261	0.883322	1.070817	0.084814
0.820001	1.214314	0.846147	1.027488	0.079569
0.825001	1.216379	0.809995	0.985260	0.074537
0.830001	1.218454	0.774834	0.944100	0.069714
0.835001	1.220542	0.740634	0.903975	0.065095
0.840001	1.222641	0.707364	0.864852	0.060673
0.845001	1.224753	0.674995	0.826702	0.056444
0.850001	1.226875	0.643501	0.789495	0.052404
0.855001	1.229010	0.612853	0.753203	0.048546
0.860001	1.231157	0.583026	0.717797	0.044871
0.865001	1.233316	0.553996	0.683252	0.041369
0.870001	1.235487	0.525738	0.649543	0.038037
0.875001	1.237670	0.498229	0.616644	0.034872
0.880001	1.239865	0.471447	0.584531	0.031869
0.885001	1.242073	0.445370	0.553182	0.029025
0.890001	1.244293	0.419978	0.522575	0.026336
0.895001	1.246525	0.395249	0.492688	0.023798
0.900001	1.248770	0.371165	0.463500	0.021408
0.905001	1.251027	0.347708	0.434992	0.019162
0.910001	1.253297	0.324857	0.407143	0.017057
0.915001	1.255580	0.302597	0.379935	0.015090
0.920001	1.257875	0.280911	0.353350	0.013257
0.925001	1.260183	0.259781	0.327371	0.011555
0.930001	1.262505	0.239192	0.301981	0.009982
0.935001	1.264839	0.219128	0.277162	0.008534
0.940001	1.267186	0.199576	0.252900	0.007209
0.945001	1.269546	0.180520	0.229178	0.006004
0.950001	1.271920	0.161946	0.205983	0.004917
0.955001	1.274307	0.143842	0.183299	0.003944
0.960001	1.276707	0.126194	0.161112	0.003083
0.965001	1.279121	0.108989	0.139410	0.002332
0.970001	1.281548	0.092215	0.118179	0.001688
0.975001	1.283989	0.075862	0.097405	0.001149
0.980001	1.286443	0.059916	0.077078	0.000713
0.985001	1.288911	0.044367	0.057185	0.000378
0.990001	1.291393	0.029205	0.037715	0.000141
0.995001	1.293889	0.014418	0.018655	0.0



INITIAL MACH NUMBER IS  
0.150001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.150001	0.0	411.894775	0.0	28.996858
0.155001	1.033175	372.723837	385.088837	28.034136
0.160001	1.034133	338.314923	349.862560	25.846495
0.165001	1.035100	307.967323	318.776928	24.176622
0.170001	1.036076	281.100415	291.241350	22.653055
0.175001	1.037061	257.230333	266.763500	21.259317
0.180001	1.038055	235.951671	244.930764	19.981183
0.185001	1.039058	216.923038	225.395572	18.806325
0.190001	1.040070	199.855573	207.863748	17.724011
0.195001	1.041091	184.503754	192.085177	16.724870
0.200001	1.042121	170.658005	177.846294	15.800682
0.205001	1.043160	158.138700	164.964002	14.944222
0.210001	1.044209	146.791293	153.280719	14.149110
0.215001	1.045266	136.482325	142.660323	13.409700
0.220001	1.046332	127.096146	132.984818	12.720981
0.225001	1.047408	118.532202	124.151583	12.078491
0.230001	1.048493	110.702790	116.071079	11.478248
0.235001	1.049587	103.531179	108.664949	10.916689
0.240001	1.050690	96.950045	101.864419	10.390618
0.245001	1.051802	90.900154	95.608961	9.897161
0.250001	1.052923	85.329248	89.845159	9.433731
0.255001	1.054054	80.191110	84.525755	8.997989
0.260001	1.055194	75.444760	79.608836	8.587820
0.265001	1.056343	71.053781	75.057142	8.201307
0.270001	1.057501	66.985734	70.837474	7.836709
0.275001	1.058668	63.211665	66.920188	7.492441
0.280001	1.059845	59.705669	63.278755	7.167058
0.285001	1.061031	56.444530	59.889393	6.859243
0.290001	1.062226	53.407397	56.730734	6.567789
0.295001	1.063431	50.575508	53.783545	6.291591
0.300001	1.064644	47.931952	51.030486	6.029637
0.305001	1.065868	45.461457	48.455891	5.730995
0.310001	1.067100	43.150210	46.045589	5.544810

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0.315001	1.068342	40.985698	43.786733	5.320292
0.320001	1.069593	38.956564	41.667663	5.106715
0.325001	1.070853	37.052486	39.677781	4.903405
0.330001	1.072123	35.264073	37.807434	4.709742
0.335001	1.073403	33.582760	36.047822	4.525150
0.340001	1.074691	32.000733	34.390911	4.349096
0.345001	1.075990	30.510849	32.829354	4.181085
0.350001	1.077297	29.106570	31.356425	4.020657
0.355001	1.078614	27.781906	29.965960	3.867386
0.360001	1.079941	26.531360	28.652301	3.720872
0.365001	1.081277	25.349883	27.410246	3.580745
0.370001	1.082623	24.232832	26.235014	3.446660
0.375001	1.083978	23.175930	25.122198	3.318293
0.380001	1.085343	22.175238	24.067735	3.195343
0.385001	1.086717	21.227118	23.067875	3.077526
0.390001	1.088101	20.328212	22.119155	2.964580
0.395001	1.089495	19.475414	21.218367	2.856256
0.400001	1.090898	18.665849	20.362546	2.752323
0.405001	1.092312	17.896854	19.548941	2.652562
0.410001	1.093734	17.165959	18.774999	2.556768
0.415001	1.095167	16.470871	18.038354	2.464750
0.420001	1.096609	15.809460	17.336802	2.376327
0.425001	1.098062	15.179746	16.668295	2.291328
0.430001	1.099524	14.579887	16.030928	2.209593
0.435001	1.100995	14.008164	15.422924	2.130971
0.440001	1.102477	13.462979	14.842626	2.055318
0.445001	1.103969	12.942838	14.288489	1.982501
0.450001	1.105470	12.446346	13.759067	1.912393
0.455001	1.106982	11.972203	13.253013	1.844872
0.460001	1.108504	11.519189	12.769062	1.779826
0.465001	1.110035	11.086165	12.306034	1.717147
0.470001	1.111577	10.672065	11.862821	1.656734
0.475001	1.113129	10.275887	11.438385	1.598488
0.480001	1.114691	9.896695	11.031754	1.542320
0.485001	1.116263	9.533609	10.642013	1.488143
0.490001	1.117845	9.185802	10.268304	1.435874
0.495001	1.119438	8.852499	9.909820	1.385435
0.500001	1.121040	8.532969	9.565803	1.336752
0.505001	1.122653	8.226527	9.235539	1.289754
0.510001	1.124277	7.932525	8.918355	1.244375
0.515001	1.125911	7.650356	8.613618	1.200550
0.520001	1.127555	7.379446	8.320731	1.158219
0.525001	1.129210	7.119255	8.039131	1.117324

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0.530001	1.130875	6.869272	7.768286	1.077810
0.535001	1.132551	6.629015	7.507694	1.039625
0.540001	1.134237	6.398031	7.256882	1.002717
0.545001	1.135934	6.175888	7.015399	0.967040
0.550001	1.137641	5.962182	6.782823	0.932549
0.555001	1.139359	5.756527	6.558753	0.899198
0.560001	1.141088	5.558560	6.342807	0.866948
0.565001	1.142828	5.367936	6.134628	0.835757
0.570001	1.144579	5.184330	5.933873	0.805589
0.575001	1.146340	5.007432	5.740219	0.776407
0.580001	1.148112	4.836949	5.553360	0.748176
0.585001	1.149895	4.672603	5.373005	0.720863
0.590001	1.151690	4.514130	5.198877	0.694435
0.595001	1.153495	4.361280	5.030714	0.668864
0.600001	1.155311	4.213814	4.868267	0.644119
0.605001	1.157139	4.071507	4.711298	0.620172
0.610001	1.158978	3.934143	4.559583	0.596997
0.615001	1.160827	3.801518	4.412906	0.574568
0.620001	1.162689	3.673438	4.271064	0.552860
0.625001	1.164561	3.549717	4.133862	0.531850
0.630001	1.166445	3.430179	4.001116	0.511514
0.635001	1.168340	3.314657	3.872648	0.491832
0.640001	1.170247	3.202990	3.748290	0.472781
0.645001	1.172166	3.095026	3.627882	0.454342
0.650001	1.174095	2.990619	3.511272	0.436496
0.655001	1.176037	2.889631	3.398313	0.419223
0.660001	1.177990	2.791929	3.288865	0.402507
0.665001	1.179955	2.697387	3.182796	0.386329
0.670001	1.181932	2.605884	3.079978	0.370674
0.675001	1.183921	2.517306	2.980291	0.355524
0.680001	1.185921	2.431541	2.883617	0.340866
0.685001	1.187934	2.348485	2.789846	0.326683
0.690001	1.189959	2.268037	2.698871	0.312963
0.695001	1.191995	2.190101	2.610591	0.299690
0.700001	1.194044	2.114585	2.524908	0.286853
0.705001	1.196105	2.041400	2.441729	0.274437
0.710001	1.198179	1.970462	2.360966	0.262431
0.715001	1.200264	1.901691	2.282532	0.250823
0.720001	1.202363	1.835008	2.206345	0.239602
0.725001	1.204473	1.770340	2.132327	0.228756
0.730001	1.206596	1.707616	2.060403	0.218275
0.735001	1.208732	1.646768	1.990501	0.208149
0.740001	1.210880	1.587729	1.922550	0.198367

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0.745001	1.213041	1.530438	1.856485	0.188920
0.750001	1.215215	1.474834	1.792241	0.179799
0.755001	1.217402	1.420860	1.729758	0.170995
0.760001	1.219602	1.368460	1.668976	0.162499
0.765001	1.221815	1.317580	1.609839	0.154303
0.770001	1.224040	1.268171	1.552292	0.146398
0.775001	1.226279	1.220182	1.496284	0.138777
0.780001	1.228531	1.173566	1.441763	0.131433
0.785001	1.230797	1.128279	1.388682	0.124357
0.790001	1.233076	1.084276	1.336994	0.117544
0.795001	1.235368	1.041515	1.286654	0.110985
0.800001	1.237674	0.999956	1.237620	0.104675
0.805001	1.239993	0.959561	1.189849	0.098607
0.810001	1.242326	0.920292	1.143303	0.092774
0.815001	1.244673	0.882112	1.097941	0.087172
0.820001	1.247034	0.844988	1.053729	0.081793
0.825001	1.249408	0.808886	1.010629	0.076633
0.830001	1.251797	0.773774	0.968607	0.071685
0.835001	1.254199	0.739620	0.927631	0.066945
0.840001	1.256616	0.706396	0.887668	0.062407
0.845001	1.259047	0.674071	0.848688	0.058066
0.850001	1.261492	0.642620	0.810660	0.053919
0.855001	1.263952	0.612014	0.773556	0.049958
0.860001	1.266426	0.582228	0.737349	0.046181
0.865001	1.268915	0.553238	0.702012	0.042583
0.870001	1.271418	0.525019	0.667518	0.039160
0.875001	1.273937	0.497547	0.633844	0.035907
0.880001	1.276470	0.470802	0.600965	0.032820
0.885001	1.279018	0.444761	0.568857	0.029896
0.890001	1.281581	0.419403	0.537499	0.027130
0.895001	1.284159	0.394708	0.506868	0.024520
0.900001	1.286753	0.370657	0.476944	0.022061
0.905001	1.289361	0.347232	0.447707	0.019749
0.910001	1.291986	0.324413	0.419136	0.017582
0.915001	1.294625	0.302183	0.391214	0.015557
0.920001	1.297281	0.280526	0.363921	0.013669
0.925001	1.299952	0.259425	0.337240	0.011917
0.930001	1.302639	0.238864	0.311154	0.010296
0.935001	1.305341	0.218828	0.285646	0.008804
0.940001	1.308060	0.199303	0.260700	0.007438
0.945001	1.310795	0.180273	0.236301	0.006196
0.950001	1.313547	0.161725	0.212433	0.005075
0.955001	1.316314	0.143645	0.189082	0.004071

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0.960001	1.319098	0.126021	0.166234	0.003183
0.965001	1.321899	0.108840	0.143875	0.002408
0.970001	1.324716	0.092089	0.121992	0.001743
0.975001	1.327550	0.075758	0.100572	0.001187
0.980001	1.330401	0.059834	0.079603	0.000737
0.985001	1.333269	0.044306	0.059072	0.000390
0.990001	1.336154	0.029165	0.038968	0.000145
0.995001	1.339057	0.014398	0.019280	0.0

INITIAL MACH NUMBER IS  
0.175001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.175001	0.0	256.814877	0.0	20.983557
0.180001	1.045357	235.570582	246.255316	20.367919
0.185001	1.046493	216.572682	226.641842	18.964119
0.190001	1.047639	199.532783	209.038371	17.875756
0.195001	1.048795	184.205759	193.194065	16.870908
0.200001	1.049960	170.382372	178.894729	15.941329
0.205001	1.051135	157.883288	165.956719	15.079768
0.210001	1.052320	146.554208	154.221972	14.279823
0.215001	1.053515	136.261890	143.553947	13.535827
0.220001	1.054720	126.890871	133.834278	12.842752
0.225001	1.055934	118.340759	124.960016	12.196118
0.230001	1.057158	110.523992	116.841333	11.591930
0.235001	1.058392	103.363964	109.399616	11.026610
0.240001	1.059636	96.793460	102.565861	10.496949
0.245001	1.060890	90.753340	96.279336	10.000064
0.250001	1.062154	85.191432	90.486442	9.533355
0.255001	1.063428	80.061592	85.139757	9.094476
0.260001	1.064712	75.322908	80.197222	8.681302
0.265001	1.066006	70.939021	75.621442	8.291908
0.270001	1.067310	66.877545	71.379099	7.924546
0.275001	1.068625	63.109570	67.440441	7.577623
0.280001	1.069949	59.609237	63.778842	7.249690
0.285001	1.071283	56.353366	60.370428	6.939423

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0.290001	1.072628	53.321138	57.193752	6.645609
0.295001	1.073983	50.493823	54.229506	6.367139
0.300001	1.075348	47.854536	51.460282	6.102996
0.305001	1.076723	45.388031	48.870355	5.852244
0.310001	1.078109	43.080518	46.445494	5.614023
0.315001	1.079505	40.919501	44.172803	5.387541
0.320001	1.080911	38.893644	42.040574	5.172066
0.325001	1.082328	36.992642	40.038163	4.966923
0.330001	1.083755	35.207117	38.155880	4.771488
0.335001	1.085192	33.528520	36.384886	4.585183
0.340001	1.086640	31.949048	34.717113	4.407471
0.345001	1.088098	30.461571	33.145183	4.237855
0.350001	1.089567	29.059560	31.662340	4.075873
0.355001	1.091046	27.737035	30.262394	3.921096
0.360001	1.092536	26.488509	28.939659	3.773123
0.365001	1.094037	25.308940	27.688913	3.631582
0.370001	1.095548	24.193693	26.505352	3.496124
0.375001	1.097070	23.138498	25.384547	3.366425
0.380001	1.098602	22.139422	24.322420	3.242182
0.385001	1.100145	21.192834	23.315201	3.123111
0.390001	1.101699	20.295380	22.359409	3.008946
0.395001	1.103264	19.443959	21.451825	2.899438
0.400001	1.104840	18.635702	20.589466	2.794354
0.405001	1.106426	17.867949	19.769568	2.693474
0.410001	1.108024	17.138234	18.989569	2.596593
0.415001	1.109632	16.444268	18.247086	2.503517
0.420001	1.111251	15.783926	17.539908	2.414064
0.425001	1.112882	15.155229	16.865976	2.328063
0.430001	1.114523	14.556339	16.223373	2.245353
0.435001	1.116175	13.985540	15.610315	2.165781
0.440001	1.117839	13.441235	15.025137	2.089204
0.445001	1.119514	12.921933	14.466283	2.015486
0.450001	1.121200	12.426244	13.932302	1.944500
0.455001	1.122897	11.952866	13.421838	1.876124
0.460001	1.124606	11.500584	12.933621	1.810245
0.465001	1.126325	11.068260	12.466463	1.746754
0.470001	1.128057	10.654828	12.019251	1.685548
0.475001	1.129799	10.259291	11.590941	1.626530
0.480001	1.131554	9.880711	11.180555	1.569609
0.485001	1.133319	9.518211	10.787174	1.514697
0.490001	1.135097	9.170966	10.409934	1.461710
0.495001	1.136886	8.838201	10.048024	1.410572
0.500001	1.138686	8.519187	9.700682	1.361206
0.505001	1.140499	8.213240	9.367188	1.313542
0.510001	1.142323	7.919713	9.046868	1.267513

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0.515001	1.144159	7.638000	8.739083	1.223053
0.520001	1.146006	7.367528	8.443233	1.180102
0.525001	1.147866	7.107757	8.158752	1.138602
0.530001	1.149738	6.858177	7.885104	1.098497
0.535001	1.151621	6.618309	7.621785	1.059734
0.540001	1.153517	6.387697	7.368318	1.022263
0.545001	1.155425	6.165913	7.124250	0.986035
0.550001	1.157345	5.952552	6.889157	0.951006
0.555001	1.159277	5.747229	6.662633	0.917130
0.560001	1.161222	5.549582	6.444297	0.884366
0.565001	1.163179	5.359266	6.233786	0.852674
0.570001	1.165148	5.175957	6.030758	0.822016
0.575001	1.167130	4.999344	5.834886	0.792354
0.580001	1.169125	4.829137	5.645863	0.763655
0.585001	1.171132	4.665056	5.463395	0.735885
0.590001	1.173151	4.506839	5.287204	0.709011
0.595001	1.175184	4.354236	5.117027	0.683003
0.600001	1.177229	4.207008	4.952611	0.657831
0.605001	1.179287	4.064931	4.793719	0.633468
0.610001	1.181353	3.927789	4.640124	0.609885
0.615001	1.183442	3.795378	4.491609	0.587058
0.620001	1.185539	3.667505	4.347968	0.564961
0.625001	1.187649	3.543984	4.209007	0.543571
0.630001	1.189772	3.424639	4.074539	0.522864
0.635001	1.191908	3.309303	3.944386	0.502818
0.640001	1.194058	3.197817	3.818379	0.483413
0.645001	1.196221	3.090027	3.696356	0.464628
0.650001	1.198398	2.985789	3.578163	0.446443
0.655001	1.200583	2.884963	3.463652	0.428840
0.660001	1.202792	2.787419	3.352685	0.411801
0.665001	1.205009	2.693030	3.245126	0.395303
0.670001	1.207240	2.601675	3.140847	0.379344
0.675001	1.209485	2.513240	3.039727	0.363894
0.680001	1.211744	2.427614	2.941647	0.348942
0.685001	1.214017	2.344692	2.846496	0.334473
0.690001	1.216304	2.264374	2.754167	0.320472
0.695001	1.218605	2.186564	2.664558	0.306927
0.700001	1.220920	2.111170	2.577570	0.293822
0.705001	1.223250	2.038103	2.493109	0.281147
0.710001	1.225594	1.967280	2.411086	0.268887
0.715001	1.227952	1.898619	2.331414	0.257032
0.720001	1.230325	1.832044	2.254010	0.245569
0.725001	1.232713	1.767481	2.178796	0.234488
0.730001	1.235115	1.704858	2.105696	0.223778
0.735001	1.237532	1.644108	2.034636	0.213428
0.740001	1.239964	1.585165	1.965547	0.203423
0.745001	1.242411	1.527966	1.898362	0.193769

0.750001	1.244873	1.472452	1.833016	0.184442
0.755001	1.247350	1.418565	1.769448	0.175436
0.760001	1.249843	1.366249	1.707597	0.166744
0.765001	1.252351	1.315452	1.647408	0.158358
0.770001	1.254874	1.266122	1.588824	0.150268
0.775001	1.257413	1.218211	1.531794	0.142467
0.780001	1.259967	1.171671	1.476267	0.134947
0.785001	1.262538	1.126456	1.422194	0.127702
0.790001	1.265124	1.082524	1.369527	0.120723
0.795001	1.267726	1.039833	1.318223	0.114004
0.800001	1.270344	0.998341	1.268237	0.107538
0.805001	1.272978	0.958011	1.219527	0.101320
0.810001	1.275628	0.918805	1.172054	0.095341
0.815001	1.278295	0.880688	1.125779	0.089597
0.820001	1.280978	0.843624	1.080663	0.084081
0.825001	1.283678	0.807580	1.036672	0.078789
0.830001	1.286395	0.772524	0.993771	0.073713
0.835001	1.289128	0.738426	0.951925	0.068849
0.840001	1.291878	0.705255	0.911103	0.064192
0.845001	1.294645	0.672983	0.871274	0.059736
0.850001	1.297429	0.641582	0.832407	0.055478
0.855001	1.300231	0.611026	0.794474	0.051411
0.860001	1.303050	0.581288	0.757447	0.047531
0.865001	1.305886	0.552344	0.721299	0.043835
0.870001	1.308740	0.524171	0.686003	0.040317
0.875001	1.311612	0.496744	0.651535	0.036974
0.880001	1.314501	0.470042	0.617870	0.033800
0.885001	1.317409	0.444042	0.584985	0.030794
0.890001	1.320335	0.418725	0.552858	0.027949
0.895001	1.323278	0.394071	0.521465	0.025264
0.900001	1.326241	0.370059	0.490787	0.022733
0.905001	1.329221	0.346671	0.460802	0.020355
0.910001	1.332220	0.323889	0.431491	0.018124
0.915001	1.335238	0.301695	0.402835	0.016039
0.920001	1.338275	0.280073	0.374815	0.014095
0.925001	1.341331	0.259006	0.347413	0.012290
0.930001	1.344406	0.238479	0.320612	0.010620
0.935001	1.347500	0.218475	0.294395	0.009082
0.940001	1.350614	0.198981	0.268746	0.007675
0.945001	1.353748	0.179982	0.243650	0.006394
0.950001	1.356901	0.161463	0.219090	0.005237
0.955001	1.360073	0.143413	0.195052	0.004202
0.960001	1.363266	0.125817	0.171523	0.003286
0.965001	1.366479	0.108664	0.148487	0.002486
0.970001	1.369713	0.091940	0.125932	0.001800
0.975001	1.372967	0.075635	0.103845	0.001226
0.980001	1.376241	0.059737	0.082213	0.000761
0.985001	1.379537	0.044235	0.061023	0.000403
0.990001	1.382853	0.029117	0.040265	0.000150
0.995001	1.386190	0.014375	0.019926	0.0



## INITIAL MACH NUMBER IS

0.20001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.20001	0.0	170.065439	0.0	15.786818
0.205001	1.059648	157.589605	166.989543	15.369344
0.210001	1.060973	146.281598	155.200826	14.414886
0.215001	1.062308	136.008426	144.482871	13.666123
0.220001	1.063654	126.654838	134.716926	12.968520
0.225001	1.065010	118.120630	125.799694	12.317582
0.230001	1.066377	110.318403	117.641043	11.709297
0.235001	1.067755	103.171694	110.162087	11.140072
0.240001	1.069143	96.613411	103.293580	10.606687
0.245001	1.070542	90.584527	96.974573	10.106246
0.250001	1.071952	85.032965	91.151276	9.636138
0.255001	1.073373	79.912667	85.776093	9.194006
0.260001	1.074804	75.182798	80.806807	8.777718
0.265001	1.076247	70.807065	76.205887	8.385340
0.270001	1.077700	66.753144	71.939886	8.015115
0.275001	1.079165	62.992179	67.978937	7.665445
0.280001	1.080640	59.498357	64.296312	7.334873
0.285001	1.082127	56.248541	60.868043	7.022068
0.290001	1.083624	53.221954	57.672596	6.725813
0.295001	1.085133	50.399898	54.690587	6.444994
0.300001	1.086653	47.765520	51.904535	6.178588
0.305001	1.088184	45.303604	49.298651	5.925655
0.310001	1.089726	43.000383	46.858645	5.685331
0.315001	1.091280	40.843386	44.571566	5.456819
0.320001	1.092845	38.821297	42.425657	5.239385
0.325001	1.094421	36.923831	40.410227	5.032349
0.330001	1.096009	35.141627	38.515542	4.835085
0.335001	1.097608	33.466153	36.732728	4.647011
0.340001	1.099219	31.889619	35.053678	4.467588
0.345001	1.100841	30.404908	33.470982	4.296317
0.350001	1.102475	29.005505	31.977853	4.132732
0.355001	1.104121	27.685441	30.568072	3.976402
0.360001	1.105778	26.439237	29.235927	3.826924
0.365001	1.107447	25.261862	27.976172	3.683924
0.370001	1.109128	24.148689	26.783979	3.547052
0.375001	1.110820	23.095458	25.654899	3.415981
0.380001	1.112524	22.098240	24.584833	3.290407
0.385001	1.114241	21.153413	23.569994	3.170042
0.390001	1.115969	20.257628	22.606884	3.054622
0.395001	1.117709	19.407791	21.692266	2.943894

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0.400001	1.119461	18.601037	20.823144	2.837625
0.405001	1.121226	17.834712	19.996739	2.735593
0.410001	1.123002	17.106354	19.210475	2.637591
0.415001	1.124791	16.413680	18.461959	2.543426
0.420001	1.126592	15.754566	17.748967	2.452913
0.425001	1.128405	15.127039	17.069429	2.365881
0.430001	1.130231	14.529262	16.421420	2.282167
0.435001	1.132069	13.959525	15.803143	2.201618
0.440001	1.133919	13.416232	15.212925	2.124090
0.445001	1.135782	12.897897	14.649203	2.049446
0.450001	1.137658	12.403130	14.110518	1.977557
0.455001	1.139546	11.930632	13.595505	1.908302
0.460001	1.141447	11.479191	13.102888	1.841565
0.465001	1.143361	11.047671	12.631472	1.777236
0.470001	1.145287	10.635009	12.180137	1.715217
0.475001	1.147226	10.240207	11.747835	1.655405
0.480001	1.149179	9.862332	11.333580	1.597709
0.485001	1.151144	9.500506	10.936448	1.542041
0.490001	1.153122	9.153907	10.555571	1.488318
0.495001	1.155113	8.821761	10.190134	1.436460
0.500001	1.157118	8.503341	9.839367	1.386393
0.505001	1.159136	8.197962	9.502550	1.338044
0.510001	1.161167	7.904982	9.179001	1.291345
0.515001	1.163211	7.623792	8.868080	1.246233
0.520001	1.165269	7.353823	8.569182	1.202645
0.525001	1.167340	7.094535	8.281737	1.160522
0.530001	1.169425	6.845420	8.005207	1.119809
0.535001	1.171524	6.605998	7.739084	1.080453
0.540001	1.173636	6.375815	7.482887	1.042402
0.545001	1.175762	6.154444	7.236163	1.005608
0.550001	1.177902	5.941480	6.998481	0.970026
0.555001	1.180056	5.736539	6.769437	0.935609
0.560001	1.182224	5.539259	6.548644	0.902318
0.565001	1.184406	5.349297	6.335739	0.870110
0.570001	1.186602	5.166329	6.130375	0.838948
0.575001	1.188812	4.990045	5.932226	0.808794
0.580001	1.191037	4.820154	5.740980	0.779614
0.585001	1.193276	4.656379	5.556344	0.751374
0.590001	1.195529	4.498456	5.378035	0.724040
0.595001	1.197797	4.346136	5.205790	0.697583
0.600001	1.200080	4.199183	5.039354	0.671973
0.605001	1.202377	4.057369	4.878488	0.647181
0.610001	1.204689	3.920482	4.722963	0.623179
0.615001	1.207016	3.788318	4.572562	0.599942
0.620001	1.209358	3.660683	4.427077	0.577445
0.625001	1.211715	3.537391	4.286312	0.555664
0.630001	1.214088	3.418269	4.150078	0.534575

0.635001	1.216475	3.303148	4.018197	0.514156
0.640001	1.218878	3.191868	3.890497	0.494386
0.645001	1.221296	3.084279	3.766817	0.475244
0.650001	1.223730	2.980235	3.647001	0.456711
0.655001	1.226179	2.879597	3.530901	0.438768
0.660001	1.228644	2.782234	3.418375	0.421397
0.665001	1.231125	2.688021	3.309288	0.404579
0.670001	1.233621	2.596836	3.203512	0.388298
0.675001	1.236134	2.508565	3.100922	0.372538
0.680001	1.238662	2.423098	3.001401	0.357284
0.685001	1.241207	2.340331	2.904836	0.342520
0.690001	1.243769	2.260162	2.811119	0.328231
0.695001	1.246346	2.182497	2.720146	0.314404
0.700001	1.248940	2.107243	2.631820	0.301025
0.705001	1.251551	2.034312	2.546045	0.288081
0.710001	1.254178	1.963620	2.462730	0.275560
0.715001	1.256822	1.895088	2.381789	0.263450
0.720001	1.259484	1.828637	2.303138	0.251739
0.725001	1.262162	1.764193	2.226697	0.240415
0.730001	1.264857	1.701687	2.152391	0.229468
0.735001	1.267570	1.641050	2.080144	0.218888
0.740001	1.270300	1.582216	2.009888	0.208664
0.745001	1.273047	1.525124	1.941554	0.198786
0.750001	1.275812	1.469713	1.875078	0.189245
0.755001	1.278595	1.415926	1.810396	0.180032
0.760001	1.281395	1.363708	1.747449	0.171138
0.765001	1.284214	1.313005	1.686180	0.162555
0.770001	1.287051	1.263767	1.626533	0.154274
0.775001	1.289906	1.215945	1.568454	0.146287
0.780001	1.292779	1.169491	1.511894	0.138587
0.785001	1.295671	1.124361	1.456802	0.131165
0.790001	1.298581	1.080511	1.403131	0.124016
0.795001	1.301510	1.037899	1.350836	0.117132
0.800001	1.304458	0.996484	1.299872	0.110506
0.805001	1.307425	0.956229	1.250199	0.104131
0.810001	1.310412	0.917096	1.201774	0.098002
0.815001	1.313417	0.879050	1.154559	0.092111
0.820001	1.316442	0.842054	1.108516	0.086454
0.825001	1.319486	0.806077	1.063608	0.081024
0.830001	1.322551	0.771087	1.019801	0.075816
0.835001	1.325635	0.737052	0.977062	0.070824
0.840001	1.328739	0.703943	0.935356	0.066044
0.845001	1.331863	0.671731	0.894653	0.061469
0.850001	1.335007	0.640389	0.854923	0.057096
0.855001	1.338172	0.609889	0.816136	0.052918
0.860001	1.341358	0.580207	0.778265	0.048933
0.865001	1.344564	0.551317	0.741281	0.045134

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0.870001	1.347791	0.523196	0.705158	0.041519
0.875001	1.351039	0.495820	0.669872	0.038081
0.880001	1.354309	0.469167	0.635397	0.034819
0.885001	1.357600	0.443216	0.601711	0.031726
0.890001	1.360912	0.417947	0.568789	0.028800
0.895001	1.364247	0.393338	0.536610	0.026037
0.900001	1.367603	0.369370	0.505152	0.023433
0.905001	1.370981	0.346026	0.474395	0.020984
0.910001	1.374382	0.323286	0.444319	0.018688
0.915001	1.377805	0.301134	0.414904	0.016540
0.920001	1.381250	0.279552	0.386131	0.014538
0.925001	1.384718	0.258524	0.357983	0.012678
0.930001	1.388210	0.238035	0.330442	0.010957
0.935001	1.391724	0.218069	0.303491	0.009372
0.940001	1.395262	0.198611	0.277114	0.007921
0.945001	1.398823	0.179647	0.251294	0.006600
0.950001	1.402409	0.161163	0.226016	0.005407
0.955001	1.406018	0.143146	0.201266	0.004339
0.960001	1.409651	0.125583	0.177029	0.003394
0.965001	1.413308	0.108462	0.153290	0.002568
0.970001	1.416990	0.091769	0.130036	0.001860
0.975001	1.420697	0.075495	0.107255	0.001267
0.980001	1.424429	0.059626	0.084933	0.000787
0.985001	1.428186	0.044152	0.063058	0.000417
0.990001	1.431968	0.029063	0.041618	0.000155
0.995001	1.435776	0.014348	0.020601	0.0

INITIAL MACH NUMBER IS  
0.225001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.225001	0.0	117.872139	0.0	12.232182
0.230001	1.076169	110.086326	118.471474	11.936004
0.235001	1.077694	102.954651	110.953617	11.257450
0.240001	1.079231	96.410165	104.048820	10.720199
0.245001	1.080779	90.393964	97.695907	10.216067
0.250001	1.082339	84.854080	91.840883	9.742433
0.255001	1.083911	79.744554	86.435970	9.296928
0.260001	1.085494	75.024635	81.438789	8.877411
0.265001	1.087089	70.658108	76.811658	8.481939
0.270001	1.088696	66.612715	72.521001	8.108748
0.275001	1.090315	62.859661	68.536829	7.756231
0.280001	1.091946	59.373189	64.832304	7.427924
0.285001	1.093589	56.130211	61.383361	7.107492

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0.290001	1.095244	53.109990	58.168375	6.808710
0.295001	1.096911	50.293871	55.167880	6.525459
0.300001	1.098590	47.665036	52.364323	6.256710
0.305001	1.100281	45.208298	49.741843	6.001520
0.310001	1.101985	42.909922	47.286090	5.759020
0.315001	1.103701	40.757463	44.984056	5.528409
0.320001	1.105430	38.739629	42.823930	5.308948
0.325001	1.107170	36.846154	40.794974	5.099955
0.330001	1.108924	35.067700	38.887410	4.900800
0.335001	1.110690	33.395750	37.092321	4.710897
0.340001	1.112469	31.822533	35.401565	4.529706
0.345001	1.114260	30.340945	33.807695	4.356723
0.350001	1.116064	28.944486	32.303894	4.191482
0.355001	1.117881	27.627199	30.883911	4.033547
0.360001	1.119710	26.383617	29.542008	3.882515
0.365001	1.121553	25.208719	28.272912	3.738008
0.370001	1.123408	24.097888	27.071771	3.599675
0.375001	1.125277	23.046872	25.934116	3.467186
0.380001	1.127159	22.051752	24.855825	3.340236
0.385001	1.129054	21.108912	23.833093	3.218537
0.390001	1.130962	20.215012	22.862404	3.101820
0.395001	1.132883	19.366963	21.940503	2.989833
0.400001	1.134818	18.561906	21.064380	2.882340
0.405001	1.136766	17.797193	20.231241	2.779119
0.410001	1.138727	17.070368	19.438495	2.679961
0.415001	1.140703	16.379150	18.683738	2.584672
0.420001	1.142691	15.721423	17.964732	2.493065
0.425001	1.144694	15.095216	17.279398	2.404969
0.430001	1.146710	14.498697	16.625797	2.320219
0.435001	1.148740	13.930158	16.002126	2.238662
0.440001	1.150784	13.388008	15.406701	2.160152
0.445001	1.152841	12.870764	14.837949	2.084551
0.450001	1.154913	12.377037	14.294404	2.011731
0.455001	1.156999	11.905534	13.774692	1.941568
0.460001	1.159099	11.455043	13.277531	1.873947
0.465001	1.161214	11.024430	12.801719	1.808757
0.470001	1.163342	10.612636	12.346128	1.745896
0.475001	1.165485	10.218665	11.909704	1.685265
0.480001	1.167643	9.841584	11.491456	1.626769
0.485001	1.169815	9.480520	11.090455	1.570322
0.490001	1.172002	9.134650	10.705826	1.515838
0.495001	1.174203	8.803203	10.336749	1.463238
0.500001	1.176420	8.485452	9.982451	1.412446

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0.505001	1.178651	8.180716	9.642206	1.363390
0.510001	1.180897	7.888352	9.315329	1.316002
0.515001	1.183158	7.607754	9.001174	1.270216
0.520001	1.185434	7.338353	8.699134	1.225970
0.525001	1.187726	7.079610	8.408635	1.183206
0.530001	1.190033	6.831019	8.129135	1.141866
0.535001	1.192355	6.592101	7.860122	1.101897
0.540001	1.194692	6.362402	7.601114	1.063248
0.545001	1.197046	6.141497	7.351652	1.025870
0.550001	1.199415	5.928980	7.111306	0.989717
0.555001	1.201799	5.724471	6.879665	0.954743
0.560001	1.204200	5.527606	6.656343	0.920906
0.565001	1.206616	5.338044	6.440972	0.888166
0.570001	1.209049	5.155460	6.233204	0.856484
0.575001	1.211498	4.979547	6.032710	0.825822
0.580001	1.213963	4.810014	5.839177	0.796145
0.585001	1.216444	4.646583	5.652308	0.767420
0.590001	1.218942	4.488992	5.471820	0.739612
0.595001	1.221456	4.336993	5.297446	0.712691
0.600001	1.223987	4.190349	5.128932	0.686628
0.605001	1.226535	4.048834	4.966035	0.661393
0.610001	1.229099	3.912235	4.808525	0.636959
0.615001	1.231681	3.780349	4.656183	0.613299
0.620001	1.234279	3.652982	4.508800	0.590389
0.625001	1.236895	3.529950	4.366178	0.568203
0.630001	1.239528	3.411078	4.228128	0.546719
0.635001	1.242179	3.296199	4.094469	0.525915
0.640001	1.244847	3.185154	3.965029	0.505768
0.645001	1.247533	3.077791	3.839645	0.486258
0.650001	1.250236	2.973965	3.718160	0.467365
0.655001	1.252958	2.873539	3.600424	0.449070
0.660001	1.255697	2.776381	3.486295	0.431354
0.665001	1.258455	2.682366	3.375637	0.414201
0.670001	1.261231	2.591373	3.268319	0.397593
0.675001	1.264025	2.503288	3.164218	0.381513
0.680001	1.266838	2.418001	3.063215	0.365945
0.685001	1.269669	2.335407	2.965194	0.350876
0.690001	1.272519	2.255407	2.870049	0.336289
0.695001	1.275388	2.177905	2.777675	0.322170
0.700001	1.278276	2.102809	2.687972	0.308507
0.705001	1.281184	2.030032	2.600844	0.295286
0.710001	1.284110	1.959489	2.516200	0.282495
0.715001	1.287056	1.891101	2.433953	0.270121

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0.720001	1.290022	1.824790	2.354018	0.258152
0.725001	1.293007	1.760482	2.276315	0.246577
0.730001	1.296012	1.698107	2.200767	0.235385
0.735001	1.299037	1.637597	2.127300	0.224566
0.740001	1.302083	1.578887	2.055842	0.214109
0.745001	1.305148	1.521915	1.986325	0.204004
0.750001	1.308234	1.466621	1.918684	0.194242
0.755001	1.311341	1.412947	1.852856	0.184814
0.760001	1.314469	1.360839	1.788780	0.175711
0.765001	1.317617	1.310243	1.726399	0.166923
0.770001	1.320787	1.261109	1.665656	0.158444
0.775001	1.323977	1.213387	1.606497	0.150264
0.780001	1.327190	1.167031	1.548871	0.142377
0.785001	1.330423	1.121996	1.492729	0.134773
0.790001	1.333679	1.078238	1.438023	0.127447
0.795001	1.336956	1.035715	1.384706	0.120391
0.800001	1.340256	0.994388	1.332734	0.113598
0.805001	1.343577	0.954218	1.282065	0.107061
0.810001	1.346922	0.915167	1.232658	0.100775
0.815001	1.350288	0.877200	1.184473	0.094733
0.820001	1.353678	0.840283	1.137472	0.088928
0.825001	1.357091	0.804382	1.091619	0.083356
0.830001	1.360526	0.769465	1.046877	0.078010
0.835001	1.363985	0.735501	1.003213	0.072885
0.840001	1.367468	0.702462	0.960594	0.067976
0.845001	1.370974	0.670318	0.918988	0.063278
0.850001	1.374504	0.639041	0.878365	0.058785
0.855001	1.378059	0.608606	0.838695	0.054493
0.860001	1.381637	0.578986	0.799949	0.050396
0.865001	1.385241	0.550157	0.762100	0.046492
0.870001	1.388868	0.522095	0.725121	0.042774
0.875001	1.392521	0.494777	0.688987	0.039239
0.880001	1.396199	0.468180	0.653673	0.035883
0.885001	1.399902	0.442284	0.619155	0.032701
0.890001	1.403631	0.417067	0.585409	0.029690
0.895001	1.407386	0.392510	0.552413	0.026846
0.900001	1.411167	0.368593	0.520147	0.024164
0.905001	1.414974	0.345298	0.488587	0.021643
0.910001	1.418807	0.322606	0.457716	0.019277
0.915001	1.422667	0.300500	0.427512	0.017065
0.920001	1.426554	0.278964	0.397957	0.015001
0.925001	1.430468	0.257980	0.369033	0.013084
0.930001	1.434410	0.237534	0.340721	0.011310

0.935001	1.438379	0.217610	0.313005	0.009676
0.940001	1.442376	0.198193	0.285869	0.008179
0.945001	1.446401	0.179269	0.259295	0.006816
0.950001	1.450455	0.160824	0.233268	0.005585
0.955001	1.454537	0.142845	0.207773	0.004483
0.960001	1.458648	0.125319	0.182796	0.003506
0.965001	1.462788	0.108234	0.158323	0.002654
0.970001	1.466958	0.091576	0.134339	0.001922
0.975001	1.471157	0.075336	0.110831	0.001310
0.980001	1.475387	0.059501	0.087786	0.000813
0.985001	1.479646	0.044060	0.065193	0.000431
0.990001	1.483937	0.029002	0.043037	0.000161
0.995001	1.488258	0.014318	0.021309	0.0

INITIAL MACH NUMBER IS  
0.250001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.250001	0.0	84.655039	0.0	9.698295
0.255001	1.095062	79.557499	87.120359	9.480494
0.260001	1.096802	74.848651	82.094125	8.980669
0.265001	1.098554	70.492366	77.439706	8.581990
0.270001	1.100320	66.456462	73.123383	8.205723
0.275001	1.102099	62.712212	69.115043	7.850255
0.280001	1.103890	59.233919	65.387734	7.514115
0.285001	1.105695	55.998547	61.917286	7.195960
0.290001	1.107512	52.985411	58.681981	6.894559
0.295001	1.109343	50.175897	55.662268	6.608789
0.300001	1.111187	47.553228	52.840514	6.337614
0.305001	1.113044	45.102254	50.200789	6.080087
0.310001	1.114915	42.809269	47.728676	5.835333
0.315001	1.116799	40.661859	45.411106	5.602548
0.320001	1.118696	38.648757	43.236216	5.380989
0.325001	1.120607	36.759725	41.193217	5.169970
0.330001	1.122532	34.985442	39.272283	4.968857
0.335001	1.124471	33.317414	37.464456	4.777063
0.340001	1.126423	31.747887	35.761553	4.594041
0.345001	1.128389	30.269775	34.156092	4.419288
0.350001	1.130370	28.876592	32.641221	4.252332
0.355001	1.132364	27.562394	31.210658	4.092738
0.360001	1.134372	26.321729	29.858637	3.940097
0.365001	1.136395	25.149587	28.579858	3.794032
0.370001	1.138432	24.041362	27.369445	3.654187

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0.375001	1.140483	22.992811	26.222903	3.520233
0.380001	1.142548	22.000025	25.136091	3.391860
0.385001	1.144628	21.059397	24.105183	3.268780
0.390001	1.146723	20.167594	23.126643	3.150722
0.395001	1.148832	19.321534	22.197202	3.037433
0.400001	1.150956	18.518365	21.313830	2.928675
0.405001	1.153095	17.755446	20.473720	2.824224
0.410001	1.155249	17.030326	19.674266	2.723871
0.415001	1.157418	16.340730	18.913050	2.627419
0.420001	1.159602	15.684545	18.187823	2.534681
0.425001	1.161801	15.059807	17.496492	2.445485
0.430001	1.164015	14.464687	16.837109	2.359664
0.435001	1.166244	13.897482	16.207859	2.277064
0.440001	1.168489	13.356604	15.607049	2.197539
0.445001	1.170750	12.840573	15.033097	2.120950
0.450001	1.173026	12.348004	14.484528	2.047166
0.455001	1.175318	11.877607	13.959961	1.976065
0.460001	1.177625	11.428173	13.458104	1.907529
0.465001	1.179949	10.998570	12.977748	1.841449
0.470001	1.182288	10.587742	12.517760	1.777718
0.475001	1.184644	10.194695	12.077079	1.716239
0.480001	1.187015	9.818499	11.654707	1.656917
0.485001	1.189403	9.458282	11.249709	1.599664
0.490001	1.191807	9.113223	10.861206	1.544393
0.495001	1.194228	8.782553	10.488372	1.491026
0.500001	1.196665	8.465548	10.130429	1.439485
0.505001	1.199119	8.161527	9.786645	1.389698
0.510001	1.201590	7.869848	9.456332	1.341596
0.515001	1.204078	7.589909	9.138841	1.295114
0.520001	1.206582	7.321139	8.833558	1.250188
0.525001	1.209104	7.063004	8.539907	1.206759
0.530001	1.211643	6.814996	8.257343	1.164770
0.535001	1.214199	6.576638	7.985349	1.124168
0.540001	1.216773	6.347478	7.723440	1.084900
0.545001	1.219364	6.127091	7.471155	1.046918
0.550001	1.221973	5.915073	7.228060	1.010174
0.555001	1.224600	5.711043	6.993742	0.974623
0.560001	1.227244	5.514640	6.767811	0.940222
0.565001	1.229907	5.325523	6.549897	0.906932
0.570001	1.232588	5.143367	6.339650	0.874711
0.575001	1.235287	4.967867	6.136739	0.843523
0.580001	1.238004	4.798731	5.940847	0.813332
0.585001	1.240740	4.635683	5.751676	0.784103

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0.590001	1.243494	4.478463	5.568942	0.755805
0.595001	1.246267	4.326820	5.392375	0.728404
0.600001	1.249059	4.180519	5.221717	0.701871
0.605001	1.251871	4.039337	5.056727	0.676177
0.610001	1.254701	3.903058	4.897171	0.651295
0.615001	1.257551	3.771481	4.742828	0.627197
0.620001	1.260420	3.644413	4.593489	0.603858
0.625001	1.263308	3.521670	4.448954	0.581254
0.630001	1.266216	3.403077	4.309031	0.559361
0.635001	1.269145	3.288467	4.173540	0.538157
0.640001	1.272093	3.177682	4.042306	0.517619
0.645001	1.275061	3.070571	3.915165	0.497727
0.650001	1.278050	2.966989	3.791959	0.478461
0.655001	1.281059	2.866799	3.672537	0.459601
0.660001	1.284088	2.769869	3.556756	0.441729
0.665001	1.287139	2.676074	3.444478	0.424228
0.670001	1.290210	2.585294	3.335572	0.407279
0.675001	1.293302	2.497416	3.229913	0.390866
0.680001	1.296416	2.412329	3.127381	0.374975
0.685001	1.299551	2.329929	3.027861	0.359588
0.690001	1.302707	2.250117	2.931243	0.344691
0.695001	1.305885	2.172797	2.837423	0.330271
0.700001	1.309085	2.097877	2.746299	0.316312
0.705001	1.312307	2.025270	2.657777	0.302803
0.710001	1.315551	1.954893	2.571762	0.289731
0.715001	1.318818	1.886665	2.488168	0.277082
0.720001	1.322107	1.820509	2.406909	0.264845
0.725001	1.325419	1.756352	2.327903	0.253009
0.730001	1.328754	1.694124	2.251074	0.241562
0.735001	1.332112	1.633756	2.176346	0.230495
0.740001	1.335493	1.575184	2.103648	0.219796
0.745001	1.338898	1.518345	2.032910	0.209455
0.750001	1.342327	1.463181	1.964067	0.199463
0.755001	1.345779	1.409633	1.897055	0.189811
0.760001	1.349255	1.357647	1.831813	0.180490
0.765001	1.352756	1.307170	1.768282	0.171490
0.770001	1.356281	1.258151	1.706406	0.162804
0.775001	1.359831	1.210541	1.646131	0.154424
0.780001	1.363406	1.164294	1.587404	0.146340
0.785001	1.367005	1.119364	1.530176	0.138547
0.790001	1.370630	1.075708	1.474399	0.131036
0.795001	1.374281	1.033286	1.420025	0.123801
0.800001	1.377957	0.992056	1.367010	0.116834

0.805001	1.381659	0.951979	1.315311	0.110129
0.810001	1.385388	0.913020	1.264887	0.103679
0.815001	1.389142	0.875143	1.215698	0.097478
0.820001	1.392924	0.838312	1.167704	0.091520
0.825001	1.396732	0.802495	1.120870	0.085799
0.830001	1.400567	0.767660	1.075159	0.080309
0.835001	1.404430	0.733776	1.030537	0.075045
0.840001	1.408320	0.700814	0.986971	0.070002
0.845001	1.412238	0.668745	0.944428	0.065174
0.850001	1.416184	0.637542	0.902877	0.060556
0.855001	1.420158	0.607178	0.862289	0.056143
0.860001	1.424161	0.577628	0.822635	0.051932
0.865001	1.428193	0.548867	0.783887	0.047916
0.870001	1.432254	0.520870	0.746019	0.044091
0.875001	1.436344	0.493616	0.709003	0.040454
0.880001	1.440464	0.467082	0.672815	0.037000
0.885001	1.444614	0.441247	0.637431	0.033725
0.890001	1.448794	0.416089	0.602827	0.030624
0.895001	1.453004	0.391590	0.568981	0.027695
0.900001	1.457245	0.367729	0.535871	0.024933
0.905001	1.461517	0.344488	0.503475	0.022335
0.910001	1.465821	0.321849	0.471773	0.019897
0.915001	1.470156	0.299796	0.440746	0.017616
0.920001	1.474523	0.278310	0.410374	0.015489
0.925001	1.478922	0.257375	0.380638	0.013512
0.930001	1.483354	0.236977	0.351521	0.011681
0.935001	1.487818	0.217099	0.323004	0.009995
0.940001	1.492316	0.197728	0.295073	0.008450
0.945001	1.496847	0.178848	0.267709	0.007044
0.950001	1.501412	0.160447	0.240897	0.005772
0.955001	1.506011	0.142510	0.214622	0.004634
0.960001	1.510645	0.125025	0.188869	0.003625
0.965001	1.515313	0.107980	0.163623	0.002744
0.970001	1.520017	0.091362	0.138871	0.001988
0.975001	1.524756	0.075159	0.114599	0.001355
0.980001	1.529531	0.059361	0.090794	0.000841
0.985001	1.534342	0.043956	0.067444	0.000446
0.990001	1.539190	0.028934	0.044535	0.000166
0.995001	1.544075	0.014284	0.022056	0.0

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INITIAL MACH NUMBER IS  
0.275001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.275001	0.0	62.550045	0.0	7.831583
0.280001	1.116496	59.080746	65.963397	7.666674
0.285001	1.118468	55.853740	62.470604	7.287709
0.290001	1.120454	52.848396	59.214191	6.983595
0.295001	1.122454	50.046148	56.174517	6.695214
0.300001	1.124469	47.430261	53.333866	6.421526
0.305001	1.126498	44.985624	50.676235	6.161577
0.310001	1.128542	42.698569	48.187138	5.914489
0.315001	1.130601	40.556712	45.853445	5.679452
0.320001	1.132674	38.548816	43.663234	5.455720
0.325001	1.134762	36.664668	41.605663	5.242603
0.330001	1.136865	34.894973	39.670860	5.039463
0.335001	1.138982	33.231258	37.849820	4.845709
0.340001	1.141115	31.665790	36.134320	4.660792
0.345001	1.143263	30.191500	34.516840	4.484205
0.350001	1.145427	28.801920	32.990493	4.315475
0.355001	1.147606	27.491121	31.548964	4.154162
0.360001	1.149800	26.253664	30.186457	3.999856
0.365001	1.152010	25.084553	28.897645	3.852176
0.370001	1.154235	23.979193	27.677623	3.710767
0.375001	1.156476	22.933354	26.521876	3.575295
0.380001	1.158733	21.943136	25.426238	3.445450
0.385001	1.161006	21.004940	24.386863	3.320940
0.390001	1.163295	20.115442	23.400195	3.201495
0.395001	1.165600	19.271570	22.462946	3.086858
0.400001	1.167922	18.470479	21.572070	2.976789
0.405001	1.170259	17.709532	20.724745	2.871065
0.410001	1.172613	16.986287	19.918348	2.769475
0.415001	1.174984	16.298474	19.150449	2.671819
0.420001	1.177372	15.643987	18.418784	2.577911
0.425001	1.179776	15.020864	17.721249	2.487575
0.430001	1.182197	14.427283	17.055885	2.400645
0.435001	1.184635	13.861545	16.420866	2.316966
0.440001	1.187090	13.322066	15.814487	2.236390
0.445001	1.189562	12.807368	15.235158	2.158777
0.450001	1.192052	12.316074	14.681394	2.083996
0.455001	1.194559	11.846893	14.151807	2.011923
0.460001	1.197083	11.398621	13.645095	1.942441
0.465001	1.199625	10.970129	13.160044	1.875437
0.470001	1.202185	10.560363	12.695512	1.810806

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0.475001	1.204763	10.168332	12.250431	1.748450
0.480001	1.207359	9.793109	11.823798	1.688272
0.485001	1.209973	9.433823	11.414671	1.630183
0.490001	1.212605	9.089657	11.022165	1.574098
0.495001	1.215256	8.759842	10.645449	1.519935
0.500001	1.217925	8.443657	10.283740	1.467619
0.505001	1.220613	8.140422	9.936302	1.417074
0.510001	1.223319	7.849498	9.602441	1.368233
0.515001	1.226045	7.570282	9.281503	1.321029
0.520001	1.228789	7.302208	8.972872	1.275398
0.525001	1.231553	7.044740	8.675967	1.231281
0.530001	1.234335	6.797373	8.390238	1.188620
0.535001	1.237138	6.559631	8.115167	1.147361
0.540001	1.239960	6.331064	7.850263	1.107451
0.545001	1.242801	6.111247	7.595064	1.068842
0.550001	1.245663	5.899777	7.349131	1.031486
0.555001	1.248544	5.696275	7.112049	0.995336
0.560001	1.251445	5.500380	6.883425	0.960351
0.565001	1.254367	5.311751	6.662887	0.926489
0.570001	1.257310	5.130067	6.450082	0.893710
0.575001	1.260272	4.955021	6.244675	0.861976
0.580001	1.263256	4.786322	6.046350	0.831251
0.585001	1.266260	4.623696	5.854803	0.801501
0.590001	1.269286	4.466882	5.669750	0.772692
0.595001	1.272333	4.315631	5.490919	0.744793
0.600001	1.275401	4.169709	5.318050	0.717773
0.605001	1.278490	4.028891	5.150899	0.691603
0.610001	1.281602	3.892965	4.989231	0.666255
0.615001	1.284735	3.761728	4.832824	0.641702
0.620001	1.287890	3.634989	4.681466	0.617919
0.625001	1.291068	3.512563	4.534956	0.594880
0.630001	1.294267	3.394277	4.393101	0.572562
0.635001	1.297490	3.279963	4.255719	0.550941
0.640001	1.300735	3.169465	4.122633	0.529997
0.645001	1.304003	3.062631	3.993679	0.509708
0.650001	1.307294	2.959317	3.868697	0.490054
0.655001	1.310608	2.859386	3.747534	0.471015
0.660001	1.313946	2.762706	3.630047	0.452572
0.665001	1.317308	2.669154	3.516097	0.434709
0.670001	1.320693	2.578609	3.405551	0.417406
0.675001	1.324102	2.490958	3.298283	0.400648
0.680001	1.327536	2.406091	3.194172	0.384418
0.685001	1.330994	2.323904	3.093103	0.368701
0.690001	1.334477	2.244298	2.994964	0.353482
0.695001	1.337984	2.167178	2.899650	0.338747
0.700001	1.341517	2.092452	2.807060	0.324481
0.705001	1.345075	2.020033	2.717096	0.310672

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0.710001	1.348658	1.949838	2.629665	0.297306
0.715001	1.352268	1.881786	2.544678	0.284371
0.720001	1.355903	1.815802	2.462050	0.271855
0.725001	1.359564	1.751811	2.381698	0.259747
0.730001	1.363251	1.689743	2.303544	0.248035
0.735001	1.366965	1.629531	2.227513	0.236708
0.740001	1.370706	1.571111	2.153531	0.225756
0.745001	1.374474	1.514419	2.081531	0.215169
0.750001	1.378270	1.459397	2.011443	0.204938
0.755001	1.382093	1.405988	1.943206	0.195052
0.760001	1.385943	1.354136	1.876756	0.185503
0.765001	1.389822	1.303789	1.812036	0.176281
0.770001	1.393729	1.254897	1.748987	0.167379
0.775001	1.397665	1.207410	1.687555	0.158789
0.780001	1.401629	1.161283	1.627688	0.150501
0.785001	1.405623	1.116469	1.569334	0.142509
0.790001	1.409645	1.072927	1.512446	0.134806
0.795001	1.413698	1.030614	1.456976	0.127383
0.800001	1.417780	0.989490	1.402879	0.120234
0.805001	1.421892	0.949518	1.350112	0.113352
0.810001	1.426035	0.910659	1.298632	0.106730
0.815001	1.430209	0.872880	1.248400	0.100363
0.820001	1.434413	0.836144	1.199376	0.094244
0.825001	1.438649	0.800420	1.151523	0.088368
0.830001	1.442917	0.765675	1.104805	0.082727
0.835001	1.447216	0.731879	1.059187	0.077318
0.840001	1.451547	0.699002	1.014635	0.072134
0.845001	1.455911	0.667016	0.971116	0.067170
0.850001	1.460308	0.635894	0.928601	0.062421
0.855001	1.464738	0.605608	0.887058	0.057882
0.860001	1.469202	0.576134	0.846458	0.053549
0.865001	1.473699	0.547447	0.806773	0.049416
0.870001	1.478230	0.519523	0.767975	0.045479
0.875001	1.482796	0.492340	0.730040	0.041735
0.880001	1.487397	0.465874	0.692940	0.038178
0.885001	1.492033	0.440106	0.656652	0.034804
0.890001	1.496704	0.415013	0.621152	0.031610
0.895001	1.501411	0.390577	0.586417	0.028591
0.900001	1.506154	0.366778	0.552424	0.025744
0.905001	1.510934	0.343597	0.519153	0.023066
0.910001	1.515751	0.321017	0.486582	0.020552
0.915001	1.520606	0.299020	0.454692	0.018199
0.920001	1.525498	0.277590	0.423463	0.016004
0.925001	1.530428	0.256710	0.392876	0.013963
0.930001	1.535396	0.236364	0.362913	0.012074
0.935001	1.540404	0.216538	0.333556	0.010333
0.940001	1.545451	0.197217	0.304789	0.008737

0.945001	1.550537	0.178386	0.276594	0.007284
0.950001	1.555664	0.160032	0.248956	0.005970
0.955001	1.560831	0.142141	0.221859	0.004794
0.960001	1.566040	0.124702	0.195288	0.003751
0.965001	1.571290	0.107700	0.169229	0.002840
0.970001	1.576581	0.091125	0.143667	0.002058
0.975001	1.581915	0.074965	0.118588	0.001402
0.980001	1.587292	0.059207	0.093980	0.000871
0.985001	1.592712	0.043843	0.069829	0.000462
0.990001	1.598176	0.028859	0.046122	0.000172
0.995001	1.603684	0.014247	0.022848	0.0

INITIAL MACH NUMBER IS  
0.300001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.300001	0.0	47.296310	0.0	6.418925
0.305001	1.140671	44.858577	51.168869	6.291003
0.310001	1.142895	42.577981	48.662156	5.996696
0.315001	1.145135	40.442173	46.311741	5.759326
0.320001	1.147391	38.439947	44.105643	5.533343
0.325001	1.149663	36.561121	42.032964	5.318052
0.330001	1.151951	34.796424	40.083783	5.112811
0.335001	1.154256	33.137408	38.249048	4.917027
0.340001	1.156577	31.576361	36.520493	4.730147
0.345001	1.158915	30.106234	34.890558	4.551661
0.350001	1.161269	28.720578	33.352320	4.381092
0.355001	1.163640	27.413481	31.899431	4.217998
0.360001	1.166028	26.179519	30.526062	4.061967
0.365001	1.168434	25.013710	29.226857	3.912616
0.370001	1.170856	23.911472	27.996885	3.769586
0.375001	1.173295	22.868586	26.831606	3.632541
0.380001	1.175752	21.881164	25.726829	3.501170
0.385001	1.178227	20.945618	24.678688	3.375180
0.390001	1.180719	20.058633	23.683606	3.254297
0.395001	1.183229	19.217144	22.738276	3.138263
0.400001	1.185756	18.418315	21.839634	3.026837
0.405001	1.188302	17.659518	20.984842	2.919794
0.410001	1.190866	16.938315	20.171262	2.816921
0.415001	1.193448	16.252445	19.396448	2.718018

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0.420001	1.196048	15.599805	18.658123	2.622897
0.425001	1.198667	14.978443	17.954171	2.531381
0.430001	1.201305	14.386538	17.282620	2.443302
0.435001	1.203961	13.822397	16.641633	2.358504
0.440001	1.206637	13.284442	16.029495	2.276838
0.445001	1.209331	12.771198	15.444606	2.198164
0.450001	1.212045	12.281291	14.885471	2.122350
0.455001	1.214777	11.813435	14.350693	2.049270
0.460001	1.217530	11.366429	13.838964	1.978805
0.465001	1.220301	10.939148	13.349058	1.910844
0.470001	1.223093	10.530539	12.879829	1.845281
0.475001	1.225905	10.139615	12.430200	1.782014
0.480001	1.228736	9.765452	11.999163	1.720948
0.485001	1.231588	9.407181	11.585768	1.661993
0.490001	1.234460	9.063986	11.189126	1.605063
0.495001	1.237352	8.735103	10.808399	1.550076
0.500001	1.240265	8.419811	10.442799	1.496954
0.505001	1.243199	8.117432	10.091585	1.445624
0.510001	1.246154	7.827329	9.754058	1.396016
0.515001	1.249130	7.548902	9.429560	1.348062
0.520001	1.252127	7.281585	9.117470	1.301700
0.525001	1.255146	7.024844	8.817203	1.256868
0.530001	1.258186	6.778176	8.528206	1.213509
0.535001	1.261248	6.541106	8.249956	1.171566
0.540001	1.264332	6.313184	7.981959	1.130993
0.545001	1.267438	6.093988	7.723750	1.091732
0.550001	1.270566	5.883115	7.474886	1.053740
0.555001	1.273717	5.680187	7.234949	1.016969
0.560001	1.276890	5.484846	7.003544	0.981376
0.565001	1.280086	5.296750	6.780296	0.946920
0.570001	1.283305	5.115579	6.564848	0.913560
0.575001	1.286547	4.941027	6.356865	0.881259
0.580001	1.289813	4.772805	6.156025	0.849980
0.585001	1.293102	4.610638	5.962025	0.819688
0.590001	1.296415	4.454267	5.774577	0.790349
0.595001	1.299752	4.303443	5.593407	0.761931
0.600001	1.303113	4.157933	5.418255	0.734405
0.605001	1.306498	4.017513	5.248872	0.707739
0.610001	1.309907	3.881971	5.085022	0.681907
0.615001	1.313342	3.751105	4.926483	0.656880
0.620001	1.316801	3.624723	4.773040	0.632634
0.625001	1.320286	3.502643	4.624490	0.609142
0.630001	1.323796	3.384690	4.480639	0.586381
0.635001	1.327331	3.270700	4.341302	0.564328
0.640001	1.330893	3.160514	4.206304	0.542961
0.645001	1.334480	3.053981	4.075477	0.522258
0.650001	1.338093	2.950959	3.948659	0.502200

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0.655001	1.341733	2.851310	3.825698	0.482765
0.660001	1.345400	2.754904	3.706448	0.463936
0.665001	1.349094	2.661616	3.590769	0.445695
0.670001	1.352814	2.571327	3.478528	0.428023
0.675001	1.356563	2.483923	3.369597	0.410904
0.680001	1.360338	2.399296	3.263854	0.394322
0.685001	1.364142	2.317341	3.161183	0.378261
0.690001	1.367974	2.237960	3.061471	0.362705
0.695001	1.371834	2.161058	2.964613	0.347641
0.700001	1.375723	2.086543	2.870505	0.333054
0.705001	1.379641	2.014328	2.779050	0.318932
0.710001	1.383588	1.944331	2.690153	0.305260
0.715001	1.387564	1.876472	2.603725	0.292026
0.720001	1.391570	1.810673	2.519680	0.279219
0.725001	1.395607	1.746863	2.437934	0.266826
0.730001	1.399673	1.684971	2.358408	0.254836
0.735001	1.403770	1.624929	2.281027	0.243238
0.740001	1.407898	1.566674	2.205716	0.232022
0.745001	1.412057	1.510142	2.132407	0.221177
0.750001	1.416247	1.455276	2.061030	0.210695
0.755001	1.420469	1.402017	1.991522	0.200564
0.760001	1.424723	1.350312	1.923821	0.190776
0.765001	1.429010	1.300107	1.857866	0.181323
0.770001	1.433329	1.251353	1.793601	0.172195
0.775001	1.437681	1.204000	1.730969	0.163384
0.780001	1.442067	1.158003	1.669918	0.154883
0.785001	1.446486	1.113316	1.610396	0.146683
0.790001	1.450939	1.069897	1.552354	0.138776
0.795001	1.455426	1.027703	1.495746	0.131157
0.800001	1.459948	0.986696	1.440524	0.123817
0.805001	1.464504	0.946836	1.386646	0.116749
0.810001	1.469097	0.908088	1.334068	0.109948
0.815001	1.473724	0.870414	1.282751	0.103406
0.820001	1.478388	0.833783	1.232654	0.097118
0.825001	1.483088	0.798159	1.183741	0.091078
0.830001	1.487825	0.763512	1.135973	0.085279
0.835001	1.492600	0.729812	1.089317	0.079716
0.840001	1.497411	0.697028	1.043737	0.074384
0.845001	1.502261	0.665132	0.999202	0.069277
0.850001	1.507149	0.634098	0.955680	0.064390
0.855001	1.512076	0.603898	0.913139	0.059719
0.860001	1.517041	0.574507	0.871551	0.055257
0.865001	1.522047	0.545901	0.830887	0.051002
0.870001	1.527092	0.518056	0.791119	0.046947
0.875001	1.532177	0.490949	0.752221	0.043089
0.880001	1.537304	0.464559	0.714168	0.039423
0.885001	1.542472	0.438863	0.676933	0.035946

0.890001	1.547681	0.413841	0.640494	0.032653
0.895001	1.552933	0.389474	0.604827	0.029540
0.900001	1.558227	0.365742	0.569909	0.026603
0.905001	1.563564	0.342627	0.535719	0.023840
0.910001	1.568945	0.320111	0.502236	0.021245
0.915001	1.574369	0.298176	0.469439	0.018816
0.920001	1.579839	0.276806	0.437309	0.016549
0.925001	1.585353	0.255985	0.405826	0.014442
0.930001	1.590913	0.235697	0.374973	0.012490
0.935001	1.596519	0.215926	0.344731	0.010691
0.940001	1.602171	0.196660	0.315082	0.009042
0.945001	1.607871	0.177882	0.286011	0.007539
0.950001	1.613618	0.159580	0.257501	0.006181
0.955001	1.619413	0.141740	0.229536	0.004963
0.960001	1.625257	0.124350	0.202100	0.003885
0.965001	1.631150	0.107396	0.175180	0.002942
0.970001	1.637093	0.090868	0.148759	0.002132
0.975001	1.643087	0.074753	0.122826	0.001453
0.980001	1.649131	0.059040	0.097365	0.000903
0.985001	1.655227	0.043719	0.072364	0.000479
0.990001	1.661376	0.028778	0.047811	0.000179
0.995001	1.667577	0.014207	0.023692	0.0

INITIAL MACH NUMBER IS  
0.325001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.325001	0.0	36.449231	0.0	5.325723
0.330001	1.167822	34.689934	40.511671	5.224444
0.335001	1.170322	33.035995	38.662750	4.991208
0.340001	1.172840	31.479726	36.920673	4.802293
0.345001	1.175376	30.014099	35.277839	4.621839
0.350001	1.177930	28.632683	33.727288	4.449364
0.355001	1.180502	27.329586	32.262635	4.284425
0.360001	1.183093	26.099400	30.878020	4.126607
0.365001	1.185703	24.937159	29.568057	3.975523
0.370001	1.188331	23.838294	28.327786	3.830812
0.375001	1.190978	22.798600	27.152640	3.692138
0.380001	1.193645	21.814200	26.038405	3.559186
0.385001	1.196330	20.881517	24.981192	3.431661

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0.390001	1.199035	19.997246	23.977403	3.309287
0.395001	1.201760	19.158333	23.023712	3.191805
0.400001	1.204504	18.361948	22.117036	3.078972
0.405001	1.207268	17.605473	21.254518	2.970562
0.410001	1.210051	16.886478	20.433507	2.866359
0.415001	1.212855	16.202706	19.651540	2.766163
0.420001	1.215680	15.552064	18.906328	2.669783
0.425001	1.218524	14.932603	18.195739	2.577043
0.430001	1.221389	14.342510	17.517790	2.487772
0.435001	1.224275	13.780096	16.870632	2.401814
0.440001	1.227182	13.243787	16.252539	2.319016
0.445001	1.230110	12.732114	15.661901	2.239244
0.450001	1.233059	12.243706	15.097213	2.162357
0.455001	1.236030	11.777282	14.557069	2.088231
0.460001	1.239022	11.331644	14.040152	2.016748
0.465001	1.242035	10.905670	13.545228	1.947794
0.470001	1.245071	10.498312	13.071144	1.881261
0.475001	1.248129	10.108584	12.616815	1.817050
0.480001	1.251209	9.735566	12.181225	1.755062
0.485001	1.254311	9.378391	11.763420	1.695208
0.490001	1.257436	9.036247	11.362503	1.637400
0.495001	1.260584	8.708370	10.977631	1.581557
0.500001	1.263755	8.394043	10.608010	1.527599
0.505001	1.266948	8.092590	10.252894	1.475453
0.510001	1.270166	7.803375	9.911579	1.425047
0.515001	1.273406	7.525800	9.583402	1.376315
0.520001	1.276671	7.259301	9.267739	1.329193
0.525001	1.279959	7.003346	8.963998	1.283618
0.530001	1.283272	6.757432	8.671623	1.239534
0.535001	1.286609	6.521087	8.390089	1.196884
0.540001	1.289970	6.293864	8.118897	1.155616
0.545001	1.293356	6.075338	7.857577	1.115679
0.550001	1.296767	5.865111	7.605685	1.077025
0.555001	1.300204	5.662804	7.362799	1.039607
0.560001	1.303665	5.468060	7.128520	1.003383
0.565001	1.307152	5.280540	6.902471	0.968309
0.570001	1.310665	5.099923	6.684294	0.934345
0.575001	1.314205	4.925905	6.473647	0.901453
0.580001	1.317770	4.758198	6.270210	0.869597
0.585001	1.321362	4.596528	6.073675	0.838740
0.590001	1.324980	4.440635	5.883753	0.808849
0.595001	1.328626	4.290273	5.700167	0.779892
0.600001	1.332298	4.145208	5.522654	0.751837
0.605001	1.335998	4.005218	5.350964	0.724656
0.610001	1.339726	3.870090	5.184861	0.698319
0.615001	1.343482	3.739625	5.024118	0.672798
0.620001	1.347266	3.613630	4.868519	0.648069

0.625001	1.351078	3.491924	4.717861	0.624105
0.630001	1.354919	3.374332	4.571946	0.600882
0.635001	1.358789	3.260691	4.430590	0.578378
0.640001	1.362688	3.150842	4.293614	0.556569
0.645001	1.366617	3.044635	4.160849	0.535435
0.650001	1.370575	2.941928	4.032133	0.514954
0.655001	1.374563	2.842584	3.907312	0.495107
0.660001	1.378582	2.746473	3.786239	0.475875
0.665001	1.382632	2.653470	3.668772	0.457239
0.670001	1.386712	2.563458	3.554777	0.439131
0.675001	1.390823	2.476321	3.444125	0.421686
0.680001	1.394966	2.391953	3.336693	0.404735
0.685001	1.399141	2.310249	3.232364	0.388313
0.690001	1.403348	2.231111	3.131025	0.372406
0.695001	1.407587	2.154444	3.032567	0.356998
0.700001	1.411859	2.080157	2.936888	0.342076
0.705001	1.416164	2.008164	2.843889	0.327625
0.710001	1.420502	1.938381	2.753474	0.313633
0.715001	1.424874	1.870729	2.665553	0.300086
0.720001	1.429280	1.805132	2.580039	0.286973
0.725001	1.433720	1.741517	2.496849	0.274282
0.730001	1.438195	1.679814	2.415901	0.262001
0.735001	1.442706	1.619956	2.337120	0.250119
0.740001	1.447251	1.561879	2.260431	0.238626
0.745001	1.451832	1.505521	2.185764	0.227512
0.750001	1.456450	1.450822	2.113049	0.216766
0.755001	1.461104	1.397727	2.042223	0.206378
0.760001	1.465794	1.346180	1.973222	0.196340
0.765001	1.470522	1.296129	1.905986	0.186643
0.770001	1.475288	1.247523	1.840456	0.177278
0.775001	1.480092	1.200316	1.776577	0.168236
0.780001	1.484934	1.154459	1.714295	0.159509
0.785001	1.489815	1.109909	1.653559	0.151090
0.790001	1.494735	1.066622	1.594318	0.142971
0.795001	1.499695	1.024558	1.536524	0.135145
0.800001	1.504694	0.983676	1.480132	0.127604
0.805001	1.509735	0.943938	1.425097	0.120341
0.810001	1.514816	0.905308	1.371376	0.113351
0.815001	1.519939	0.867751	1.318928	0.106625
0.820001	1.525103	0.831231	1.267713	0.100159
0.825001	1.530310	0.795717	1.217693	0.093946
0.830001	1.535560	0.761176	1.168831	0.087980
0.835001	1.540852	0.727578	1.121091	0.082256
0.840001	1.546189	0.694895	1.074438	0.076768
0.845001	1.551569	0.663097	1.028841	0.071510
0.850001	1.556995	0.632157	0.984265	0.066478
0.855001	1.562465	0.602050	0.940682	0.061666

0.860001	1.567981	0.572749	0.898060	0.057069
0.865001	1.573544	0.544231	0.856370	0.052683
0.870001	1.579153	0.516471	0.815586	0.048504
0.875001	1.584809	0.489447	0.775680	0.044526
0.880001	1.590513	0.463137	0.736625	0.040746
0.885001	1.596266	0.437520	0.698397	0.037159
0.890001	1.602067	0.412575	0.660972	0.033760
0.895001	1.607918	0.388282	0.624325	0.030548
0.900001	1.613819	0.364623	0.588435	0.027516
0.905001	1.619771	0.341578	0.553278	0.024662
0.910001	1.625773	0.319131	0.518834	0.021982
0.915001	1.631828	0.297263	0.485083	0.019472
0.920001	1.637935	0.275959	0.452003	0.017130
0.925001	1.644096	0.255201	0.419575	0.014951
0.930001	1.650310	0.234975	0.387782	0.012933
0.935001	1.656578	0.215266	0.356604	0.011073
0.940001	1.662902	0.196058	0.326025	0.009366
0.945001	1.669281	0.177338	0.296026	0.007811
0.950001	1.675717	0.159092	0.266592	0.006405
0.955001	1.682209	0.141306	0.237707	0.005144
0.960001	1.688760	0.123969	0.209354	0.004027
0.965001	1.695369	0.107068	0.181519	0.003050
0.970001	1.702037	0.090590	0.154187	0.002211
0.975001	1.708766	0.074524	0.127345	0.001507
0.980001	1.715555	0.058860	0.100977	0.000937
0.985001	1.722406	0.043585	0.075071	0.000497
0.990001	1.729319	0.028690	0.049614	0.000185
0.995001	1.736295	0.014164	0.024592	0.0

INITIAL MACH NUMBER IS  
0.350001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.350001	0.0	28.538358	0.0	4.463619
0.355001	1.198226	27.239554	32.639149	4.382021
0.360001	1.201030	26.013421	31.242898	4.193953
0.365001	1.203854	24.855008	29.921802	4.041073
0.370001	1.206699	23.759764	28.670874	3.894620
0.375001	1.209564	22.723495	27.485520	3.754256
0.380001	1.212450	21.742338	26.361502	3.619664

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0.385001	1.215357	20.812727	25.294904	3.490547
0.390001	1.218286	19.931369	24.282109	3.366627
0.395001	1.221236	19.095220	23.319769	3.247644
0.400001	1.224208	18.301459	22.404784	3.133352
0.405001	1.227201	17.547476	21.534277	3.023523
0.410001	1.230216	16.830849	20.705582	2.917941
0.415001	1.233254	16.149330	19.916219	2.816402
0.420001	1.236313	15.500831	19.163884	2.718718
0.425001	1.239396	14.883411	18.446433	2.624706
0.430001	1.242500	14.295262	17.761869	2.534199
0.435001	1.245628	13.734700	17.108331	2.447037
0.440001	1.248779	13.200158	16.484082	2.363068
0.445001	1.251953	12.690170	15.887500	2.282150
0.450001	1.255151	12.203371	15.317073	2.204150
0.455001	1.258372	11.738484	14.771381	2.128939
0.460001	1.261617	11.294314	14.249102	2.056398
0.465001	1.264886	10.869744	13.748992	1.986412
0.470001	1.268180	10.463727	13.269889	1.918873
0.475001	1.271498	10.075284	12.810702	1.853680
0.480001	1.274841	9.703494	12.370408	1.790735
0.485001	1.278208	9.347496	11.948045	1.729946
0.490001	1.281601	9.006479	11.542710	1.671227
0.495001	1.285019	8.679682	11.153554	1.614493
0.500001	1.288462	8.366391	10.779778	1.559666
0.505001	1.291932	8.065930	10.420630	1.506671
0.510001	1.295427	7.777668	10.075400	1.455437
0.515001	1.298948	7.501008	9.743422	1.405895
0.520001	1.302496	7.235387	9.424065	1.357982
0.525001	1.306071	6.980274	9.116735	1.311635
0.530001	1.309673	6.735171	8.820870	1.266795
0.535001	1.313302	6.499605	8.535941	1.223408
0.540001	1.316958	6.273130	8.261447	1.181419
0.545001	1.320642	6.055324	7.996913	1.140777
0.550001	1.324354	5.845789	7.741892	1.101434
0.555001	1.328094	5.644149	7.495958	1.063343
0.560001	1.331862	5.450047	7.258710	1.026460
0.565001	1.335659	5.263145	7.029767	0.990742
0.570001	1.339485	5.083123	6.808767	0.956149
0.575001	1.343340	4.909678	6.595369	0.922642
0.580001	1.347225	4.742523	6.389247	0.890184
0.585001	1.351140	4.581385	6.190092	0.858738
0.590001	1.355084	4.426006	5.997612	0.828272
0.595001	1.359059	4.276140	5.811528	0.798752
0.600001	1.363065	4.131553	5.631575	0.770146
0.605001	1.367102	3.992024	5.457502	0.742426
0.610001	1.371169	3.857341	5.289068	0.715562
0.615001	1.375268	3.727306	5.126046	0.689527

0.620001	1.379400	3.601726	4.968219	0.664293
0.625001	1.383563	3.480420	4.815379	0.639836
0.630001	1.387758	3.363216	4.667331	0.616131
0.635001	1.391987	3.249949	4.523885	0.593155
0.640001	1.396248	3.140462	4.384864	0.570885
0.645001	1.400543	3.034605	4.250095	0.549300
0.650001	1.404871	2.932237	4.119415	0.528377
0.655001	1.409234	2.833220	3.992670	0.508099
0.660001	1.413631	2.737425	3.869709	0.488445
0.665001	1.418063	2.644729	3.750392	0.469396
0.670001	1.422530	2.555013	3.634581	0.450935
0.675001	1.427032	2.468163	3.522148	0.433044
0.680001	1.431570	2.384073	3.412968	0.415708
0.685001	1.436144	2.302639	3.306922	0.398910
0.690001	1.440755	2.223761	3.203896	0.382634
0.695001	1.445403	2.147347	3.103781	0.366866
0.700001	1.450088	2.073304	3.006474	0.351591
0.705001	1.454811	2.001548	2.911874	0.336797
0.710001	1.459572	1.931995	2.819886	0.322468
0.715001	1.464371	1.864566	2.730418	0.308594
0.720001	1.469210	1.799186	2.643381	0.295160
0.725001	1.474087	1.735780	2.558692	0.282156
0.730001	1.479005	1.674280	2.476269	0.269569
0.735001	1.483962	1.614620	2.396035	0.257390
0.740001	1.488961	1.556734	2.317915	0.245606
0.745001	1.494000	1.500561	2.241838	0.234207
0.750001	1.499080	1.446043	2.167734	0.223184
0.755001	1.504203	1.393122	2.095538	0.212527
0.760001	1.509368	1.341745	2.025187	0.202226
0.765001	1.514576	1.291859	1.956618	0.192272
0.770001	1.519827	1.243414	1.889774	0.182656
0.775001	1.525122	1.196362	1.824598	0.173371
0.780001	1.530462	1.150656	1.761035	0.164408
0.785001	1.535846	1.106253	1.699033	0.155758
0.790001	1.541275	1.063109	1.638543	0.147415
0.795001	1.546751	1.021183	1.579515	0.139370
0.800001	1.552272	0.980436	1.521903	0.131618
0.805001	1.557841	0.940829	1.465662	0.124149
0.810001	1.563457	0.902326	1.410748	0.116959
0.815001	1.569121	0.864892	1.357120	0.110040
0.820001	1.574833	0.828493	1.304738	0.103385
0.825001	1.580595	0.793095	1.253562	0.096990
0.830001	1.586406	0.758668	1.203556	0.090843
0.835001	1.592267	0.725181	1.154683	0.084953
0.840001	1.598179	0.692606	1.106908	0.079299
0.845001	1.604143	0.660912	1.060198	0.073882
0.850001	1.610159	0.630075	1.014521	0.068696

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0.855001	1.616227	0.600066	0.969844	0.063735
0.860001	1.622349	0.570862	0.926138	0.058996
0.865001	1.628525	0.542438	0.883373	0.054472
0.870001	1.634755	0.514769	0.841522	0.050160
0.875001	1.641041	0.487834	0.800556	0.046025
0.880001	1.647383	0.461611	0.760450	0.042153
0.885001	1.653781	0.436078	0.721178	0.038450
0.890001	1.660237	0.411215	0.682715	0.034940
0.895001	1.666751	0.387003	0.645037	0.031621
0.900001	1.673323	0.363421	0.608122	0.028489
0.905001	1.679955	0.340453	0.571946	0.025539
0.910001	1.686648	0.318080	0.536488	0.022768
0.915001	1.693402	0.296284	0.501728	0.020173
0.920001	1.700217	0.275050	0.467644	0.017749
0.925001	1.707095	0.254361	0.434218	0.015495
0.930001	1.714036	0.234201	0.401429	0.013406
0.935001	1.721042	0.214557	0.369261	0.011480
0.940001	1.728113	0.195412	0.337694	0.009713
0.945001	1.735250	0.176753	0.306711	0.008102
0.950001	1.742454	0.158567	0.276296	0.006645
0.955001	1.749725	0.140841	0.246433	0.005338
0.960001	1.757065	0.123561	0.217104	0.004179
0.965001	1.764475	0.106715	0.188296	0.003166
0.970001	1.771955	0.090291	0.159992	0.002296
0.975001	1.779507	0.074279	0.132180	0.001565
0.980001	1.787131	0.058666	0.104843	0.000973
0.985001	1.794828	0.043441	0.077970	0.000516
0.990001	1.802600	0.028595	0.051546	0.000193
0.995001	1.810447	0.014117	0.025558	0.0

INITIAL MACH NUMBER IS

0.375001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.375001	0.0	22.643375	0.0	3.772690
0.380001	1.232210	21.665678	26.696661	3.705949
0.385001	1.235351	20.739345	25.620360	3.557012
0.390001	1.238514	19.861095	24.598253	3.426488
0.395001	1.241702	19.027893	23.626972	3.305946



0.400001	1.244913	18.236931	22.703395	3.190140
0.405001	1.248148	17.485606	21.824630	3.078839
0.410001	1.251408	16.771506	20.987990	2.971825
0.415001	1.254691	16.092390	20.190981	2.868894
0.420001	1.257999	15.446178	19.431283	2.769854
0.425001	1.261332	14.830934	18.706739	2.674523
0.430001	1.264691	14.244859	18.015338	2.582732
0.435001	1.268074	13.686274	17.355205	2.494319
0.440001	1.271483	13.153616	16.724593	2.409132
0.445001	1.274917	12.645427	16.121870	2.327027
0.450001	1.278377	12.160344	15.545509	2.247870
0.455001	1.281864	11.697096	14.994086	2.171531
0.460001	1.285377	11.254492	14.466264	2.097690
0.465001	1.288917	10.831419	13.960794	2.026832
0.470001	1.292483	10.426834	13.476505	1.958247
0.475001	1.296077	10.039760	13.012298	1.892033
0.480001	1.299698	9.669281	12.567142	1.828093
0.485001	1.303346	9.314538	12.140069	1.766332
0.490001	1.307023	8.974724	11.730169	1.706664
0.495001	1.310728	8.649079	11.336587	1.649004
0.500001	1.314461	8.336892	10.958517	1.593273
0.505001	1.318222	8.037491	10.595201	1.539394
0.510001	1.322013	7.750245	10.245927	1.487297
0.515001	1.325833	7.474560	9.910020	1.436913
0.520001	1.329683	7.209876	9.586846	1.388176
0.525001	1.333562	6.955663	9.275807	1.341025
0.530001	1.337471	6.711424	8.976336	1.295399
0.535001	1.341411	6.476688	8.687900	1.251243
0.540001	1.345381	6.251012	8.409993	1.208503
0.545001	1.349382	6.033974	8.142137	1.167127
0.550001	1.353415	5.825178	7.883862	1.127066
0.555001	1.357479	5.624249	7.634798	1.088273
0.560001	1.361575	5.430831	7.394481	1.050703
0.565001	1.365703	5.244587	7.162547	1.014314
0.570001	1.369863	5.065200	6.938631	0.979064
0.575001	1.374056	4.892367	6.722388	0.944915
0.580001	1.378283	4.725802	6.513491	0.911829
0.585001	1.382543	4.565232	6.311628	0.879769
0.590001	1.386836	4.410401	6.116503	0.848701
0.595001	1.391164	4.261063	5.927836	0.818593
0.600001	1.395526	4.116986	5.745361	0.789413
0.605001	1.399923	3.977948	5.568822	0.761130
0.610001	1.404355	3.843741	5.397978	0.733715
0.615001	1.408823	3.714164	5.232599	0.707141
0.620001	1.413327	3.589027	5.072467	0.681380
0.625001	1.417867	3.468149	4.917372	0.656408
0.630001	1.422443	3.351358	4.767116	0.632199

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0.635001	1.427057	3.238490	4.621509	0.608729
0.640001	1.431708	3.129389	4.480370	0.585976
0.645001	1.436396	3.023906	4.343527	0.563915
0.650001	1.441123	2.921898	4.210815	0.542534
0.655001	1.445889	2.823230	4.082077	0.521803
0.660001	1.450694	2.727774	3.957163	0.501707
0.665001	1.455533	2.635404	3.835930	0.482226
0.670001	1.460421	2.546004	3.718239	0.463342
0.675001	1.465346	2.459461	3.603961	0.445038
0.680001	1.470311	2.375667	3.492969	0.427297
0.685001	1.475317	2.294520	3.385144	0.410103
0.690001	1.480364	2.215921	3.280370	0.393440
0.695001	1.485454	2.139775	3.178539	0.377294
0.700001	1.490587	2.065994	3.079543	0.361650
0.705001	1.495762	1.994491	2.983284	0.346494
0.710001	1.500981	1.925183	2.889663	0.331813
0.715001	1.506244	1.857992	2.798589	0.317593
0.720001	1.511551	1.792842	2.709972	0.303823
0.725001	1.516903	1.729660	2.623727	0.290490
0.730001	1.522301	1.668377	2.539773	0.277582
0.735001	1.527745	1.608927	2.458030	0.265088
0.740001	1.533236	1.551245	2.378424	0.252998
0.745001	1.538773	1.495270	2.300881	0.241301
0.750001	1.544358	1.440944	2.225334	0.229986
0.755001	1.549991	1.388210	2.151714	0.219044
0.760001	1.555673	1.337014	2.079957	0.208466
0.765001	1.561405	1.287304	2.010002	0.198242
0.770001	1.567186	1.239030	1.941790	0.188363
0.775001	1.573018	1.192143	1.875263	0.178821
0.780001	1.578901	1.146599	1.810366	0.169608
0.785001	1.584835	1.102352	1.747046	0.160715
0.790001	1.590822	1.059360	1.685253	0.152135
0.795001	1.596862	1.017582	1.624938	0.143860
0.800001	1.602955	0.976979	1.566053	0.135883
0.805001	1.609103	0.937512	1.508553	0.128197
0.810001	1.615305	0.899145	1.452393	0.120795
0.815001	1.621563	0.861843	1.397532	0.113671
0.820001	1.627878	0.825571	1.343930	0.106818
0.825001	1.634249	0.790299	1.291545	0.100230
0.830001	1.640679	0.755993	1.240342	0.093900
0.835001	1.647166	0.722625	1.190283	0.087824
0.840001	1.653713	0.690164	1.141332	0.081996
0.845001	1.660320	0.658582	1.093457	0.076409
0.850001	1.666987	0.627853	1.046623	0.071059
0.855001	1.673716	0.597951	1.000799	0.065941
0.860001	1.680507	0.568849	0.955955	0.061050
0.865001	1.687361	0.540525	0.912061	0.056380

0.870001	1.694279	0.512954	0.869088	0.051928
0.875001	1.701261	0.486114	0.827008	0.047638
0.880001	1.708310	0.459984	0.785794	0.043656
0.885001	1.715424	0.434541	0.745422	0.039828
0.890001	1.722606	0.409766	0.705865	0.036201
0.895001	1.729856	0.385638	0.667099	0.032769
0.900001	1.737176	0.362140	0.629101	0.029528
0.905001	1.744565	0.339253	0.591848	0.026476
0.910001	1.752025	0.316958	0.555319	0.023609
0.915001	1.759558	0.295239	0.519491	0.020922
0.920001	1.767163	0.274080	0.484344	0.018413
0.925001	1.774842	0.253464	0.449258	0.016077
0.930001	1.782596	0.233375	0.416014	0.013913
0.935001	1.790427	0.213800	0.382793	0.011916
0.940001	1.798334	0.194723	0.350177	0.010084
0.945001	1.806319	0.176130	0.318147	0.008413
0.950001	1.814384	0.158008	0.286688	0.006902
0.955001	1.822529	0.140344	0.255781	0.005546
0.960001	1.830756	0.123125	0.225412	0.004343
0.965001	1.839065	0.106339	0.195564	0.003291
0.970001	1.847458	0.089973	0.166222	0.002386
0.975001	1.855937	0.074017	0.137371	0.001628
0.980001	1.864501	0.058459	0.108997	0.001012
0.985001	1.873154	0.043288	0.081035	0.000537
0.990001	1.881895	0.028494	0.053623	0.000200
0.995001	1.890726	0.014067	0.026597	0.0

INITIAL MACH NUMBER IS  
0.400001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.400001	0.0	18.168454	0.0	3.211158
0.405001	1.270159	17.419950	22.126101	3.155842
0.410001	1.273676	16.708531	21.261251	3.028182
0.415001	1.277220	16.031965	20.476341	2.923804
0.420001	1.280791	15.388180	19.709035	2.823357
0.425001	1.284389	14.775246	18.977161	2.726656
0.430001	1.288015	14.191371	18.278694	2.633530
0.435001	1.291668	13.634884	17.611747	2.543817
0.440001	1.295350	13.104226	16.974561	2.457364

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0.445001	1.299060	12.597945	16.365490	2.374025
0.450001	1.302799	12.114684	15.783000	2.293667
0.455001	1.306567	11.653175	15.225653	2.216154
0.460001	1.310364	11.212233	14.692105	2.141370
0.465001	1.314190	10.790748	14.181097	2.069196
0.470001	1.318047	10.387682	13.691450	1.999523
0.475001	1.321933	10.002062	13.222056	1.932248
0.480001	1.325850	9.632975	12.771876	1.867271
0.485001	1.329797	9.279564	12.339937	1.804499
0.490001	1.333775	8.941025	11.925320	1.743843
0.495001	1.337785	8.616603	11.527163	1.685219
0.500001	1.341826	8.305588	11.144657	1.628546
0.505001	1.345899	8.007311	10.777036	1.573748
0.510001	1.350005	7.721144	10.423582	1.520752
0.515001	1.354143	7.446494	10.083616	1.469490
0.520001	1.358313	7.182804	9.756499	1.419895
0.525001	1.362517	6.929546	9.441626	1.371905
0.530001	1.366755	6.686224	9.138429	1.325460
0.535001	1.371026	6.452369	8.846368	1.280502
0.540001	1.375332	6.227540	8.564934	1.236978
0.545001	1.379672	6.011317	8.293646	1.194836
0.550001	1.384047	5.803305	8.032048	1.154026
0.555001	1.388458	5.603130	7.779709	1.114500
0.560001	1.392904	5.410439	7.536220	1.076214
0.565001	1.397386	5.224895	7.301194	1.039124
0.570001	1.401904	5.046181	7.074263	1.003189
0.575001	1.406460	4.873997	6.855080	0.968369
0.580001	1.411052	4.708057	6.643313	0.934626
0.585001	1.415682	4.548090	6.438650	0.901924
0.590001	1.420350	4.393840	6.240791	0.870228
0.595001	1.425056	4.245063	6.049454	0.839505
0.600001	1.429802	4.101527	5.864370	0.809723
0.605001	1.434586	3.963012	5.685281	0.780852
0.610001	1.439410	3.829308	5.511945	0.752861
0.615001	1.444274	3.700218	5.344128	0.725723
0.620001	1.449179	3.575550	5.181611	0.699411
0.625001	1.454124	3.455126	5.024183	0.673899
0.630001	1.459111	3.338774	4.871642	0.649161
0.635001	1.464140	3.226330	4.723798	0.625175
0.640001	1.469211	3.117639	4.580468	0.601916
0.645001	1.474325	3.012551	4.441479	0.579363
0.650001	1.479482	2.910927	4.306663	0.557494
0.655001	1.484683	2.812630	4.175862	0.536290
0.660001	1.489928	2.717531	4.048925	0.515729
0.665001	1.495218	2.625509	3.925707	0.495794
0.670001	1.500553	2.536444	3.806068	0.476466
0.675001	1.505934	2.450226	3.689878	0.457728

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0.680001	1.511361	2.366747	3.577009	0.439562
0.685001	1.516835	2.285904	3.467340	0.421952
0.690001	1.522356	2.207600	3.360754	0.404883
0.695001	1.527926	2.131741	3.257142	0.388340
0.700001	1.533544	2.058237	3.156396	0.372307
0.705001	1.539211	1.987002	3.058415	0.356771
0.710001	1.544927	1.917955	2.963100	0.341719
0.715001	1.550694	1.851016	2.870359	0.327136
0.720001	1.556512	1.786110	2.780102	0.313011
0.725001	1.562381	1.723165	2.692241	0.299331
0.730001	1.568303	1.662113	2.606696	0.286085
0.735001	1.574277	1.602886	2.523385	0.273261
0.740001	1.580304	1.545420	2.442234	0.260847
0.745001	1.586385	1.489656	2.363168	0.248835
0.750001	1.592522	1.435534	2.286118	0.237212
0.755001	1.598713	1.382998	2.211016	0.225970
0.760001	1.604960	1.331994	2.137797	0.215099
0.765001	1.611265	1.282470	2.066399	0.204589
0.770001	1.617626	1.234377	1.996761	0.194432
0.775001	1.624046	1.187667	1.928826	0.184619
0.780001	1.630525	1.142294	1.862539	0.175141
0.785001	1.637064	1.098213	1.797845	0.165991
0.790001	1.643663	1.055383	1.734693	0.157160
0.795001	1.650323	1.013761	1.673033	0.148642
0.800001	1.657045	0.973310	1.612819	0.140426
0.805001	1.663830	0.933991	1.554003	0.132511
0.810001	1.670679	0.895769	1.496541	0.124885
0.815001	1.677592	0.858606	1.440391	0.117543
0.820001	1.684570	0.822472	1.385511	0.110479
0.825001	1.691615	0.787331	1.331861	0.103686
0.830001	1.698726	0.753155	1.279404	0.097159
0.835001	1.705906	0.719911	1.228101	0.090890
0.840001	1.713154	0.687572	1.177917	0.084876
0.845001	1.720473	0.656109	1.128818	0.079109
0.850001	1.727862	0.625496	1.080770	0.073586
0.855001	1.735323	0.595706	1.033741	0.068300
0.860001	1.742856	0.566714	0.987700	0.063247
0.865001	1.750463	0.538496	0.942617	0.058421
0.870001	1.758145	0.511028	0.898462	0.053819
0.875001	1.765903	0.484289	0.855208	0.049435
0.880001	1.773738	0.458256	0.812827	0.045266
0.885001	1.781650	0.432909	0.771293	0.041306
0.890001	1.789642	0.408227	0.730580	0.037551
0.895001	1.797713	0.384190	0.690664	0.033999
0.900001	1.805866	0.360780	0.651521	0.030643
0.905001	1.814102	0.337979	0.613128	0.027482
0.910001	1.822421	0.315768	0.575462	0.024511

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0.915001	1.830825	0.294131	0.538502	0.021726
0.920001	1.839316	0.273051	0.502227	0.019125
0.925001	1.847893	0.252512	0.466615	0.016703
0.930001	1.856559	0.232499	0.431649	0.014456
0.935001	1.865316	0.212997	0.397307	0.012385
0.940001	1.874163	0.193992	0.363572	0.010483
0.945001	1.883104	0.175469	0.330426	0.008749
0.950001	1.892138	0.157415	0.297851	0.007178
0.955001	1.901269	0.139817	0.265830	0.005769
0.960001	1.910496	0.122663	0.234347	0.004519
0.965001	1.919821	0.105939	0.203385	0.003425
0.970001	1.929247	0.089635	0.172929	0.002484
0.975001	1.938774	0.073739	0.142963	0.001695
0.980001	1.948405	0.058239	0.113474	0.001054
0.985001	1.958140	0.043126	0.084446	0.000559
0.990001	1.967981	0.028387	0.055866	0.000209
0.995001	1.977931	0.014015	0.027720	0.0

INITIAL MACH NUMBER IS  
0.425001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.425001	0.0	14.716423	0.0	2.749181
0.430001	1.312531	14.134873	18.552456	2.702800
0.435001	1.316471	13.580601	17.878470	2.595701
0.440001	1.320443	13.052056	17.234491	2.507931
0.445001	1.324445	12.547790	16.618864	2.423309
0.450001	1.328480	12.066453	16.030041	2.341698
0.455001	1.332546	11.606782	15.466575	2.262967
0.460001	1.336645	11.167595	14.927112	2.186993
0.465001	1.340777	10.747788	14.410383	2.113659
0.470001	1.344941	10.346327	13.915200	2.042854
0.475001	1.349139	9.962242	13.440448	1.974473
0.480001	1.353370	9.594624	12.985079	1.908417
0.485001	1.357636	9.242620	12.548112	1.844592
0.490001	1.361936	8.905429	12.128622	1.782908
0.495001	1.366270	8.582299	11.725741	1.723279
0.500001	1.370640	8.272522	11.338651	1.665624

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0.505001	1.375045	7.975433	10.966582	1.609867
0.510001	1.379486	7.690405	10.608810	1.555935
0.515001	1.383964	7.416849	10.264650	1.503757
0.520001	1.388478	7.154208	9.933458	1.453267
0.525001	1.393029	6.901958	9.614626	1.404402
0.530001	1.397617	6.659605	9.307578	1.357101
0.535001	1.402243	6.426681	9.011772	1.311308
0.540001	1.406908	6.202747	8.726694	1.266966
0.545001	1.411611	5.987385	8.451858	1.224024
0.550001	1.416353	5.780201	8.186806	1.182431
0.555001	1.421135	5.580823	7.931103	1.142140
0.560001	1.425956	5.388899	7.684335	1.103106
0.565001	1.430818	5.204094	7.446113	1.065283
0.570001	1.435721	5.026092	7.216066	1.028631
0.575001	1.440665	4.854593	6.993843	0.993109
0.580001	1.445651	4.689313	6.779111	0.958680
0.585001	1.450679	4.529984	6.571552	0.925307
0.590001	1.455750	4.376348	6.370867	0.892953
0.595001	1.460864	4.228163	6.176769	0.861587
0.600001	1.466021	4.085198	5.988986	0.831175
0.605001	1.471223	3.947234	5.807260	0.801687
0.610001	1.476469	3.814063	5.631345	0.773093
0.615001	1.481760	3.685486	5.461007	0.745364
0.620001	1.487097	3.561315	5.296023	0.718474
0.625001	1.492481	3.441371	5.136180	0.692396
0.630001	1.497911	3.325482	4.981275	0.667104
0.635001	1.503388	3.213485	4.831116	0.642575
0.640001	1.508914	3.105227	4.685519	0.618786
0.645001	1.514487	3.000558	4.544307	0.595713
0.650001	1.520110	2.899338	4.407312	0.573335
0.655001	1.525782	2.801432	4.274375	0.551633
0.660001	1.531505	2.706712	4.145343	0.530585
0.665001	1.537278	2.615056	4.020068	0.510173
0.670001	1.543103	2.526346	3.898412	0.490379
0.675001	1.548979	2.440471	3.780240	0.471183
0.680001	1.554909	2.357325	3.665425	0.452571
0.685001	1.560892	2.276804	3.553844	0.434524
0.690001	1.566928	2.198811	3.445380	0.417027
0.695001	1.573020	2.123254	3.339920	0.400065
0.700001	1.579166	2.050043	3.237358	0.383623
0.705001	1.585369	1.979091	3.137590	0.367687
0.710001	1.591628	1.910319	3.040517	0.352243
0.715001	1.597945	1.843646	2.946045	0.337277
0.720001	1.604320	1.778999	2.854084	0.322778
0.725001	1.610754	1.716305	2.764545	0.308733
0.730001	1.617247	1.655496	2.677346	0.295129
0.735001	1.623801	1.596504	2.592405	0.281955

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0.740001	1.630416	1.539268	2.509647	0.269201
0.745001	1.637093	1.483725	2.428997	0.256855
0.750001	1.643833	1.429818	2.350383	0.244908
0.755001	1.650637	1.377492	2.273739	0.233348
0.760001	1.657505	1.326691	2.198997	0.222167
0.765001	1.664438	1.277364	2.126095	0.211355
0.770001	1.671438	1.229463	2.054971	0.200903
0.775001	1.678505	1.182939	1.985568	0.190803
0.780001	1.685639	1.137746	1.917830	0.181045
0.785001	1.692843	1.093841	1.851701	0.171622
0.790001	1.700117	1.051181	1.787130	0.162525
0.795001	1.707461	1.009725	1.724067	0.153748
0.800001	1.714877	0.969435	1.662462	0.145282
0.805001	1.722366	0.930273	1.602271	0.137121
0.810001	1.729928	0.892202	1.543446	0.129257
0.815001	1.737566	0.855188	1.485946	0.121684
0.820001	1.745279	0.819197	1.429728	0.114396
0.825001	1.753070	0.784197	1.374752	0.107385
0.830001	1.760938	0.750156	1.320978	0.100646
0.835001	1.768885	0.717045	1.268371	0.094173
0.840001	1.776913	0.684835	1.216892	0.087961
0.845001	1.785022	0.653497	1.166507	0.082003
0.850001	1.793214	0.623006	1.117182	0.076294
0.855001	1.801489	0.593334	1.068885	0.070829
0.860001	1.809850	0.564457	1.021583	0.065603
0.865001	1.818297	0.536352	0.975247	0.060612
0.870001	1.826831	0.508994	0.929846	0.055849
0.875001	1.835455	0.482361	0.885352	0.051312
0.880001	1.844168	0.456432	0.841737	0.046994
0.885001	1.852973	0.431186	0.798975	0.042893
0.890001	1.861871	0.406602	0.757040	0.039003
0.895001	1.870864	0.382661	0.715906	0.035321
0.900001	1.879952	0.359344	0.675549	0.031843
0.905001	1.889137	0.336633	0.635946	0.028565
0.910001	1.898422	0.314511	0.597074	0.025482
0.915001	1.907806	0.292960	0.558910	0.022593
0.920001	1.917293	0.271964	0.521434	0.019892
0.925001	1.926882	0.251507	0.484624	0.017377
0.930001	1.936577	0.231574	0.448460	0.015045
0.935001	1.946379	0.212149	0.412923	0.012892
0.940001	1.956289	0.193219	0.377993	0.010915
0.945001	1.966310	0.174770	0.343653	0.009111
0.950001	1.976442	0.156788	0.309883	0.007477
0.955001	1.986689	0.139261	0.276667	0.006011
0.960001	1.997051	0.122174	0.243988	0.004709
0.965001	2.007530	0.105518	0.211830	0.003570
0.970001	2.018129	0.089278	0.180175	0.002590
0.975001	2.028850	0.073445	0.149010	0.001768
0.980001	2.039694	0.058007	0.118318	0.001099
0.985001	2.050664	0.042954	0.088084	0.000584
0.990001	2.061762	0.028274	0.058295	0.000218
0.995001	2.072989	0.013959	0.028936	0.0

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INITIAL MACH NUMBER IS  
0.450001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PROF T FUNCTION	FRICTION FUNCTION
0.450001	0.0	12.015717	0.0	2.365000
0.455001	1.359872	11.557978	15.717372	2.325706
0.460001	1.364292	11.120638	15.171800	2.234931
0.465001	1.368748	10.702597	14.649163	2.160388
0.470001	1.373241	10.302824	14.148263	2.088404
0.475001	1.377771	9.920354	13.667976	2.018872
0.480001	1.382338	9.554281	13.207248	1.951692
0.485001	1.386943	9.203757	12.765088	1.886769
0.490001	1.391586	8.867984	12.340565	1.824012
0.495001	1.396268	8.546213	11.932803	1.763335
0.500001	1.400989	8.237738	11.540978	1.704658
0.505001	1.405749	7.941898	11.164315	1.647901
0.510001	1.410549	7.658069	10.802082	1.592991
0.515001	1.415390	7.385663	10.453591	1.539857
0.520001	1.420271	7.124126	10.118190	1.488433
0.525001	1.425194	6.872937	9.795266	1.438655
0.530001	1.430158	6.631603	9.484240	1.390461
0.535001	1.435165	6.399659	9.184564	1.343794
0.540001	1.440214	6.176666	8.895721	1.298598
0.545001	1.445307	5.962210	8.617220	1.254819
0.550001	1.450443	5.755897	8.348599	1.212409
0.555001	1.455623	5.557358	8.089419	1.171318
0.560001	1.460848	5.366240	7.839263	1.131500
0.565001	1.466119	5.182212	7.597738	1.092911
0.570001	1.471435	5.004958	7.364470	1.055509
0.575001	1.476797	4.834181	7.139106	1.019253
0.580001	1.482207	4.669596	6.921307	0.984105
0.585001	1.487664	4.510936	6.710756	0.950028
0.590001	1.493168	4.357946	6.507147	0.916986
0.595001	1.498722	4.210385	6.310194	0.884946
0.600001	1.504324	4.068021	6.119621	0.853874
0.605001	1.509976	3.930637	5.935168	0.823740
0.610001	1.515679	3.798026	5.756587	0.794513
0.615001	1.521432	3.669990	5.583640	0.766164
0.620001	1.527237	3.546341	5.416103	0.738667
0.625001	1.533094	3.426901	5.253762	0.711995
0.630001	1.539004	3.311499	5.096411	0.686121
0.635001	1.544968	3.199974	4.943856	0.661023
0.640001	1.550985	3.092170	4.795911	0.636675
0.645001	1.557058	2.987941	4.652398	0.613056

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0.650001	1.563186	2.887147	4.513147	0.590144
0.655001	1.569370	2.789653	4.377998	0.567918
0.660001	1.575611	2.695331	4.246795	0.546358
0.665001	1.581910	2.604060	4.119390	0.525444
0.670001	1.588268	2.515724	3.995642	0.505158
0.675001	1.594684	2.430210	3.875417	0.485482
0.680001	1.601160	2.347413	3.758584	0.466398
0.685001	1.607698	2.267230	3.645021	0.447890
0.690001	1.614296	2.189566	3.534608	0.429943
0.695001	1.620957	2.114326	3.427232	0.412539
0.700001	1.627681	2.041423	3.322785	0.395666
0.705001	1.634469	1.970770	3.221162	0.379307
0.710001	1.641322	1.902286	3.122264	0.363449
0.715001	1.648240	1.835894	3.025995	0.348080
0.720001	1.655225	1.771519	2.932263	0.333185
0.725001	1.662278	1.709089	2.840980	0.318753
0.730001	1.669398	1.648535	2.752061	0.304772
0.735001	1.676589	1.589791	2.665426	0.291229
0.740001	1.683849	1.532795	2.580996	0.278114
0.745001	1.691181	1.477487	2.498697	0.265415
0.750001	1.698585	1.423807	2.418456	0.253123
0.755001	1.706062	1.371700	2.340204	0.241227
0.760001	1.713613	1.321112	2.263875	0.229718
0.765001	1.721240	1.271994	2.189406	0.218586
0.770001	1.728942	1.224293	2.116733	0.207821
0.775001	1.736723	1.177965	2.045799	0.197415
0.780001	1.744582	1.132962	1.976545	0.187360
0.785001	1.752521	1.089242	1.908918	0.177647
0.790001	1.760540	1.046761	1.842864	0.168269
0.795001	1.768641	1.005480	1.778333	0.159216
0.800001	1.776826	0.965359	1.715275	0.150483
0.805001	1.785095	0.926362	1.653644	0.142061
0.810001	1.793450	0.888451	1.593392	0.133944
0.815001	1.801892	0.851592	1.534477	0.126125
0.820001	1.810422	0.815753	1.476856	0.118597
0.825001	1.819041	0.780900	1.420488	0.111354
0.830001	1.827751	0.747002	1.365334	0.104390
0.835001	1.836554	0.714030	1.311355	0.097699
0.840001	1.845450	0.681955	1.258515	0.091275
0.845001	1.854442	0.650749	1.206777	0.085112
0.850001	1.863530	0.620386	1.156108	0.079205
0.855001	1.872716	0.590839	1.106474	0.073549
0.860001	1.882002	0.562084	1.057843	0.068139

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SD 69-722

0.865001	1.891389	0.534096	1.010184	0.062969
0.870001	1.900879	0.506854	0.983467	0.058035
0.875001	1.910473	0.480333	0.917663	0.053333
0.880001	1.920173	0.454513	0.872743	0.048857
0.885001	1.929981	0.429373	0.828681	0.044604
0.890001	1.939898	0.404892	0.785449	0.040569
0.895001	1.949927	0.381052	0.743023	0.036748
0.900001	1.960069	0.357833	0.701377	0.033138
0.905001	1.970326	0.335218	0.660488	0.029733
0.910001	1.980699	0.313188	0.620332	0.026532
0.915001	1.991192	0.291728	0.580886	0.023529
0.920001	2.001805	0.270820	0.542129	0.020722
0.925001	2.012541	0.250449	0.504039	0.018106
0.930001	2.023401	0.230600	0.466596	0.015680
0.935001	2.034389	0.211257	0.429779	0.013439
0.940001	2.045506	0.192407	0.393570	0.011381
0.945001	2.056754	0.174035	0.357948	0.009503
0.950001	2.068136	0.156129	0.322896	0.007801
0.955001	2.079654	0.138675	0.288396	0.006273
0.960001	2.091310	0.121661	0.254430	0.004916
0.965001	2.103107	0.105074	0.220982	0.003728
0.970001	2.115048	0.088903	0.188034	0.002705
0.975001	2.127134	0.073137	0.155571	0.001847
0.980001	2.139368	0.057764	0.123578	0.001149
0.985001	2.151754	0.042773	0.092038	0.000610
0.990001	2.164294	0.028155	0.060937	0.000228
0.995001	2.176990	0.013900	0.030260	0.0

INITIAL MACH NUMBER IS  
0.475001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.475001	0.0	9.876453	0.0	2.042448
0.480001	1.412837	9.512001	13.438911	2.008851
0.485001	1.417805	9.163028	12.991389	1.931203
0.490001	1.422815	8.828741	12.561668	1.867328
0.495001	1.427868	8.508393	12.148866	1.805558
0.500001	1.432965	8.201284	11.752152	1.745812
0.505001	1.438105	7.906753	11.370744	1.688012
0.510001	1.443290	7.624180	11.003905	1.632091

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0.515001	1.448520	7.352979	10.650938	1.577950
0.520001	1.453796	7.092600	10.311190	1.525550
0.525001	1.459117	6.842522	9.984041	1.474817
0.530001	1.464485	6.602256	9.668905	1.425690
0.535001	1.469900	6.371339	9.365232	1.378109
0.540001	1.475363	6.149333	9.072499	1.332019
0.545001	1.480875	5.935825	8.790212	1.287367
0.550001	1.486435	5.730425	8.517904	1.244101
0.555001	1.492044	5.532765	8.255131	1.202172
0.560001	1.497704	5.342493	8.001474	1.161534
0.565001	1.503415	5.159279	7.756536	1.122143
0.570001	1.509177	4.982810	7.519940	1.083955
0.575001	1.514990	4.812788	7.291328	1.046930
0.580001	1.520857	4.648932	7.070360	1.011029
0.585001	1.526777	4.490974	6.856715	0.976215
0.590001	1.532750	4.338661	6.650085	0.942451
0.595001	1.538779	4.191752	6.450180	0.909703
0.600001	1.544863	4.050019	6.256722	0.877938
0.605001	1.551002	3.913243	6.069449	0.847125
0.610001	1.557199	3.781219	5.888109	0.817234
0.615001	1.563453	3.653749	5.712464	0.788235
0.620001	1.569765	3.530647	5.542287	0.760100
0.625001	1.576136	3.411736	5.377360	0.732803
0.630001	1.582567	3.296845	5.217478	0.706318
0.635001	1.589059	3.185813	5.062443	0.680621
0.640001	1.595611	3.078486	4.912068	0.655686
0.645001	1.602226	2.974719	4.766173	0.631493
0.650001	1.608904	2.874370	4.624587	0.608017
0.655001	1.615646	2.777308	4.487146	0.585240
0.660001	1.622452	2.683404	4.353695	0.563139
0.665001	1.629324	2.592537	4.224083	0.541697
0.670001	1.636263	2.504591	4.098168	0.520892
0.675001	1.643268	2.419455	3.975814	0.500709
0.680001	1.650342	2.337025	3.856890	0.481129
0.685001	1.657485	2.257197	3.741271	0.462135
0.690001	1.664693	2.179876	3.628836	0.443711
0.695001	1.671982	2.104970	3.519473	0.425841
0.700001	1.679339	2.032389	3.413069	0.408511
0.705001	1.686768	1.962049	3.309521	0.391706
0.710001	1.694272	1.893868	3.208728	0.375411
0.715001	1.701851	1.827770	3.110591	0.359614
0.720001	1.709506	1.763679	3.015020	0.344301
0.725001	1.717238	1.701525	2.921924	0.329460
0.730001	1.725049	1.641239	2.831218	0.315078
0.735001	1.732939	1.582756	2.742820	0.301144
0.740001	1.740910	1.526012	2.656650	0.287646
0.745001	1.748963	1.470948	2.572634	0.274574

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0.750001	1.757099	1.417506	2.490698	0.261916
0.755001	1.765320	1.365629	2.410773	0.249664
0.760001	1.773626	1.315266	2.332790	0.237805
0.765001	1.782019	1.266365	2.256685	0.226333
0.770001	1.790500	1.218876	2.182397	0.215236
0.775001	1.799070	1.172752	2.109864	0.204506
0.780001	1.807732	1.127948	2.039028	0.194134
0.785001	1.816486	1.084421	1.969836	0.184113
0.790001	1.825333	1.042129	1.902232	0.174433
0.795001	1.834276	1.001030	1.836165	0.165088
0.800001	1.843315	0.961087	1.771586	0.156069
0.805001	1.852452	0.922262	1.708446	0.147370
0.810001	1.861688	0.884519	1.646699	0.138982
0.815001	1.871026	0.847824	1.586301	0.130900
0.820001	1.880467	0.812143	1.527208	0.123117
0.825001	1.890012	0.777444	1.469378	0.115626
0.830001	1.899663	0.743696	1.412773	0.108421
0.835001	1.909422	0.710870	1.357352	0.101496
0.840001	1.919291	0.678937	1.303073	0.094846
0.845001	1.929271	0.647870	1.249916	0.088464
0.850001	1.939364	0.617641	1.197830	0.082345
0.855001	1.949572	0.588224	1.146786	0.076484
0.860001	1.959897	0.559597	1.096752	0.070875
0.865001	1.970341	0.531733	1.047695	0.065515
0.870001	1.980906	0.504611	0.999586	0.060397
0.875001	1.991594	0.478207	0.952394	0.055517
0.880001	2.002406	0.452501	0.906092	0.050871
0.885001	2.013346	0.427472	0.860650	0.046455
0.890001	2.024415	0.403100	0.816042	0.042264
0.895001	2.035616	0.379365	0.772242	0.038293
0.900001	2.046950	0.356250	0.729225	0.034540
0.905001	2.058421	0.333734	0.686966	0.031000
0.910001	2.070031	0.311802	0.645440	0.027669
0.915001	2.081781	0.290437	0.604626	0.024544
0.920001	2.093675	0.269622	0.564500	0.021622
0.925001	2.105715	0.249341	0.525041	0.018898
0.930001	2.117904	0.229579	0.486227	0.016370
0.935001	2.130244	0.210322	0.448038	0.014035
0.940001	2.142739	0.191556	0.410454	0.011889
0.945001	2.155390	0.173265	0.373454	0.009929
0.950001	2.168202	0.155438	0.337021	0.008153
0.955001	2.181176	0.138061	0.301136	0.006558
0.960001	2.194317	0.121122	0.265781	0.005141
0.965001	2.207626	0.104609	0.230938	0.003899
0.970001	2.221108	0.088510	0.196589	0.002831
0.975001	2.234766	0.072813	0.162720	0.001933
0.980001	2.248603	0.057508	0.129313	0.001203
0.985001	2.262622	0.042584	0.096352	0.000639
0.990001	2.276827	0.028031	0.063821	0.000239
0.995001	2.291222	0.013839	0.031707	0.0

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INITIAL MACH NUMBER IS  
0.500001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.500001	0.0	8.163206	0.0	1.769319
0.505001	1.472217	7.870043	11.586415	1.740353
0.510001	1.477815	7.588782	11.214818	1.673385
0.515001	1.483463	7.318840	10.857232	1.618210
0.520001	1.489162	7.059670	10.512994	1.564790
0.525001	1.494913	6.810753	10.181480	1.513060
0.530001	1.500715	6.571603	9.862102	1.462956
0.535001	1.506570	6.341757	9.554300	1.414419
0.540001	1.512478	6.120782	9.257550	1.367394
0.545001	1.518441	5.908266	8.971352	1.321927
0.550001	1.524458	5.703820	8.695234	1.277664
0.555001	1.530531	5.507077	8.428750	1.234858
0.560001	1.536660	5.317688	8.171476	1.193362
0.565001	1.542845	5.135325	7.923012	1.153129
0.570001	1.549089	4.959675	7.682977	1.114118
0.575001	1.555390	4.790443	7.451009	1.076286
0.580001	1.561751	4.627347	7.226767	1.039595
0.585001	1.568172	4.470123	7.009923	1.004006
0.590001	1.574654	4.318517	6.800171	0.969484
0.595001	1.581197	4.172291	6.597214	0.935993
0.600001	1.587803	4.031215	6.400774	0.903501
0.605001	1.594471	3.895074	6.210585	0.871975
0.610001	1.601204	3.763663	6.026393	0.841385
0.615001	1.608002	3.636785	5.847957	0.811702
0.620001	1.614865	3.514255	5.675049	0.782897
0.625001	1.621796	3.395896	5.507448	0.754943
0.630001	1.628793	3.281538	5.344947	0.727814
0.635001	1.635860	3.171021	5.187346	0.701485
0.640001	1.642996	3.064193	5.034456	0.675932
0.645001	1.650202	2.960908	4.886095	0.651133
0.650001	1.657480	2.861025	4.742091	0.627064
0.655001	1.664830	2.764413	4.602277	0.603705
0.660001	1.672254	2.670945	4.466497	0.581035
0.665001	1.679752	2.580500	4.334599	0.559034
0.670001	1.687326	2.492962	4.206439	0.537683
0.675001	1.694976	2.408222	4.081879	0.516963
0.680001	1.702704	2.326174	3.960787	0.496858
0.685001	1.710511	2.246717	3.843036	0.477350
0.690001	1.718399	2.169756	3.728505	0.458423
0.695001	1.726367	2.095197	3.617079	0.440060
0.700001	1.734413	2.022953	3.508645	0.422247

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SD 69-722

0.705001	1.742553	1.952939	3.403099	0.404969
0.710001	1.750772	1.885075	3.300337	0.388211
0.715001	1.759077	1.819284	3.200261	0.371961
0.720001	1.767470	1.755491	3.102778	0.356204
0.725001	1.775952	1.693625	3.007798	0.340929
0.730001	1.784524	1.633619	2.915233	0.326122
0.735001	1.793188	1.575407	2.825001	0.311773
0.740001	1.801944	1.518927	2.737022	0.297869
0.745001	1.810795	1.464119	2.651218	0.284399
0.750001	1.819741	1.410924	2.567517	0.271353
0.755001	1.828785	1.359289	2.485847	0.258720
0.760001	1.837927	1.309160	2.406140	0.246491
0.765001	1.847170	1.260485	2.328330	0.234656
0.770001	1.856515	1.213217	2.252355	0.223205
0.775001	1.865964	1.167307	2.178153	0.212129
0.780001	1.875518	1.122712	2.105665	0.201421
0.785001	1.885179	1.079387	2.034836	0.191070
0.790001	1.894948	1.037290	1.965611	0.181070
0.795001	1.904828	0.996383	1.897938	0.171411
0.800001	1.914821	0.956625	1.831765	0.162088
0.805001	1.924927	0.917980	1.767045	0.153091
0.810001	1.935150	0.880412	1.703730	0.144415
0.815001	1.945490	0.843887	1.641775	0.136052
0.820001	1.955951	0.808372	1.581136	0.127995
0.825001	1.966533	0.773834	1.521771	0.120238
0.830001	1.977240	0.740243	1.463639	0.112775
0.835001	1.988073	0.707570	1.406700	0.105600
0.840001	1.999034	0.675785	1.350917	0.098706
0.845001	2.010126	0.644862	1.296253	0.092089
0.850001	2.021351	0.614773	1.242672	0.085742
0.855001	2.032711	0.585493	1.190139	0.079660
0.860001	2.044208	0.556998	1.138621	0.073339
0.865001	2.055846	0.529264	1.088086	0.068273
0.870001	2.067626	0.502268	1.038502	0.062956
0.875001	2.079551	0.475987	0.989839	0.057886
0.880001	2.091624	0.450401	0.942069	0.053057
0.885001	2.103848	0.425488	0.895161	0.048464
0.890001	2.116224	0.401229	0.849090	0.044104
0.895001	2.128757	0.377604	0.803827	0.039972
0.900001	2.141448	0.354596	0.759348	0.036064
0.905001	2.154302	0.332185	0.715626	0.032377
0.910001	2.167320	0.310355	0.672638	0.028907
0.915001	2.180506	0.289089	0.630359	0.025649
0.920001	2.193864	0.268370	0.588767	0.022602
0.925001	2.207396	0.248183	0.547839	0.019761
0.930001	2.221106	0.228513	0.507553	0.017122
0.935001	2.234997	0.209346	0.467887	0.014684

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0.940001	2.249073	0.190666	0.428822	0.012443
0.945001	2.263338	0.172461	0.390337	0.010395
0.950001	2.277795	0.154717	0.352412	0.008538
0.955001	2.292447	0.137420	0.315029	0.006870
0.960001	2.307300	0.120560	0.278168	0.005387
0.965001	2.322357	0.104123	0.241811	0.004087
0.970001	2.337623	0.088099	0.205941	0.002963
0.975001	2.353100	0.072475	0.170541	0.002027
0.980001	2.368795	0.057241	0.135592	0.001262
0.985001	2.384711	0.042386	0.101079	0.000671
0.990001	2.400853	0.027901	0.066986	0.000251
0.995001	2.417226	0.013774	0.033296	0.0

INITIAL MACH NUMBER IS  
0.525001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.525001	0.0	6.777672	0.0	1.536261
0.530001	1.538974	6.539683	10.064399	1.511100
0.535001	1.545303	6.310954	9.752335	1.452911
0.540001	1.551692	6.091052	9.451436	1.404906
0.545001	1.558142	5.879568	9.161199	1.358379
0.550001	1.564653	5.676115	8.881148	1.313277
0.555001	1.571226	5.480327	8.610831	1.269551
0.560001	1.577862	5.291859	8.349822	1.227153
0.565001	1.584562	5.110382	8.097716	1.186038
0.570001	1.591327	4.935585	7.854128	1.146162

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SD 69-722



0.575001	1.598157	4.767174	7.618694	1.107484
0.580001	1.605054	4.604871	7.391067	1.069962
0.585001	1.612019	4.448411	7.170920	1.033561
0.590001	1.619051	4.297541	6.957940	0.998241
0.595001	1.626154	4.152025	6.751830	0.963970
0.600001	1.633326	4.011634	6.552307	0.930712
0.605001	1.640570	3.876155	6.359104	0.898436
0.610001	1.647886	3.745382	6.171963	0.867111
0.615001	1.655276	3.619120	5.990643	0.836707
0.620001	1.662740	3.497185	5.814910	0.807196
0.625001	1.670280	3.379401	5.644544	0.778549
0.630001	1.677896	3.265599	5.479334	0.750742
0.635001	1.685590	3.155619	5.319078	0.723748
0.640001	1.693362	3.049310	5.163586	0.697543
0.645001	1.701215	2.946526	5.012673	0.672104
0.650001	1.709149	2.847128	4.866166	0.647409
0.655001	1.717165	2.750986	4.723896	0.623436
0.660001	1.725265	2.657971	4.585704	0.600163
0.665001	1.733449	2.567966	4.451439	0.577572
0.670001	1.741720	2.480853	4.320953	0.555643
0.675001	1.750078	2.396525	4.194107	0.534357
0.680001	1.758525	2.314875	4.070767	0.513696
0.685001	1.767063	2.235804	3.950807	0.493643
0.690001	1.775691	2.159217	3.834102	0.474182
0.695001	1.784413	2.085020	3.720536	0.455297
0.700001	1.793229	2.013127	3.609997	0.436972
0.705001	1.802141	1.943453	3.502376	0.419192
0.710001	1.811150	1.875919	3.397570	0.401944
0.715001	1.820258	1.810447	3.295481	0.385212
0.720001	1.829466	1.746964	3.196012	0.368985
0.725001	1.838777	1.685399	3.099073	0.353248
0.730001	1.848191	1.625684	3.004575	0.337990
0.735001	1.857711	1.567755	2.912436	0.323198
0.740001	1.867337	1.511549	2.822573	0.308862
0.745001	1.877073	1.457007	2.734909	0.294969
0.750001	1.886919	1.404071	2.649369	0.281509
0.755001	1.896878	1.352687	2.565881	0.268472
0.760001	1.906951	1.302801	2.484376	0.255847
0.765001	1.917140	1.254362	2.404788	0.243625
0.770001	1.927447	1.207324	2.327052	0.231796
0.775001	1.937875	1.161637	2.251107	0.220351
0.780001	1.948424	1.117258	2.176893	0.209282
0.785001	1.959099	1.074144	2.104353	0.198580

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SD 69-722

0.790001	1.969899	1.032252	2.033432	0.188236
0.795001	1.980823	0.991543	1.964076	0.178243
0.800001	1.991889	0.951978	1.896235	0.168593
0.805001	2.003082	0.913521	1.829858	0.159278
0.810001	2.014410	0.876136	1.764898	0.150292
0.815001	2.025877	0.839789	1.701308	0.141627
0.820001	2.037484	0.804446	1.639045	0.133276
0.825001	2.049235	0.770076	1.578065	0.125234
0.830001	2.061130	0.736648	1.518327	0.117494
0.835001	2.073174	0.704133	1.459790	0.110049
0.840001	2.085369	0.672503	1.402416	0.102894
0.845001	2.097717	0.641729	1.346167	0.096023
0.850001	2.110222	0.611787	1.291006	0.089430
0.855001	2.122886	0.582650	1.236898	0.083111
0.860001	2.135712	0.554293	1.183810	0.077060
0.865001	2.148705	0.526693	1.131709	0.071271
0.870001	2.161865	0.499828	1.080561	0.065741
0.875001	2.175198	0.473675	1.030337	0.060464
0.880001	2.188706	0.448213	0.981006	0.055436
0.885001	2.202392	0.423421	0.932539	0.050653
0.890001	2.216260	0.399280	0.884908	0.046109
0.895001	2.230314	0.375770	0.838085	0.041802
0.900001	2.244558	0.352873	0.792044	0.037727
0.905001	2.258994	0.330571	0.746759	0.033881
0.910001	2.273628	0.308847	0.702204	0.030259
0.915001	2.288462	0.287684	0.658355	0.026857
0.920001	2.303501	0.267066	0.615188	0.023674
0.925001	2.318750	0.246978	0.572680	0.020704
0.930001	2.334212	0.227404	0.530808	0.017946
0.935001	2.349892	0.208329	0.489551	0.015395
0.940001	2.365795	0.189740	0.448886	0.013050
0.945001	2.381925	0.171623	0.408794	0.010906
0.950001	2.398287	0.153965	0.369252	0.008961
0.955001	2.414886	0.136753	0.330243	0.007212
0.960001	2.431728	0.119974	0.291745	0.005657
0.965001	2.448816	0.103618	0.253740	0.004294
0.970001	2.466158	0.087671	0.216210	0.003119
0.975001	2.483758	0.072123	0.179136	0.002131
0.980001	2.501622	0.056963	0.142500	0.001327
0.985001	2.519756	0.042180	0.106284	0.000705
0.990001	2.538166	0.027765	0.070473	0.000264
0.995001	2.556859	0.013707	0.035048	0.0

INITIAL MACH NUMBER IS  
0.550001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.550001	0.0	5.647346	0.0	1.336013
0.555001	1.614287	5.452551	8.801980	1.314008
0.560001	1.621473	5.265038	8.537114	1.263104
0.565001	1.628730	5.084480	8.281247	1.221062
0.570001	1.636061	4.910569	8.033990	1.180278
0.575001	1.643465	4.743013	7.794976	1.140709
0.580001	1.650944	4.581532	7.563855	1.102315
0.585001	1.658500	4.425864	7.340295	1.065058
0.590001	1.666132	4.275760	7.123981	1.028900
0.595001	1.673843	4.130981	6.914613	0.993807
0.600001	1.681633	3.991302	6.711905	0.959743
0.605001	1.689504	3.856509	6.515587	0.926677
0.610001	1.697456	3.726399	6.325400	0.894577
0.615001	1.705492	3.600777	6.141097	0.863413
0.620001	1.713612	3.479460	5.962445	0.833157
0.625001	1.721817	3.362273	5.789219	0.803780
0.630001	1.730110	3.249047	5.621208	0.775256
0.635001	1.738490	3.139625	5.458207	0.747559
0.640001	1.746960	3.033855	5.300023	0.720666
0.645001	1.755521	2.931592	5.146471	0.694552
0.650001	1.764174	2.832698	4.997373	0.669194
0.655001	1.772921	2.737043	4.852561	0.644571
0.660001	1.781764	2.644500	4.711874	0.620661
0.665001	1.790703	2.554950	4.575157	0.597446
0.670001	1.799740	2.468280	4.442262	0.574904
0.675001	1.808877	2.384378	4.313048	0.553017
0.680001	1.818116	2.303143	4.187381	0.531767
0.685001	1.827458	2.224473	4.065130	0.511137
0.690001	1.836904	2.148273	3.946172	0.491110
0.695001	1.846457	2.074452	3.830388	0.471670
0.700001	1.856119	2.002923	3.717664	0.452802
0.705001	1.865890	1.933603	3.607891	0.434489
0.710001	1.875773	1.866411	3.500964	0.416718
0.715001	1.885770	1.801271	3.396783	0.399475
0.720001	1.895882	1.738110	3.295252	0.382746
0.725001	1.906112	1.676857	3.196277	0.366518
0.730001	1.916462	1.617445	3.099771	0.350779
0.735001	1.926933	1.559809	3.005648	0.335516

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0.740001	1.937527	1.503888	2.913825	0.320719
0.745001	1.948248	1.449623	2.824224	0.306374
0.750001	1.959097	1.396955	2.736770	0.292473
0.755001	1.970075	1.345831	2.651388	0.279003
0.760001	1.981187	1.296198	2.568009	0.265956
0.765001	1.992433	1.248005	2.486566	0.253320
0.770001	2.003816	1.201204	2.406993	0.241087
0.775001	2.015340	1.155750	2.329228	0.229247
0.780001	2.027005	1.111596	2.253210	0.217792
0.785001	2.038815	1.068700	2.178881	0.206712
0.790001	2.050773	1.027020	2.106185	0.196000
0.795001	2.062881	0.986517	2.035068	0.185648
0.800001	2.075142	0.947153	1.965478	0.175647
0.805001	2.087559	0.908891	1.897364	0.165991
0.810001	2.100134	0.871695	1.830677	0.156671
0.815001	2.112871	0.835532	1.765372	0.147681
0.820001	2.125773	0.800368	1.701401	0.139015
0.825001	2.138843	0.766173	1.638723	0.130665
0.830001	2.152084	0.732914	1.577293	0.122626
0.835001	2.165499	0.700564	1.517071	0.114890
0.840001	2.179092	0.669094	1.458018	0.107453
0.845001	2.192867	0.638477	1.400095	0.100308
0.850001	2.206826	0.608686	1.343264	0.093450
0.855001	2.220974	0.579696	1.287491	0.086874
0.860001	2.235315	0.551484	1.232739	0.080574
0.865001	2.249851	0.524024	1.178976	0.074545
0.870001	2.264588	0.497295	1.126168	0.068782
0.875001	2.279529	0.471274	1.074284	0.063282
0.880001	2.294679	0.445941	1.023292	0.058038
0.885001	2.310042	0.421275	0.973163	0.053047
0.890001	2.325621	0.397256	0.923867	0.048305
0.895001	2.341423	0.373865	0.875377	0.043807
0.900001	2.357451	0.351085	0.827665	0.039550
0.905001	2.373710	0.328896	0.780703	0.035529
0.910001	2.390206	0.307282	0.734467	0.031742
0.915001	2.406943	0.286226	0.688930	0.028184
0.920001	2.423926	0.265713	0.644066	0.024851
0.925001	2.441162	0.245726	0.599857	0.021742
0.930001	2.458656	0.226251	0.556273	0.018852
0.935001	2.476412	0.207273	0.513294	0.016178
0.940001	2.494439	0.188778	0.470896	0.013718
0.945001	2.512740	0.170753	0.429053	0.011468
0.950001	2.531323	0.153185	0.387760	0.009426
0.955001	2.550194	0.136060	0.346979	0.007590
0.960001	2.569360	0.119366	0.306695	0.005956
0.965001	2.588828	0.103092	0.266883	0.004522
0.970001	2.608605	0.087226	0.227539	0.003286
0.975001	2.628697	0.071757	0.188628	0.002246
0.980001	2.649114	0.056674	0.150136	0.001399
0.985001	2.669861	0.041967	0.112045	0.000744
0.990001	2.690948	0.027624	0.074336	0.000278
0.995001	2.712383	0.013638	0.036991	0.0

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SD 69-722

INITIAL MACH NUMBER IS  
0.575001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.575001	0.0	4.717988	0.0	1.162872
0.580001	1.699620	4.557359	7.745779	1.143508
0.585001	1.707819	4.402513	7.518696	1.098703
0.590001	1.716105	4.253200	7.298939	1.061662
0.595001	1.724480	4.109185	7.086207	1.025702
0.600001	1.732944	3.970243	6.880210	0.990788
0.605001	1.741500	3.836162	6.680674	0.956889
0.610001	1.750148	3.706738	6.487339	0.923971
0.615001	1.758890	3.581779	6.299956	0.892006
0.620001	1.767728	3.461102	6.118287	0.860962
0.625001	1.776663	3.344533	5.942108	0.830814
0.630001	1.785696	3.231905	5.771201	0.801533
0.635001	1.794830	3.123060	5.605363	0.773093
0.640001	1.804066	3.017848	5.444396	0.745471
0.645001	1.813405	2.916124	5.288114	0.718642
0.650001	1.822849	2.817752	5.136338	0.692582
0.655001	1.832401	2.722602	4.988897	0.667271
0.660001	1.842061	2.630547	4.845627	0.642667
0.665001	1.851831	2.541470	4.706373	0.618808
0.670001	1.861714	2.455257	4.570985	0.595616
0.675001	1.871711	2.371798	4.439320	0.573092
0.680001	1.881824	2.290991	4.311242	0.551217
0.685001	1.892055	2.212736	4.186619	0.529974
0.690001	1.902407	2.136938	4.065326	0.509346
0.695001	1.912881	2.063507	3.947243	0.489316
0.700001	1.923479	1.992356	3.832254	0.469868
0.705001	1.934203	1.923401	3.720249	0.450988
0.710001	1.945057	1.856564	3.611122	0.432661
0.715001	1.956041	1.791767	3.504771	0.414872
0.720001	1.967159	1.728939	3.401098	0.397609
0.725001	1.978412	1.668010	3.300010	0.380857
0.730001	1.989803	1.608911	3.201416	0.364604
0.735001	2.001335	1.551580	3.105231	0.348839
0.740001	2.013010	1.495954	3.011370	0.333548
0.745001	2.024831	1.441974	2.919754	0.318721
0.750001	2.036801	1.389584	2.830306	0.304347
0.755001	2.048921	1.338730	2.742952	0.290415
0.760001	2.061196	1.289359	2.657621	0.276914
0.765001	2.073627	1.241420	2.574243	0.263836
0.770001	2.086219	1.194867	2.492753	0.251169

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0.775001	2.098973	1.149652	2.413088	0.238905
0.780001	2.111893	1.105731	2.335185	0.227035
0.785001	2.124983	1.063061	2.258986	0.215550
0.790001	2.138244	1.021601	2.184433	0.204442
0.795001	2.151682	0.981312	2.111472	0.193703
0.800001	2.165299	0.942156	2.040050	0.183325
0.805001	2.179099	0.904096	1.970114	0.173300
0.810001	2.193085	0.867096	1.901616	0.163622
0.815001	2.207262	0.831124	1.834508	0.154282
0.820001	2.221632	0.796146	1.768742	0.145274
0.825001	2.236200	0.762130	1.704276	0.136592
0.830001	2.250971	0.729047	1.641064	0.128230
0.835001	2.265947	0.696868	1.579066	0.120180
0.840001	2.281134	0.665564	1.518241	0.112437
0.845001	2.296536	0.635108	1.458549	0.104995
0.850001	2.312156	0.605475	1.399952	0.097850
0.855001	2.328001	0.576638	1.342414	0.090994
0.860001	2.344075	0.548574	1.285898	0.084424
0.865001	2.360382	0.521259	1.230371	0.078134
0.870001	2.376928	0.494671	1.175798	0.072119
0.875001	2.393718	0.468788	1.122146	0.066374
0.880001	2.410757	0.443588	1.069384	0.060896
0.885001	2.428051	0.419052	1.017480	0.055679
0.890001	2.445605	0.395160	0.966406	0.050719
0.895001	2.463426	0.371893	0.916131	0.046013
0.900001	2.481518	0.349232	0.866626	0.041557
0.905001	2.499890	0.327161	0.817865	0.037346
0.910001	2.518546	0.305661	0.769820	0.033377
0.915001	2.537493	0.284716	0.722465	0.029647
0.920001	2.556739	0.264311	0.675774	0.026151
0.925001	2.576291	0.244430	0.629722	0.022888
0.930001	2.596154	0.225057	0.584283	0.019853
0.935001	2.616338	0.206180	0.539435	0.017044
0.940001	2.636850	0.187782	0.495154	0.014458
0.945001	2.657697	0.169852	0.451416	0.012092
0.950001	2.678888	0.152376	0.408199	0.009943
0.955001	2.700432	0.135342	0.365482	0.008009
0.960001	2.722336	0.118737	0.323241	0.006287
0.965001	2.744611	0.102548	0.281456	0.004776
0.970001	2.767266	0.086766	0.240105	0.003472
0.975001	2.790310	0.071379	0.199169	0.002374
0.980001	2.813753	0.056375	0.158626	0.001480
0.985001	2.837606	0.041745	0.118457	0.000787
0.990001	2.861880	0.027479	0.078641	0.000294
0.995001	2.886585	0.013566	0.039159	0.0

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SD 69-722

INITIAL MACH NUMBER IS  
0.600001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.600001	0.0	3.948485	0.0	1.012310
0.605001	1.796809	3.815138	6.855075	0.995173
0.610001	1.806220	3.686423	6.658491	0.955512
0.615001	1.815737	3.562150	6.467927	0.922699
0.620001	1.825363	3.442134	6.283143	0.890823
0.625001	1.835099	3.326204	6.103912	0.859858
0.630001	1.844947	3.214193	5.930016	0.829776
0.635001	1.854909	3.105945	5.761246	0.800550
0.640001	1.864988	3.001309	5.597404	0.772155
0.645001	1.875184	2.900143	5.438302	0.744568
0.650001	1.885501	2.802310	5.283757	0.717764
0.655001	1.895939	2.707681	5.133598	0.691723
0.660001	1.906502	2.616131	4.987659	0.666421
0.665001	1.917192	2.527542	4.845782	0.641840
0.670001	1.928010	2.441801	4.707815	0.617957
0.675001	1.938958	2.358800	4.573615	0.594755
0.680001	1.950041	2.278435	4.443042	0.572215
0.685001	1.961258	2.200609	4.315963	0.550319
0.690001	1.972614	2.125227	4.192253	0.529050
0.695001	1.984111	2.052198	4.071789	0.508391
0.700001	1.995751	1.981437	3.954454	0.488327
0.705001	2.007536	1.912860	3.840135	0.468842
0.710001	2.019470	1.846389	3.728727	0.449921
0.715001	2.031555	1.781948	3.620125	0.431550
0.720001	2.043794	1.719464	3.514231	0.413715
0.725001	2.056191	1.658868	3.410949	0.396403
0.730001	2.068747	1.600094	3.310189	0.379601
0.735001	2.081466	1.543076	3.211861	0.363297
0.740001	2.094352	1.487755	3.115893	0.347479
0.745001	2.107406	1.434072	3.022171	0.332135
0.750001	2.120634	1.381969	2.930650	0.317253
0.755001	2.134037	1.331393	2.841242	0.302825
0.760001	2.147620	1.282292	2.753877	0.288838
0.765001	2.161386	1.234617	2.668483	0.275283
0.770001	2.175338	1.188318	2.584995	0.262150
0.775001	2.189481	1.143351	2.503346	0.249430
0.780001	2.203819	1.099671	2.423475	0.237113
0.785001	2.218355	1.057235	2.345322	0.225192
0.790001	2.233092	1.016003	2.268828	0.213657
0.795001	2.248037	0.975934	2.193937	0.202501
0.800001	2.263192	0.936993	2.120595	0.191715
0.805001	2.278563	0.899141	2.048749	0.181293

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0.810001	2.294153	0.862344	1.978350	0.171225
0.815001	2.309968	0.826569	1.909348	0.161507
0.820001	2.326012	0.791782	1.841695	0.152130
0.825001	2.342290	0.757953	1.775347	0.143088
0.830001	2.358808	0.725052	1.710258	0.134374
0.835001	2.375570	0.693049	1.646386	0.125983
0.840001	2.392582	0.661916	1.583689	0.117908
0.845001	2.409850	0.631628	1.522128	0.110144
0.850001	2.427379	0.602156	1.461661	0.102685
0.855001	2.445175	0.573478	1.402253	0.095526
0.860001	2.463244	0.545567	1.343866	0.088661
0.865001	2.481592	0.518402	1.286463	0.082086
0.870001	2.500227	0.491960	1.230012	0.075795
0.875001	2.519153	0.466219	1.174476	0.069784
0.880001	2.538380	0.441157	1.119825	0.064049
0.885001	2.557913	0.416756	1.066025	0.058584
0.890001	2.577759	0.392995	1.013045	0.053387
0.895001	2.597927	0.369855	0.960856	0.048453
0.900001	2.618424	0.347318	0.909427	0.043777
0.905001	2.639259	0.325368	0.858729	0.039357
0.910001	2.660438	0.303986	0.808735	0.035189
0.915001	2.681972	0.283156	0.759416	0.031269
0.920001	2.703869	0.262862	0.710745	0.027594
0.925001	2.726138	0.243090	0.662697	0.024160
0.930001	2.748788	0.223824	0.615244	0.020966
0.935001	2.771830	0.205050	0.568362	0.018007
0.940001	2.795273	0.186753	0.522026	0.015281
0.945001	2.819128	0.168922	0.476211	0.012786
0.950001	2.843406	0.151541	0.430894	0.010518
0.955001	2.868118	0.134600	0.386049	0.008476
0.960001	2.893276	0.118086	0.341655	0.006657
0.965001	2.918891	0.101986	0.297687	0.005059
0.970001	2.944977	0.086291	0.254124	0.003679
0.975001	2.971547	0.070988	0.210943	0.002517
0.980001	2.998613	0.056066	0.168121	0.001569
0.985001	3.026190	0.041516	0.125637	0.000835
0.990001	3.054292	0.027328	0.083468	0.000313
0.995001	3.082935	0.013492	0.041594	0.0

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INITIAL MACH NUMBER IS  
0.625001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.625001	0.0	3.307307	0.0	0.880695
0.630001	1.908186	3.195932	6.098435	0.865449
0.635001	1.919063	3.088299	5.926640	0.830161
0.640001	1.930071	2.984258	5.759831	0.800947
0.645001	1.941215	2.883666	5.597816	0.772555
0.650001	1.952496	2.786390	5.440414	0.744961
0.655001	1.963916	2.692298	5.287448	0.718144
0.660001	1.975479	2.601268	5.138751	0.692080
0.665001	1.987187	2.513182	4.994163	0.666749
0.670001	1.999042	2.427929	4.853532	0.642132
0.675001	2.011048	2.345399	4.716711	0.618208
0.680001	2.023207	2.265491	4.583559	0.594959
0.685001	2.035523	2.188107	4.453942	0.572366
0.690001	2.047997	2.113153	4.327731	0.550414
0.695001	2.060633	2.040539	4.204803	0.529084
0.700001	2.073435	1.970180	4.085040	0.508360
0.705001	2.086405	1.901993	3.968327	0.488228
0.710001	2.099547	1.835899	3.854557	0.468672
0.715001	2.112864	1.771824	3.743623	0.449678
0.720001	2.126359	1.709696	3.635427	0.431231
0.725001	2.140037	1.649444	3.529871	0.413319
0.730001	2.153900	1.591003	3.426862	0.395929
0.735001	2.167953	1.534310	3.326312	0.379047
0.740001	2.182199	1.479303	3.228134	0.362661
0.745001	2.196643	1.425924	3.132246	0.346761
0.750001	2.211288	1.374118	3.038570	0.331335
0.755001	2.226138	1.323829	2.947027	0.316372
0.760001	2.241198	1.275008	2.857545	0.301862
0.765001	2.256473	1.227603	2.770052	0.287794
0.770001	2.271966	1.181567	2.684481	0.274158
0.775001	2.287683	1.136856	2.600765	0.260946
0.780001	2.303628	1.093423	2.518841	0.248147
0.785001	2.319806	1.051229	2.438646	0.235754
0.790001	2.336222	1.010230	2.360123	0.223758

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0.795001	2.352882	0.970340	2.283213	0.212151
0.800001	2.369791	0.931669	2.207862	0.200923
0.805001	2.386954	0.894033	2.134015	0.190069
0.810001	2.404378	0.857445	2.061622	0.179581
0.815001	2.422067	0.821373	1.990631	0.169451
0.820001	2.440028	0.787284	1.920995	0.159672
0.825001	2.458268	0.753647	1.852667	0.150239
0.830001	2.476793	0.720933	1.785601	0.141144
0.835001	2.495609	0.689112	1.719753	0.132381
0.840001	2.514723	0.658156	1.655080	0.123944
0.845001	2.534142	0.628039	1.591541	0.115828
0.850001	2.553875	0.598735	1.529095	0.108027
0.855001	2.573927	0.570220	1.467704	0.100535
0.860001	2.594307	0.542468	1.407329	0.093348
0.865001	2.615024	0.515457	1.347933	0.086460
0.870001	2.636084	0.489165	1.289480	0.079867
0.875001	2.657498	0.463570	1.231936	0.073564
0.880001	2.679273	0.438651	1.175266	0.067547
0.885001	2.701419	0.414388	1.119436	0.061810
0.890001	2.723945	0.390762	1.064414	0.056351
0.895001	2.746861	0.367754	1.010168	0.051165
0.900001	2.770178	0.345345	0.956668	0.046248
0.905001	2.793906	0.323519	0.903882	0.041597
0.910001	2.818055	0.302259	0.851781	0.037208
0.915001	2.842637	0.281547	0.800336	0.033078
0.920001	2.867664	0.261369	0.749518	0.029204
0.925001	2.893147	0.241709	0.699299	0.025582
0.930001	2.919099	0.222552	0.649652	0.022210
0.935001	2.945533	0.203885	0.600549	0.019084
0.940001	2.972464	0.185692	0.551964	0.016203
0.945001	2.999903	0.167962	0.503869	0.013564
0.950001	3.027867	0.150680	0.456240	0.011164
0.955001	3.056370	0.133835	0.409051	0.009001
0.960001	3.085427	0.117415	0.362275	0.007073
0.965001	3.115056	0.101407	0.315889	0.005377
0.970001	3.145273	0.085800	0.269866	0.003913
0.975001	3.176095	0.070584	0.224182	0.002678
0.980001	3.207541	0.055748	0.178813	0.001671
0.985001	3.239630	0.041281	0.133734	0.000890
0.990001	3.272381	0.027173	0.088920	0.000333
0.995001	3.305816	0.013415	0.044347	0.0

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INITIAL MACH NUMBER IS  
0.650001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.650001	0.0	2.770010	0.0	0.765089
0.655001	2.036758	2.676472	5.451325	0.751461
0.660001	2.049432	2.585977	5.299784	0.719914
0.665001	2.062272	2.498409	5.152400	0.693785
0.670001	2.075282	2.413656	5.009019	0.668383
0.675001	2.088466	2.331612	4.869492	0.643689
0.680001	2.101826	2.252174	4.733677	0.619682
0.685001	2.115366	2.175245	4.601439	0.596346
0.690001	2.129090	2.100731	4.472645	0.573662
0.695001	2.143001	2.028544	4.347172	0.551614
0.700001	2.157103	1.958599	4.224899	0.530185
0.705001	2.171401	1.890812	4.105711	0.509360
0.710001	2.185897	1.825107	3.989498	0.489123
0.715001	2.200597	1.761409	3.876152	0.469460
0.720001	2.215505	1.699645	3.765573	0.450357
0.725001	2.230625	1.639748	3.657662	0.431800
0.730001	2.245960	1.581651	3.552325	0.413776
0.735001	2.261517	1.525291	3.449471	0.396273
0.740001	2.277300	1.470607	3.349014	0.379278
0.745001	2.293313	1.417542	3.250869	0.362779
0.750001	2.309562	1.366040	3.154955	0.346765
0.755001	2.326052	1.316047	3.061195	0.331226
0.760001	2.342788	1.267513	2.969513	0.316150
0.765001	2.359776	1.220387	2.879838	0.301527
0.770001	2.377021	1.174622	2.792100	0.287348
0.775001	2.394529	1.130173	2.706231	0.273603
0.780001	2.412306	1.086996	2.622167	0.260283
0.785001	2.430358	1.045049	2.539844	0.247379
0.790001	2.448693	1.004292	2.459203	0.234882
0.795001	2.467315	0.964686	2.380184	0.222784
0.800001	2.486233	0.926193	2.302731	0.211077
0.805001	2.505452	0.888777	2.226790	0.199754

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SD 69-722

0.810001	2.524981	0.852405	2.152306	0.188807
0.815001	2.544827	0.817042	2.079230	0.178229
0.820001	2.564997	0.782656	2.007511	0.168013
0.825001	2.585500	0.749217	1.937101	0.158152
0.830001	2.606342	0.716695	1.867952	0.148640
0.835001	2.627535	0.685061	1.800021	0.139470
0.840001	2.649084	0.654287	1.733262	0.130637
0.845001	2.671001	0.624347	1.667632	0.122136
0.850001	2.693294	0.595216	1.603091	0.113959
0.855001	2.715973	0.566868	1.539597	0.106103
0.860001	2.739048	0.539279	1.477112	0.098562
0.865001	2.762529	0.512427	1.415595	0.091330
0.870001	2.786427	0.486290	1.355011	0.084404
0.875001	2.810754	0.460845	1.295322	0.077779
0.880001	2.835520	0.436072	1.236492	0.071449
0.885001	2.860738	0.411952	1.178487	0.065412
0.890001	2.886420	0.388465	1.121273	0.059663
0.895001	2.912579	0.365592	1.064815	0.054198
0.900001	2.939228	0.343315	1.009081	0.049014
0.905001	2.966381	0.321617	0.954040	0.044106
0.910001	2.994052	0.300482	0.899658	0.039472
0.915001	3.022257	0.279892	0.845906	0.035109
0.920001	3.051011	0.259833	0.792752	0.031012
0.925001	3.080330	0.240288	0.740167	0.027180
0.930001	3.110230	0.221244	0.688120	0.023610
0.935001	3.140729	0.202686	0.636582	0.020298
0.940001	3.171845	0.184601	0.585525	0.017243
0.945001	3.203597	0.166975	0.534919	0.014442
0.950001	3.236005	0.149795	0.484736	0.011893
0.955001	3.269088	0.133049	0.434948	0.009594
0.960001	3.302669	0.116725	0.385526	0.007543
0.965001	3.337369	0.100811	0.336443	0.005739
0.970001	3.372611	0.085296	0.287671	0.004176
0.975001	3.408620	0.070169	0.239181	0.002861
0.980001	3.445421	0.055420	0.190945	0.001786
0.985001	3.483040	0.041038	0.142937	0.000952
0.990001	3.521504	0.027013	0.095127	0.000356
0.995001	3.560843	0.013336	0.047488	0.0

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SD 69-722

INITIAL MACH NUMBER IS  
0.675001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.675001	0.0	2.317455	0.0	0.663095
0.680001	2.186466	2.238500	4.894404	0.650859
0.685001	2.201378	2.162037	4.759462	0.622533
0.690001	2.216503	2.087976	4.628006	0.599066
0.695001	2.231845	2.016228	4.499908	0.576248
0.700001	2.247409	1.946707	4.375046	0.554061
0.705001	2.263200	1.879332	4.253304	0.532492
0.710001	2.279222	1.814026	4.134568	0.511523
0.715001	2.295482	1.750714	4.018732	0.491141
0.720001	2.311983	1.689326	3.905692	0.471332
0.725001	2.328732	1.629792	3.795348	0.452080
0.730001	2.345733	1.572047	3.687604	0.433374
0.735001	2.362993	1.516030	3.582368	0.415200
0.740001	2.380518	1.461678	3.479551	0.397546
0.745001	2.398314	1.408935	3.379069	0.380401
0.750001	2.416386	1.357746	3.280838	0.363752
0.755001	2.434741	1.308057	3.184780	0.347589
0.760001	2.453387	1.259817	3.090818	0.331900
0.765001	2.472329	1.212977	2.998878	0.316677
0.770001	2.491576	1.167490	2.908889	0.301908
0.775001	2.511133	1.123311	2.820783	0.287585
0.780001	2.531009	1.080396	2.734492	0.273698
0.785001	2.551212	1.038704	2.649954	0.260237
0.790001	2.571749	0.998194	2.567105	0.247195
0.795001	2.592630	0.958828	2.485887	0.234563
0.800001	2.613861	0.920569	2.406240	0.222334
0.805001	2.635453	0.883381	2.328110	0.210499
0.810001	2.657415	0.847229	2.251440	0.199050
0.815001	2.679756	0.812081	2.176178	0.187982
0.820001	2.702485	0.777904	2.102274	0.177286
0.825001	2.725614	0.744668	2.029678	0.166957
0.830001	2.749152	0.712343	1.958340	0.156987
0.835001	2.773110	0.680901	1.888214	0.147372
0.840001	2.797501	0.650314	1.819255	0.138103
0.845001	2.822334	0.620557	1.751418	0.129177
0.850001	2.847624	0.591602	1.684659	0.120587
0.855001	2.873381	0.563426	1.618937	0.112329
0.860001	2.899620	0.536005	1.554210	0.104396
0.865001	2.926353	0.509316	1.490438	0.096785

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0.870001	2.953595	0.483337	1.427582	0.089490
0.875001	2.981360	0.458047	1.365603	0.082508
0.880001	3.009664	0.433425	1.304463	0.075833
0.885001	3.038522	0.409451	1.244126	0.069462
0.890001	3.067951	0.386106	1.184555	0.063391
0.895001	3.097967	0.363372	1.125715	0.057615
0.900001	3.128588	0.341231	1.067570	0.052132
0.905001	3.159833	0.319665	1.010087	0.046938
0.910001	3.191721	0.298657	0.953231	0.042030
0.915001	3.224271	0.278193	0.896968	0.037405
0.920001	3.257505	0.258255	0.841267	0.033060
0.925001	3.291444	0.238829	0.786093	0.028992
0.930001	3.326111	0.219901	0.731414	0.025198
0.935001	3.361530	0.201456	0.677199	0.021677
0.940001	3.397724	0.183480	0.623414	0.018425
0.945001	3.434720	0.165961	0.570029	0.015442
0.950001	3.472544	0.148885	0.517010	0.012724
0.955001	3.511225	0.132241	0.464328	0.010271
0.960001	3.550792	0.116016	0.411949	0.008081
0.965001	3.591275	0.100199	0.359842	0.006151
0.970001	3.632707	0.084778	0.307974	0.004482
0.975001	3.675121	0.069743	0.256315	0.003071
0.980001	3.718552	0.055084	0.204831	0.001918
0.985001	3.763038	0.040789	0.153490	0.001023
0.990001	3.808618	0.026849	0.102258	0.000383
0.995001	3.855331	0.013255	0.051103	0.0

## INITIAL MACH NUMBER IS

0.700001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.700001	0.0	1.934518	0.0	0.572742
0.705001	2.362582	1.867565	4.412275	0.561711
0.710001	2.380330	1.802668	4.290944	0.536175
0.715001	2.398354	1.739752	4.172543	0.515017
0.720001	2.416662	1.678748	4.056967	0.494445
0.725001	2.435260	1.619587	3.944115	0.474443
0.730001	2.454154	1.562204	3.833890	0.454999
0.735001	2.473352	1.506537	3.726197	0.436100
0.740001	2.492861	1.452526	3.620946	0.417733

0.745001	2.512690	1.400114	3.518051	0.399887
0.750001	2.532844	1.349245	3.417427	0.382549
0.755001	2.553334	1.299867	3.318993	0.365709
0.760001	2.574166	1.251928	3.222672	0.349356
0.765001	2.595351	1.205382	3.128388	0.333479
0.770001	2.616895	1.160180	3.036069	0.318069
0.775001	2.638810	1.116277	2.945643	0.303115
0.780001	2.661104	1.073631	2.857044	0.288609
0.785001	2.683787	1.032200	2.770205	0.274542
0.790001	2.706869	0.991944	2.685063	0.260904
0.795001	2.730362	0.952825	2.601557	0.247688
0.800001	2.754275	0.914805	2.519625	0.234886
0.805001	2.778621	0.877850	2.439212	0.222490
0.810001	2.803411	0.841924	2.360260	0.210492
0.815001	2.828657	0.806996	2.282715	0.198885
0.820001	2.854372	0.773033	2.206524	0.187662
0.825001	2.880568	0.740005	2.131636	0.176817
0.830001	2.907261	0.707883	2.058001	0.166344
0.835001	2.934463	0.676638	1.985569	0.156235
0.840001	2.962190	0.646243	1.914293	0.146486
0.845001	2.990456	0.616671	1.844127	0.137091
0.850001	3.019277	0.587898	1.775026	0.128043
0.855001	3.048671	0.559898	1.706945	0.119339
0.860001	3.078653	0.532649	1.639841	0.110972
0.865001	3.109243	0.506127	1.573672	0.102939
0.870001	3.140457	0.480311	1.508395	0.095234
0.875001	3.172317	0.455179	1.443971	0.087853
0.880001	3.204841	0.430711	1.380360	0.080793
0.885001	3.238050	0.406887	1.317521	0.074048
0.890001	3.271968	0.383689	1.255417	0.067616
0.895001	3.306615	0.361097	1.194008	0.061493
0.900001	3.342016	0.339094	1.133258	0.055675
0.905001	3.378197	0.317663	1.073128	0.050160
0.910001	3.415181	0.296787	1.013583	0.044943
0.915001	3.452998	0.276451	0.954584	0.040023
0.920001	3.491675	0.256638	0.896096	0.035396
0.925001	3.531241	0.237334	0.838083	0.031061
0.930001	3.571728	0.218524	0.780508	0.027015
0.935001	3.613168	0.200194	0.723335	0.023255
0.940001	3.655594	0.182331	0.666528	0.019781
0.945001	3.699043	0.164922	0.610052	0.016590
0.950001	3.743552	0.147953	0.553870	0.013680
0.955001	3.789160	0.131413	0.497945	0.011050
0.960001	3.835908	0.115290	0.442240	0.008700
0.965001	3.883840	0.099571	0.386719	0.006628
0.970001	3.932999	0.084247	0.331345	0.004833
0.975001	3.983436	0.069307	0.276078	0.003314
0.980001	4.035199	0.054739	0.220881	0.002072
0.985001	4.088341	0.040533	0.165714	0.001105
0.990001	4.142919	0.026681	0.110537	0.000415
0.995001	4.198991	0.013172	0.055310	0.0

INITIAL MACH NUMBER IS

0.725001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.725001	0.0	1.609145	0.0	0.492398
0.730001	2.572315	1.552132	3.992574	0.482417
0.735001	2.593729	1.496824	3.882356	0.459310
0.740001	2.615511	1.443161	3.774603	0.440169
0.745001	2.637669	1.391087	3.669226	0.421560
0.750001	2.660215	1.340546	3.566140	0.403473
0.755001	2.683158	1.291486	3.465261	0.385895
0.760001	2.706509	1.243857	3.366510	0.368817
0.765001	2.730278	1.197610	3.269810	0.352227
0.770001	2.754478	1.152700	3.175086	0.336115
0.775001	2.779119	1.109080	3.082266	0.320473
0.780001	2.804214	1.066709	2.991281	0.305290
0.785001	2.829776	1.025545	2.902064	0.290557
0.790001	2.855817	0.985549	2.814547	0.276266
0.795001	2.882351	0.946682	2.728669	0.262409
0.800001	2.909393	0.908907	2.644368	0.248977
0.805001	2.936956	0.872190	2.561584	0.235963
0.810001	2.965056	0.836496	2.480258	0.223359
0.815001	2.993709	0.801793	2.400336	0.211158
0.820001	3.022931	0.768049	2.321760	0.199353
0.825001	3.052739	0.735234	2.244479	0.187938
0.830001	3.083151	0.703319	2.168439	0.176906
0.835001	3.114185	0.672275	2.093590	0.166252
0.840001	3.145861	0.642076	2.019882	0.155969
0.845001	3.178199	0.612695	1.947267	0.146051
0.850001	3.211219	0.584107	1.875697	0.136494
0.855001	3.244944	0.556288	1.805124	0.127293
0.860001	3.279395	0.529215	1.735504	0.118441
0.865001	3.314598	0.502864	1.666791	0.109936
0.870001	3.350575	0.477214	1.598942	0.101772
0.875001	3.387354	0.452244	1.531911	0.093945
0.880001	3.424961	0.427934	1.465657	0.086452
0.885001	3.463425	0.404264	1.400138	0.079287
0.890001	3.502774	0.381215	1.335310	0.072449
0.895001	3.543040	0.358769	1.271132	0.065933
0.900001	3.584255	0.336908	1.207564	0.059737
0.905001	3.626454	0.315615	1.144563	0.053857
0.910001	3.669670	0.294874	1.082090	0.048290
0.915001	3.713943	0.274668	1.020103	0.043035
0.920001	3.759310	0.254983	0.958561	0.038089

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0.925001	3.805813	0.235804	0.697424	0.033449
0.930001	3.853495	0.217115	0.836651	0.029114
0.935001	3.902401	0.198903	0.776201	0.025082
0.940001	3.952579	0.181156	0.716032	0.021351
0.945001	4.004079	0.163858	0.656102	0.017921
0.950001	4.056954	0.146999	0.596368	0.014790
0.955001	4.111260	0.130566	0.536789	0.011957
0.960001	4.167054	0.114546	0.477321	0.009422
0.965001	4.224401	0.098929	0.417918	0.007184
0.970001	4.283363	0.083704	0.358536	0.005243
0.975001	4.344012	0.068860	0.299128	0.003599
0.980001	4.406421	0.054386	0.239646	0.002252
0.985001	4.470666	0.040272	0.180043	0.001202
0.990001	4.536830	0.026509	0.120267	0.000451
0.995001	4.605001	0.013087	0.060267	0.0

INITIAL MACH NUMBER IS  
0.750001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.750001	0.0	1.331659	0.0	0.420704
0.755001	2.825791	1.282924	3.625276	0.411641
0.760001	2.852059	1.235611	3.524036	0.390662
0.765001	2.878828	1.189671	3.424858	0.373291
0.770001	2.906112	1.145058	3.327668	0.356411
0.775001	2.933928	1.101728	3.232391	0.340011
0.780001	2.962290	1.059638	3.138955	0.324084
0.785001	2.991214	1.018747	3.047290	0.308619
0.790001	3.020718	0.979015	2.957330	0.293608
0.795001	3.050819	0.940406	2.869008	0.279043
0.800001	3.081535	0.902882	2.782262	0.264915
0.805001	3.112885	0.866408	2.697029	0.251218
0.810001	3.144888	0.830951	2.613248	0.237943
0.815001	3.177567	0.796478	2.530862	0.225083
0.820001	3.210941	0.762958	2.449813	0.212632
0.825001	3.245034	0.730360	2.370044	0.200583
0.830001	3.279868	0.698657	2.291502	0.188929
0.835001	3.315469	0.667819	2.214132	0.177666

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0.840001	3.351862	0.637820	2.137883	0.166786
0.845001	3.389072	0.608633	2.062703	0.156285
0.850001	3.427129	0.580235	1.988541	0.146157
0.855001	3.466061	0.552600	1.915347	0.136398
0.860001	3.505899	0.525706	1.843073	0.127002
0.865001	3.546674	0.499530	1.771671	0.117966
0.870001	3.588421	0.474050	1.701093	0.109284
0.875001	3.631174	0.449246	1.631291	0.100954
0.880001	3.674969	0.425097	1.562219	0.092970
0.885001	3.719846	0.401584	1.493830	0.085330
0.890001	3.765844	0.378688	1.426079	0.078031
0.895001	3.813007	0.356390	1.358919	0.071069
0.900001	3.861379	0.334674	1.292305	0.064441
0.905001	3.911007	0.313523	1.226190	0.058145
0.910001	3.961941	0.292919	1.160528	0.052178
0.915001	4.014232	0.272848	1.095273	0.046539
0.920001	4.067936	0.253293	1.030379	0.041225
0.925001	4.123110	0.234240	0.965799	0.036235
0.930001	4.179815	0.215676	0.901484	0.031566
0.935001	4.238117	0.197585	0.837388	0.027219
0.940001	4.298083	0.179955	0.773460	0.023192
0.945001	4.359786	0.162772	0.709651	0.019485
0.950001	4.423302	0.146025	0.645911	0.016096
0.955001	4.488712	0.129700	0.582186	0.013025
0.960001	4.556102	0.113787	0.518425	0.010274
0.965001	4.625563	0.0988274	0.454571	0.007841
0.970001	4.697192	0.083149	0.390568	0.005728
0.975001	4.771092	0.068403	0.326358	0.003936
0.980001	4.847373	0.054025	0.261880	0.002465
0.985001	4.926151	0.040005	0.197071	0.001316
0.990001	5.007551	0.026333	0.131865	0.000495
0.995001	5.091706	0.013000	0.066194	0.0

INITIAL MACH NUMBER IS

0.775001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.775001	0.0	1.094228	0.0	0.356520
0.780001	3.137689	1.052425	3.302181	0.348265
0.785001	3.170571	1.011812	3.208021	0.329159

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0.790001	3.204157	0.972351	3.115566	0.313351
0.795001	3.238472	0.934004	3.024747	0.298001
0.800001	3.273538	0.896736	2.935499	0.283101
0.805001	3.309381	0.860510	2.847756	0.268643
0.810001	3.346026	0.825295	2.761457	0.254621
0.815001	3.383502	0.791056	2.676540	0.241026
0.820001	3.421835	0.757764	2.592944	0.227853
0.825001	3.461057	0.725389	2.510612	0.215095
0.830001	3.501198	0.693901	2.429484	0.202745
0.835001	3.542291	0.663273	2.349505	0.190798
0.840001	3.584371	0.633478	2.270619	0.179248
0.845001	3.627472	0.604490	2.192771	0.168090
0.850001	3.671632	0.576285	2.115908	0.157319
0.855001	3.716892	0.548839	2.039975	0.146930
0.860001	3.763292	0.522128	1.964919	0.136918
0.865001	3.810877	0.496130	1.890690	0.127279
0.870001	3.859691	0.470823	1.817233	0.118009
0.875001	3.909784	0.446188	1.744499	0.109105
0.880001	3.961206	0.422203	1.672434	0.100563
0.885001	4.014010	0.398850	1.600989	0.092380
0.890001	4.068253	0.376110	1.530110	0.084553
0.895001	4.123995	0.353964	1.459747	0.077076
0.900001	4.181298	0.332396	1.389847	0.069954
0.905001	4.240229	0.311389	1.320359	0.063179
0.910001	4.300858	0.290925	1.251227	0.056750
0.915001	4.363260	0.270990	1.182401	0.050666
0.920001	4.427513	0.251569	1.113824	0.044926
0.925001	4.493700	0.232646	1.045441	0.039528
0.930001	4.561912	0.214207	0.977196	0.034471
0.935001	4.632241	0.196240	0.909030	0.029756
0.940001	4.704787	0.178730	0.840885	0.025381
0.945001	4.779658	0.161664	0.772699	0.021347
0.950001	4.856966	0.145031	0.704408	0.017654
0.955001	4.936833	0.128817	0.635949	0.014303
0.960001	5.019388	0.113012	0.567253	0.011295
0.965001	5.104768	0.097605	0.498249	0.008631
0.970001	5.193120	0.082583	0.428865	0.006313
0.975001	5.284604	0.067938	0.359023	0.004343
0.980001	5.379387	0.053657	0.288644	0.002724
0.985001	5.477653	0.039733	0.217642	0.001458
0.990001	5.579595	0.026154	0.145929	0.000549
0.995001	5.685425	0.012912	0.073410	0.0

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INITIAL MACH NUMBER IS  
0.800001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PROF T FUNCTION	FRICTION FUNCTION
0.800001	0.0	0.890475	0.0	0.293884
0.805001	3.530127	0.854503	3.016503	0.291342
0.810001	3.572342	0.819533	2.927652	0.273894
0.815001	3.615588	0.785534	2.840166	0.259475
0.820001	3.659903	0.752474	2.753982	0.245490
0.825001	3.705327	0.720324	2.669037	0.231933
0.830001	3.751901	0.689056	2.585271	0.218798
0.835001	3.799670	0.658642	2.502623	0.206079
0.840001	3.848681	0.629055	2.421033	0.193770
0.845001	3.898983	0.600270	2.340443	0.181867
0.850001	3.950627	0.572262	2.260794	0.170364
0.855001	4.003667	0.545007	2.182027	0.159258
0.860001	4.058161	0.518483	2.104086	0.148543
0.865001	4.114170	0.492666	2.026912	0.138215
0.870001	4.171757	0.467536	1.950449	0.128272
0.875001	4.230990	0.443073	1.874638	0.118710
0.880001	4.291941	0.419256	1.799421	0.109525
0.885001	4.354686	0.396066	1.724742	0.100715
0.890001	4.419303	0.373484	1.650540	0.092277
0.895001	4.485880	0.351493	1.576756	0.084209
0.900001	4.554505	0.330076	1.503331	0.076509
0.905001	4.625276	0.309215	1.430203	0.069175
0.910001	4.698293	0.288894	1.357309	0.062206
0.915001	4.773667	0.269098	1.284586	0.055602
0.920001	4.851512	0.249812	1.211968	0.049360
0.925001	4.931952	0.231022	1.139388	0.043482
0.930001	5.015119	0.212712	1.066776	0.037966
0.935001	5.101154	0.194870	0.994061	0.032814
0.940001	5.190208	0.177482	0.921168	0.028026
0.945001	5.282442	0.160535	0.848019	0.023603
0.950001	5.378031	0.144018	0.774533	0.019547
0.955001	5.477159	0.127918	0.700627	0.015858
0.960001	5.580027	0.112223	0.626209	0.012541
0.965001	5.686852	0.096923	0.551188	0.009597
0.970001	5.797865	0.082007	0.475464	0.007031
0.975001	5.913317	0.067463	0.398932	0.004844
0.980001	6.033481	0.053283	0.321481	0.003043
0.985001	6.158651	0.039455	0.242992	0.001631
0.990001	6.289145	0.025971	0.163338	0.000615
0.995001	6.425312	0.012822	0.082384	0.0

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INITIAL MACH NUMBER IS  
0.825001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.825001	0.0	0.715173	0.0	0.246979
0.830001	4.038047	0.684129	2.762544	0.240072
0.835001	4.094030	0.653932	2.677217	0.224100
0.840001	4.151595	0.624557	2.592906	0.210925
0.845001	4.210811	0.595977	2.509548	0.198169
0.850001	4.271750	0.568169	2.427078	0.185828
0.855001	4.334488	0.541110	2.345432	0.173897
0.860001	4.399105	0.514775	2.264548	0.162372
0.865001	4.465688	0.489143	2.184359	0.151250
0.870001	4.534328	0.464193	2.104803	0.140528
0.875001	4.605121	0.439904	2.025813	0.130201
0.880001	4.678170	0.416258	1.947324	0.120269
0.885001	4.753585	0.393233	1.869268	0.110727
0.890001	4.831483	0.370813	1.791578	0.101576
0.895001	4.911987	0.348980	1.714183	0.092811
0.900001	4.995232	0.327715	1.637013	0.084433
0.905001	5.081358	0.307003	1.559993	0.076441
0.910001	5.170520	0.286828	1.483050	0.068833
0.915001	5.262879	0.267174	1.406104	0.061610
0.920001	5.358611	0.248026	1.329074	0.054772
0.925001	5.457904	0.229370	1.251877	0.048320
0.930001	5.560960	0.211191	1.174424	0.042254
0.935001	5.667998	0.193476	1.096623	0.036576
0.940001	5.779252	0.176213	1.018377	0.031289
0.945001	5.894977	0.159387	0.939584	0.026394
0.950001	6.015447	0.142988	0.860137	0.021894
0.955001	6.140961	0.127003	0.779921	0.017794
0.960001	6.271842	0.111421	0.698814	0.014096
0.965001	6.408441	0.096230	0.616685	0.010807
0.970001	6.551142	0.081420	0.533396	0.007931
0.975001	6.700362	0.066981	0.448796	0.005475
0.980001	6.856559	0.052902	0.362724	0.003446
0.985001	7.020234	0.039173	0.275005	0.001851
0.990001	7.191937	0.025786	0.185449	0.000699
0.995001	7.372272	0.012730	0.093850	0.0

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0.850001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.850001	0.0	0.564012	0.0	0.200103
0.855001	4.720089	0.537150	2.535395	0.193770
0.860001	4.797573	0.511008	2.451597	0.179120
0.865001	4.877653	0.485563	2.368410	0.167070
0.870001	4.960460	0.460796	2.265761	0.155435
0.875001	5.046136	0.436685	2.203574	0.144212
0.880001	5.134833	0.413212	2.121772	0.133398
0.885001	5.226714	0.390356	2.040278	0.122993
0.890001	5.321952	0.368100	1.959009	0.112995
0.895001	5.420736	0.346426	1.877883	0.103403
0.900001	5.523268	0.325317	1.796813	0.094216
0.905001	5.629763	0.304757	1.715708	0.085435
0.910001	5.740458	0.284729	1.634475	0.077060
0.915001	5.855605	0.265219	1.553016	0.069091
0.920001	5.975477	0.246211	1.471228	0.061530
0.925001	6.100373	0.227691	1.389001	0.054379
0.930001	6.230615	0.209645	1.306220	0.047641
0.935001	6.366553	0.192060	1.222763	0.041318
0.940001	6.508569	0.174923	1.138499	0.035415
0.945001	6.657080	0.158221	1.053290	0.029935
0.950001	6.812543	0.141942	0.966984	0.024884
0.955001	6.975456	0.126074	0.879422	0.020267
0.960001	7.146369	0.110605	0.790427	0.016092
0.965001	7.325885	0.095526	0.699812	0.012366
0.970001	7.514671	0.080824	0.607369	0.009097
0.975001	7.713464	0.066491	0.512874	0.006296
0.980001	7.923081	0.052515	0.416078	0.003972
0.985001	8.144430	0.038887	0.316709	0.002139
0.990001	8.378525	0.025597	0.214465	0.000810
0.995001	8.626500	0.012637	0.109013	0.0

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INITIAL MACH NUMBER IS  
0.875001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.875001	0.0	0.433419	0.0	0.157674
0.880001	5.682761	0.410121	2.330618	0.151847
0.885001	5.796531	0.387436	2.245785	0.138393
0.890001	5.914959	0.365346	2.161009	0.127376
0.895001	6.038334	0.343835	2.076189	0.116783
0.900001	6.166975	0.322884	1.991216	0.106615
0.905001	6.301225	0.302477	1.905977	0.096871
0.910001	6.441459	0.282599	1.820353	0.087555
0.915001	6.588086	0.263235	1.734215	0.078669
0.920001	6.741555	0.244369	1.647429	0.070214
0.925001	6.902355	0.225988	1.559850	0.062196
0.930001	7.071024	0.208077	1.471320	0.054618
0.935001	7.248154	0.190624	1.381671	0.047485
0.940001	7.434399	0.173615	1.290721	0.040803
0.945001	7.630481	0.157038	1.198272	0.034580
0.950001	7.837199	0.140880	1.104105	0.028823
0.955001	8.055444	0.125131	1.007984	0.023542
0.960001	8.286207	0.109778	0.909645	0.018747
0.965001	8.530598	0.094811	0.808798	0.014450
0.970001	8.789859	0.080220	0.705122	0.010664
0.975001	9.065391	0.065993	0.598256	0.007404
0.980001	9.358774	0.052122	0.487797	0.004688
0.985001	9.671803	0.038596	0.373290	0.002533
0.990001	10.006518	0.025406	0.254221	0.000963
0.995001	10.365254	0.012542	0.130005	0.0

INITIAL MACH NUMBER IS  
0.885001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.885001	0.0	0.386257	0.0	0.141823
0.890001	6.188291	0.364235	2.253990	0.136188

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0.895001	6.323924	0.342788	2.167767	0.123183
0.900001	6.465643	0.321901	2.081297	0.112560
0.905001	6.613867	0.301557	1.994456	0.102371
0.910001	6.769055	0.281739	1.907109	0.092617
0.915001	6.931708	0.262434	1.819116	0.083301
0.920001	7.102380	0.243626	1.730322	0.074427
0.925001	7.281677	0.225300	1.640564	0.065999
0.930001	7.470271	0.207444	1.549664	0.058023
0.935001	7.668905	0.190044	1.457427	0.050505
0.940001	7.878400	0.173086	1.363644	0.043452
0.945001	8.099675	0.156560	1.268082	0.036872
0.950001	8.333750	0.140451	1.170486	0.030774
0.955001	8.581770	0.124750	1.070575	0.025171
0.960001	8.845020	0.109444	0.968035	0.020073
0.965001	9.124945	0.094523	0.862516	0.015495
0.970001	9.423183	0.079976	0.753627	0.011454
0.975001	9.741591	0.065793	0.640924	0.007966
0.980001	10.082287	0.051963	0.523908	0.005052
0.985001	10.447696	0.038478	0.402009	0.002735
0.990001	10.840609	0.025328	0.274573	0.001041
0.995001	11.264251	0.012504	0.140851	0.0

INITIAL MACH NUMBER IS  
0.890001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.890001	0.0	0.363677	0.0	0.134122
0.895001	6.476472	0.342263	2.216657	0.128580
0.900001	6.625438	0.321408	2.129468	0.115795
0.905001	6.781425	0.301095	2.041851	0.105367
0.910001	6.944942	0.281308	1.953666	0.095378
0.915001	7.116546	0.262032	1.864762	0.085831
0.920001	7.296854	0.243252	1.774977	0.076732
0.925001	7.486545	0.224955	1.684136	0.068083
0.930001	7.686370	0.207126	1.592049	0.059892
0.935001	7.897165	0.189753	1.498507	0.052165
0.940001	8.119857	0.172821	1.403283	0.044910
0.945001	8.355484	0.156320	1.306127	0.038136
0.950001	8.605205	0.140236	1.206761	0.031853
0.955001	8.870325	0.124559	1.104877	0.026073

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0.960001	9.152314	0.109276	1.000132	0.020809
0.965001	9.452834	0.094378	0.892140	0.016077
0.970001	9.773774	0.079853	0.780468	0.011894
0.975001	10.117288	0.065692	0.664622	0.008279
0.980001	10.485845	0.051884	0.544043	0.005256
0.985001	10.882287	0.038419	0.418089	0.002848
0.990001	11.309903	0.025289	0.286021	0.001085
0.995001	11.772522	0.012485	0.146981	0.0

INITIAL MACH NUMBER IS  
0.895001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.895001	0.0	0.341736	0.0	0.126567
0.900001	6.792868	0.320913	2.179922	0.121117
0.905001	6.957204	0.300631	2.091554	0.108548
0.910001	7.129695	0.280875	2.002553	0.098312
0.915001	7.310964	0.261629	1.912758	0.088524
0.920001	7.501698	0.242878	1.821998	0.079187
0.925001	7.702657	0.224609	1.730086	0.070306
0.930001	7.914688	0.206808	1.636817	0.061888
0.935001	8.138731	0.189461	1.541969	0.053940
0.940001	8.375837	0.172555	1.445295	0.046471
0.945001	8.627182	0.156079	1.346524	0.039491
0.950001	8.894088	0.140020	1.245354	0.033010
0.955001	9.178048	0.124367	1.141448	0.027042
0.960001	9.480749	0.109108	1.034428	0.021601
0.965001	9.804111	0.094233	0.923869	0.016704
0.970001	10.150323	0.079730	0.809289	0.012369
0.975001	10.521895	0.065591	0.690138	0.008619
0.980001	10.921721	0.051804	0.565786	0.005477
0.985001	11.353151	0.038360	0.435509	0.002971
0.990001	11.820086	0.025251	0.298463	0.001134
0.995001	12.327097	0.012466	0.153668	0.0

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INITIAL MACH NUMBER IS  
0.900001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.900001	0.0	0.320418	0.0	0.119153
0.905001	7.141820	0.300167	2.143739	0.113793
0.910001	7.323999	0.280441	2.053950	0.101438
0.915001	7.515721	0.261225	1.963291	0.091394
0.920001	7.717756	0.242503	1.871578	0.081807
0.925001	7.930960	0.224262	1.778613	0.072681
0.930001	8.156286	0.206488	1.684176	0.064023
0.935001	8.394797	0.189168	1.588026	0.055842
0.940001	8.647685	0.172289	1.489899	0.048146
0.945001	8.916290	0.155838	1.389498	0.040947
0.950001	9.202127	0.139804	1.286495	0.034256
0.955001	9.506906	0.124175	1.180520	0.028087
0.960001	9.832576	0.108940	1.071158	0.022457
0.965001	10.181361	0.094087	0.957937	0.017382
0.970001	10.555813	0.079607	0.840319	0.012885
0.975001	10.958873	0.065489	0.717689	0.008988
0.980001	11.393950	0.051724	0.589338	0.005718
0.985001	11.865016	0.038301	0.454441	0.003105
0.990001	12.376730	0.025212	0.312036	0.001186
0.995001	12.934590	0.012447	0.160992	0.0

INITIAL MACH NUMBER IS  
0.905001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICITION FUNCTION
0.905001	0.0	0.299701	0.0	0.111877
0.910001	7.528606	0.280006	2.108055	0.106607
0.915001	7.731658	0.260819	2.016566	0.094462
0.920001	7.945971	0.242127	1.923933	0.084610
0.925001	8.177509	0.223914	1.829941	0.075225
0.930001	8.412350	0.206168	1.734356	0.066314
0.935001	8.666699	0.188875	1.636919	0.057885

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0.940001	8.936915	0.172022	1.537342	0.049949
0.945001	9.224531	0.155596	1.435304	0.042516
0.950001	9.531282	0.139587	1.330445	0.035600
0.955001	9.859145	0.123982	1.222361	0.029217
0.960001	10.210376	0.108771	1.110590	0.023383
0.965001	10.587566	0.093941	0.994610	0.018116
0.970001	10.993704	0.079484	0.873821	0.013445
0.975001	11.432255	0.065388	0.747530	0.009389
0.980001	11.907261	0.051644	0.614933	0.005980
0.985001	12.423465	0.038241	0.475092	0.003252
0.990001	12.986469	0.025172	0.326901	0.001244
0.995001	13.602940	0.012427	0.169048	0.0

INITIAL MACH NUMBER IS

0.910001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.910001	0.0	0.279570	0.0	0.104735
0.915001	7.959711	0.260413	2.072814	0.099553
0.920001	8.187392	0.241750	1.979300	0.087617
0.925001	8.428485	0.223566	1.884319	0.077958
0.930001	8.684212	0.205847	1.787617	0.068777
0.935001	8.955948	0.188580	1.688917	0.060085
0.940001	9.245243	0.171754	1.587905	0.051892
0.945001	9.553858	0.155354	1.484231	0.044211
0.950001	9.883794	0.139370	1.377503	0.037055
0.955001	10.237340	0.123789	1.267274	0.030442
0.960001	10.617124	0.108601	1.153034	0.024389
0.965001	11.026180	0.093795	1.034202	0.018919
0.970001	11.468028	0.079360	0.910103	0.014056
0.975001	11.946776	0.065286	0.779957	0.009825
0.980001	12.467247	0.051563	0.642850	0.006269
0.985001	13.035145	0.038182	0.497707	0.003414
0.990001	13.657262	0.025133	0.343251	0.001306
0.995001	14.341752	0.012408	0.177952	0.0

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INITIAL MACH NUMBER IS  
0.915001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.915001	0.0	0.260006	0.0	0.097724
0.920001	8.443192	0.241372	2.037949	0.092629
0.925001	8.700213	0.223216	1.942027	0.080901
0.930001	8.973375	0.205525	1.844253	0.071435
0.935001	9.264250	0.188286	1.744325	0.062462
0.940001	9.574617	0.171485	1.641905	0.053996
0.945001	9.906505	0.155111	1.536611	0.046048
0.950001	10.262231	0.139152	1.428010	0.038635
0.955001	10.644461	0.123596	1.315611	0.031775
0.960001	11.056271	0.108432	1.198849	0.025487
0.965001	11.501233	0.093648	1.077073	0.019795
0.970001	11.983517	0.079236	0.949525	0.014726
0.975001	12.508027	0.065184	0.815322	0.010311
0.980001	13.080561	0.051483	0.673420	0.006586
0.985001	13.708032	0.038122	0.522581	0.003592
0.990001	14.398745	0.025094	0.361321	0.001378
0.995001	15.162770	0.012389	0.187845	0.0

INITIAL MACH NUMBER IS  
0.920001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.920001	0.0	0.240993	0.0	0.090840
0.925001	8.989186	0.222866	2.003381	0.085832
0.930001	9.281536	0.205202	1.904594	0.074310
0.935001	9.593543	0.187990	1.803492	0.065039
0.940001	9.927258	0.171216	1.699706	0.056230
0.945001	10.285029	0.154868	1.592820	0.048047
0.950001	10.669552	0.138934	1.482360	0.040358
0.955001	11.083947	0.123402	1.367780	0.033231
0.960001	11.531835	0.108261	1.248455	0.026688
0.965001	12.017447	0.093502	1.123649	0.020756

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0.970001	12.545759	0.079112	0.992515	0.015453
0.975001	13.122663	0.065032	0.654044	0.010843
0.980001	13.755185	0.051402	0.707040	0.006937
0.985001	14.451777	0.038062	0.550070	0.003790
0.990001	15.222693	0.025055	0.381398	0.001457
0.995001	16.080498	0.012369	0.198902	0.0

INITIAL MACH NUMBER IS  
0.925001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.925001	0.0	0.222515	0.0	0.084081
0.930001	9.610624	0.204879	1.969017	0.079158
0.935001	9.946040	0.187694	1.866812	0.067842
0.940001	10.305714	0.170946	1.761724	0.058770
0.945001	10.692376	0.154624	1.653297	0.050231
0.950001	11.109184	0.138715	1.541008	0.042244
0.955001	11.559806	0.123207	1.424255	0.034829
0.960001	12.048529	0.108091	1.302336	0.028010
0.965001	12.580401	0.093354	1.174433	0.021816
0.970001	13.161401	0.078987	1.039579	0.016278
0.975001	13.798663	0.064979	0.896624	0.011434
0.980001	14.500777	0.051321	0.744191	0.007328
0.985001	15.278174	0.038002	0.580608	0.004011
0.990001	16.143648	0.025015	0.403834	0.001544
0.995001	17.113067	0.012350	0.211340	0.0

INITIAL MACH NUMBER IS  
0.930001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.930001	0.0	0.204555	0.0	0.077441
0.935001	10.324270	0.187397	1.934739	0.072604

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0.940001	10.712914	0.170676	1.828437	0.061495
0.945001	11.131960	0.154379	1.718545	0.052626
0.950001	11.585118	0.138495	1.604486	0.044317
0.955001	12.076733	0.123013	1.485591	0.036590
0.960001	12.611917	0.107920	1.361078	0.029471
0.965001	13.196729	0.093207	1.230022	0.022990
0.970001	13.838411	0.078862	1.091325	0.017184
0.975001	14.545680	0.064876	0.943670	0.012092
0.980001	15.329135	0.051240	0.785458	0.007765
0.985001	16.201787	0.037942	0.614734	0.004260
0.990001	17.179788	0.024976	0.429074	0.001644
0.995001	18.283442	0.012330	0.225437	0.0

INITIAL MACH NUMBER IS  
0.935001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.935001	0.0	0.187100	0.0	0.070917
0.940001	11.152254	0.170405	1.900400	0.066166
0.945001	11.607750	0.154134	1.789152	0.055266
0.950001	12.102032	0.138276	1.673415	0.046608
0.955001	12.640272	0.122817	1.552445	0.038541
0.960001	13.228611	0.107749	1.425365	0.031094
0.965001	13.874382	0.093059	1.291131	0.024300
0.970001	14.586428	0.078737	1.148490	0.018197
0.975001	15.375505	0.064773	0.995923	0.012832
0.980001	16.254827	0.051158	0.831568	0.008258
0.985001	17.240815	0.037882	0.653119	0.004541
0.990001	18.354132	0.024936	0.457676	0.001757
0.995001	19.621147	0.012311	0.241547	0.0

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INITIAL MACH NUMBER IS  
0.940001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.940001	0.0	0.170134	0.0	0.064506
0.945001	12.124401	0.153889	1.865808	0.059842
0.950001	12.665441	0.138055	1.748530	0.049153
0.955001	13.257010	0.122622	1.625597	0.040716
0.960001	13.906535	0.107577	1.496023	0.032909
0.965001	14.622972	0.092910	1.358625	0.025769
0.970001	15.417222	0.078611	1.211969	0.019339
0.975001	16.302691	0.064670	1.054297	0.013668
0.980001	17.296052	0.051077	0.883426	0.008819
0.985001	18.418304	0.037822	0.696613	0.004862
0.990001	19.696274	0.024896	0.490361	0.001886
0.995001	21.164789	0.012291	0.260135	0.0

INITIAL MACH NUMBER IS  
0.945001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.945001	0.0	0.153643	0.0	0.058203
0.950001	13.281893	0.137834	1.830703	0.053626
0.955001	13.934834	0.122426	1.705980	0.043155
0.960001	14.655266	0.107405	1.574047	0.034952
0.965001	15.454231	0.092762	1.433561	0.027429
0.970001	16.345312	0.078486	1.282873	0.020634
0.975001	17.345414	0.064567	1.119936	0.014622
0.980001	18.475849	0.050995	0.942176	0.009460
0.985001	19.763871	0.037761	0.746309	0.005232
0.990001	21.244903	0.024856	0.528070	0.002036
0.995001	22.965843	0.012271	0.281820	0.0

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INITIAL MACH NUMBER IS  
0.950001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.950001	0.0	0.137613	0.0	0.052003
0.955001	14.683275	0.122229	1.794723	0.047516
0.960001	15.486487	0.107232	1.660655	0.037270
0.965001	16.382632	0.092613	1.517242	0.029322
0.970001	17.388827	0.078360	1.362583	0.022117
0.975001	18.526673	0.064463	1.194286	0.015719
0.980001	19.823917	0.050913	1.009293	0.010203
0.985001	21.316230	0.037701	0.803636	0.005663
0.990001	23.051596	0.024816	0.572058	0.002213
0.995001	25.094497	0.012252	0.307447	0.0

INITIAL MACH NUMBER IS  
0.955001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.955001	0.0	0.122032	0.0	0.045900
0.960001	16.414603	0.107060	1.757343	0.041506
0.965001	17.426231	0.092464	1.611292	0.031498
0.970001	18.570698	0.078233	1.452850	0.023833
0.975001	19.876008	0.064359	1.279204	0.016996
0.980001	21.378633	0.050831	1.086700	0.011074
0.985001	23.126972	0.037640	0.870498	0.006171
0.990001	25.186663	0.024776	0.624036	0.002422
0.995001	27.649008	0.012232	0.338198	0.0

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INITIAL MACH NUMBER IS

0.960001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.960001	0.0	0.106887	0.0	0.039886
0.965001	18.607858	0.092314	1.717768	0.035592
0.970001	19.920359	0.078107	1.555918	0.025841
0.975001	21.431998	0.064255	1.377115	0.018501
0.980001	23.191818	0.050749	1.176960	0.012107
0.985001	25.266407	0.037579	0.949488	0.006780
0.990001	27.748513	0.024736	0.686397	0.002675
0.995001	30.771290	0.012212	0.375781	0.0

INITIAL MACH NUMBER IS

0.965001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.965001	0.0	0.092164	0.0	0.033952
0.970001	21.476230	0.077980	1.674721	0.029766
0.975001	23.246005	0.064151	1.491251	0.020302
0.980001	25.333551	0.050667	1.283565	0.013355
0.985001	27.832899	0.037518	1.044237	0.007522
0.990001	30.879236	0.024696	0.762601	0.002988
0.995001	34.674194	0.012192	0.422756	0.0

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INITIAL MACH NUMBER IS

0.970001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.970001	0.0	0.077853	0.0	0.028084
0.975001	25.387954	0.064046	1.626006	0.024019
0.980001	27.901960	0.050584	1.411395	0.014892
0.985001	30.968407	0.037457	1.159983	0.008445
0.990001	34.791871	0.024656	0.857829	0.003383
0.995001	39.692159	0.012172	0.483148	0.0

INITIAL MACH NUMBER IS

0.975001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.975001	0.0	0.063942	0.0	0.022260
0.980001	31.038570	0.050501	1.567492	0.018341
0.985001	34.885655	0.037396	1.304576	0.009636
0.990001	39.821010	0.024616	0.980222	0.003898
0.995001	46.382492	0.012152	0.563663	0.0

INITIAL MACH NUMBER IS

0.980001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICTION FUNCTION
0.980001	0.0	0.050419	0.0	0.016440
0.985001	39.918491	0.037334	1.490334	0.012715
0.990001	46.523905	0.024575	1.143341	0.004599
0.995001	55.748138	0.012133	0.676367	0.0

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INITIAL MACH NUMBER IS  
0.985001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICION FUNCTION
0.985001	0.0	0.037273	0.0	0.010553
0.990001	55.902649	0.024535	1.371566	0.007124
0.995001	69.794384	0.012113	0.845391	0.0

INITIAL MACH NUMBER IS  
0.990001

MACH NO	PROCESS FUNCTION	CLASS FUNCTION	PRODUCT FUNCTION	FRICION FUNCTION
0.990001	0.0	0.024494	0.0	0.002818
0.995001	93.198115	0.012093	1.127006	0.0

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APPENDIX B  
FRICTIONAL ADIABATIC DUCT FLOW OF A CALORICALLY  
PERFECT GAS -  
DEVELOPED FLOW TABLES  
FINAL REFERENCE MACH NUMBER = 1.000000

## FINAL REFERENCE MACH NUMBER IS 1.00000

MACH NO	CLASSICAL	STAGNATION	EXTREMUM
O.CCCCC1*****			
O.CC1CC1	712847.078935	712848.896017	712860.710125
O.CC2CC1	178381.828821	178383.448005	178394.074717
O.CC3CC1	79301.701394	79303.204779	79313.136694
O.CC4CC1	44610.533293	44611.954508	44621.393397
O.CC5CC1	28550.370707	28551.728183	28560.784625
O.CC6CC1	19825.335132	19826.640527	19835.384476
O.CC7CC1	14564.035612	14565.296973	14573.776705
O.CC8CC1	11149.092753	11150.315970	11158.566822
O.CC9CC1	8807.752219	8808.941790	8816.990753
O.C01CC1	7132.978297	7134.137772	7142.006136
O.C02CC1	5893.827104	5894.959354	5902.664345
O.C03CC1	4951.352276	4952.459672	4960.015514
O.C04CC1	4217.890959	4218.975491	4226.394129
O.C05CC1	3635.919611	3636.982976	3644.274582
O.C06CC1	3166.423371	3167.467030	3174.640372
O.C07CC1	2782.183787	2783.209013	2790.271725
O.C08CC1	2463.743902	2464.751814	2471.710605
O.C09CC1	2196.896290	2197.887878	2204.748690
O.C10CC1	1971.070827	1972.046973	1978.815105
O.C11CC1	1778.271895	1779.233394	1785.913600
O.C12CC1	1612.361003	1613.308569	1619.905140
O.C13CC1	1468.562276	1469.496509	1476.013336
O.C14CC1	1343.114750	1344.036341	1350.476970
O.C15CC1	1233.024557	1233.933997	1240.301670
O.C16CC1	1135.884188	1136.781973	1143.079671
O.C17CC1	1049.740066	1050.626654	1056.857120
O.C18CC1	972.993554	973.869369	980.035141

C.028001	904.326292	905.191726	911.295157
C.029001	842.643235	843.498653	849.541932
C.030001	787.028752	787.874494	793.859660
C.031001	736.712476	737.548861	743.477819
C.032001	691.042501	691.869825	697.744360
C.033001	649.464176	650.282720	656.104507
C.034001	611.503204	612.313231	618.053845
C.035001	576.752064	577.553820	583.274745
C.036001	544.859040	545.652760	551.325395
C.037001	515.519298	516.305202	521.930871
C.038001	483.467580	489.245878	494.825833
C.039001	463.472198	464.243087	469.778516
C.040001	440.330057	441.093727	446.585757
C.041001	418.862530	419.619159	425.068862
C.042001	398.911993	399.661756	405.070153
C.043001	380.338957	381.082007	386.450069
C.044001	363.019575	363.756072	369.084727
C.045001	346.843627	347.573718	352.863851
C.046001	331.712736	332.436563	337.689022
C.047001	317.538881	318.256580	323.472175
C.048001	304.243117	304.954817	310.134323
C.049001	291.754468	292.460294	297.604456
C.050001	280.008989	280.709059	285.818592
C.051001	268.948941	269.643370	274.718959
C.052001	258.522083	259.210983	264.253287
C.053001	248.631060	249.364535	254.374189
C.054001	239.382856	240.061010	245.038624
C.055001	230.588337	231.261266	236.207428
C.056001	222.261826	222.929626	227.844903
C.057001	214.370753	215.033515	219.918454
C.058001	206.885329	207.543142	212.398270
C.059001	199.778271	200.431221	205.257048
C.060001	193.024550	193.672718	198.469736
C.061001	186.601171	187.244637	192.013323
C.062001	180.486980	181.125821	185.866637
C.063001	174.662489	175.296780	180.010170
C.064001	169.109720	169.739534	174.425931
C.065001	163.812070	164.437475	169.097298
C.066001	158.754180	159.375246	164.008900
C.067001	153.921834	154.538626	159.146505
C.068001	149.301851	149.914433	154.496919
C.069001	144.881998	145.490433	150.047897
C.070001	140.650912	141.255260	145.788062



C.C71001	136.598024	137.198343	141.706833
C.C72001	132.713492	133.309840	137.794358
C.C73001	128.988148	129.580580	134.041456
C.C74001	125.413435	126.002005	130.439562
C.C75001	121.981366	122.566126	126.980676
C.C76001	118.684474	119.265476	123.657325
C.C77001	115.515775	116.093069	120.462513
C.C78001	112.468731	113.042365	117.389693
C.C79001	109.537214	110.107235	114.432730
C.C80001	106.715477	107.281930	111.585867
C.C81001	103.998125	104.561057	108.843702
C.C82001	101.380091	101.939545	106.201161
C.C83001	98.856612	99.412631	103.653473
C.C84001	96.423205	96.975833	101.196148
C.C85001	94.075654	94.624928	98.824962
C.C86001	91.809981	92.355942	96.535930
C.C87001	89.622437	90.165125	94.325300
C.C88001	87.509487	88.048940	92.189523
C.C89001	85.467793	86.004048	90.125270
C.C90001	83.494200	84.027293	88.129366
C.C91001	81.585726	82.115693	86.198829
C.C92001	79.739552	80.266428	84.330834
C.C93001	77.953008	78.476826	82.522705
C.C94001	76.223565	76.744359	80.771909
C.C95001	74.548828	75.066632	79.076046
C.C96001	72.926526	73.441370	77.432839
C.C97001	71.354503	71.866420	75.840130
C.C98001	69.830715	70.339735	74.295868
C.C99001	68.353218	68.859371	72.798106
C.C100001	66.920167	67.423483	71.344994
C.C101001	65.529807	66.030314	69.934774
C.C102001	64.180468	64.678195	68.565771
C.C103001	62.870563	63.365537	67.236394
C.C104001	61.598578	62.090827	65.945127
C.C105001	60.363073	60.852623	64.690525
C.C106001	59.162674	59.649553	63.471211
C.C107001	57.996074	58.480306	62.285374
C.C108001	56.862022	57.343633	61.133260
C.C109001	55.759328	56.238343	60.012176
C.C110001	54.686853	55.163296	58.921480
C.C111001	53.643511	54.117407	57.860083
C.C112001	52.628264	53.099635	56.826944
C.C113001	51.640119	52.103989	55.821066



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0.115001	49.741380	50.205316	53.887329
0.116001	48.829009	49.290511	52.957689
0.117001	47.940182	48.399271	52.051741
0.118001	47.074103	47.530800	51.168687
0.119001	46.230007	46.684333	50.307760
0.120001	45.407162	45.859139	49.468227
0.121001	44.604868	45.054515	48.649384
0.122001	43.822452	44.269798	47.850555
0.123001	43.059267	43.504313	47.071092
0.124001	42.314694	42.757469	46.310375
0.125001	41.588138	42.028661	45.567804
0.126001	40.879028	41.317317	44.842808
0.127001	40.186814	40.622887	44.134834
0.128001	39.510969	39.944845	43.443354
0.129001	38.850986	39.282683	42.767858
0.130001	38.206377	38.635911	42.107856
0.131001	37.576672	38.004062	41.462878
0.132001	36.961421	37.386683	40.832470
0.133001	36.360188	36.783339	40.216196
0.134001	35.772556	36.193612	39.613636
0.135001	35.198121	35.617099	39.024385
0.136001	34.636496	35.053412	38.448053
0.137001	34.087306	34.502175	37.884265
0.138001	33.550191	33.963029	37.332659
0.139001	33.024803	33.435625	36.792886
0.140001	32.510807	32.919629	36.264609
0.141001	32.007880	32.414716	35.747503
0.142001	31.515710	31.920576	35.241256
0.143001	31.033996	31.436905	34.745563
0.144001	30.562447	30.963415	34.260135
0.145001	30.100783	30.499823	33.784688
0.146001	29.648733	30.045859	33.318950
0.147001	29.206035	29.601260	32.862658
0.148001	28.772436	29.165774	32.415558
0.149001	28.347691	28.739156	31.977404
0.150001	27.931564	28.321169	31.547959
0.151001	27.523826	27.911584	31.126992
0.152001	27.124257	27.510181	30.714282
0.153001	26.732643	27.116745	30.309614
0.154001	26.348776	26.731069	29.912779
0.155001	25.972456	26.352953	29.523576
0.156001	25.603491	25.982203	29.141811





0.157001	25.241691	25.618631	28.767294
0.158001	24.886876	25.262056	28.399343
0.159001	24.538868	24.912300	28.039280
0.160001	24.197499	24.569193	27.685435
0.161001	23.862602	24.232571	27.338141
0.162001	23.534017	23.902272	26.997236
0.163001	23.211589	23.578141	26.662565
0.164001	22.895168	23.260028	26.333977
0.165001	22.584607	22.947787	26.011324
0.166001	22.279766	22.641276	25.694463
0.167001	21.980506	22.340356	25.383258
0.168001	21.686694	22.044896	25.077573
0.169001	21.398202	21.754766	24.777278
0.170001	21.114904	21.469840	24.482248
0.171001	20.836677	21.189995	24.192358
0.172001	20.563404	20.915114	23.907492
0.173001	20.294969	20.645082	23.627531
0.174001	20.031261	20.379787	23.352366
0.175001	19.772173	20.119120	23.081885
0.176001	19.517597	19.862977	22.815983
0.177001	19.267433	19.611254	22.554557
0.178001	19.021580	19.363851	22.297507
0.179001	18.779942	19.120674	22.044736
0.180001	18.542424	18.881626	21.796148
0.181001	18.308937	18.646617	21.551651
0.182001	18.079389	18.415557	21.311157
0.183001	17.853696	18.188360	21.074578
0.184001	17.631773	17.964943	20.841828
0.185001	17.413538	17.745222	20.612826
0.186001	17.198911	17.529118	20.387492
0.187001	16.987815	17.316554	20.165746
0.188001	16.780175	17.107454	19.947514
0.189001	16.575917	16.901744	19.732720
0.190001	16.374969	16.699353	19.521294
0.191001	16.177262	16.500211	19.313164
0.192001	15.982728	16.304250	19.108262
0.193001	15.791301	16.111405	18.906522
0.194001	15.602917	15.921609	18.707379
0.195001	15.417512	15.734802	18.512268
0.196001	15.235026	15.550921	18.319630
0.197001	15.055400	15.369907	18.129903
0.198001	14.878574	15.191702	17.943029
0.199001	14.704493	15.016249	17.758951

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0.201001	14.364344	14.673379	17.393961
0.202001	14.199170	14.505856	17.222942
0.203001	14.034529	14.340872	17.049504
0.204001	13.873369	14.178378	16.878597
0.205001	13.714642	14.018323	16.710171
0.206001	13.558300	13.860661	16.544179
0.207001	13.404298	13.705346	16.380573
0.208001	13.252590	13.552331	16.219309
0.209001	13.103131	13.401573	16.060341
0.210001	12.955880	13.253029	15.903626
0.211001	12.810792	13.106655	15.749120
0.212001	12.667828	12.962412	15.596784
0.213001	12.526947	12.820259	15.446576
0.214001	12.388111	12.680157	15.298456
0.215001	12.251280	12.542067	15.152386
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0.217001	11.983486	12.271775	14.866245
0.218001	11.852451	12.139500	14.726101
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0.220001	11.595931	11.880520	14.451490
0.221001	11.470379	11.753746	14.316954
0.222001	11.346587	11.628740	14.184221
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0.224001	11.104161	11.383903	13.924035
0.225001	10.985465	11.264010	13.796519
0.226001	10.868407	11.145762	13.670681
0.227001	10.752958	11.029128	13.546492
0.228001	10.639089	10.914081	13.423922
0.229001	10.526774	10.800592	13.302944
0.230001	10.415983	10.688634	13.183529
0.231001	10.306691	10.578181	13.065652
0.232001	10.198872	10.469207	12.949285
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0.234001	9.987551	10.255591	12.720981
0.235001	9.883999	10.150900	12.608993
0.236001	9.781821	10.047589	12.498416
0.237001	9.680993	9.945633	12.389225
0.238001	9.581493	9.845011	12.281398
0.239001	9.483299	9.745699	12.174912
0.240001	9.386387	9.647676	12.069744
0.241001	9.290737	9.550919	11.965873
0.242001	9.196328	9.455409	11.863278

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0.263C01	7.467216	7.704316	9.969828
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0.299001	5.346760	5.550620	7.596777
0.300001	5.299207	5.502214	7.542665
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0.310001	4.850622	5.045288	7.029698
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0.403001	2.254666	2.385452	3.921943
0.404001	2.237035	2.367246	3.899512
0.405001	2.219555	2.349194	3.877243
0.406001	2.202222	2.331291	3.855136
0.407001	2.185037	2.313538	3.833188
0.408001	2.167997	2.295932	3.811398
0.409001	2.151101	2.278473	3.789764
0.410001	2.134348	2.261157	3.768285
0.411001	2.117736	2.243986	3.746960
0.412001	2.101264	2.226955	3.725787
0.413001	2.084930	2.210066	3.704764
0.414001	2.068733	2.193315	3.683890

0.415001	2.052671	2.176702	3.663164
0.416001	2.036744	2.160224	3.642584
0.417001	2.020950	2.143882	3.622149
0.418001	2.005287	2.127673	3.601857
0.419001	1.989755	2.111597	3.581707
0.420001	1.974351	2.095651	3.561698
0.421001	1.959076	2.079835	3.541829
0.422001	1.943926	2.064148	3.522097
0.423001	1.928902	2.048587	3.502503
0.424001	1.914002	2.033152	3.483043
0.425001	1.899225	2.017842	3.463719
0.426001	1.884569	2.002656	3.444527
0.427001	1.870033	1.987592	3.425466
0.428001	1.855617	1.972648	3.406537
0.429001	1.841319	1.957825	3.387736
0.430001	1.827137	1.943121	3.369064
0.431001	1.813072	1.928534	3.350519
0.432001	1.799121	1.914063	3.332100
0.433001	1.785284	1.899708	3.313805
0.434001	1.771559	1.885468	3.295634
0.435001	1.757946	1.871340	3.277585
0.436001	1.744442	1.857325	3.259657
0.437001	1.731049	1.843421	3.241849
0.438001	1.717763	1.829627	3.224161
0.439001	1.704585	1.815941	3.206590
0.440001	1.691512	1.802354	3.189137
0.441001	1.678545	1.788894	3.171799
0.442001	1.665683	1.775530	3.154576
0.443001	1.652923	1.762270	3.137467
0.444001	1.640266	1.749115	3.120471
0.445001	1.627709	1.736063	3.103586
0.446001	1.615254	1.723113	3.086813
0.447001	1.602897	1.710264	3.070149
0.448001	1.590639	1.697515	3.053594
0.449001	1.578479	1.684865	3.037147
0.450001	1.566415	1.672314	3.020806
0.451001	1.554447	1.659860	3.004572
0.452001	1.542574	1.647503	2.988443
0.453001	1.530795	1.635241	2.972417
0.454001	1.519109	1.623075	2.956496
0.455001	1.507515	1.611002	2.940676
0.456001	1.496013	1.599022	2.924958
0.457001	1.484601	1.587135	2.909340



0.458001	1.473279	1.575339	2.893822
0.459001	1.462046	1.563633	2.878403
0.460001	1.450901	1.552018	2.863082
0.461001	1.439843	1.540491	2.847858
0.462001	1.428872	1.529052	2.832730
0.463001	1.417986	1.517701	2.817697
0.464001	1.407186	1.506437	2.802760
0.465001	1.396470	1.495258	2.787916
0.466001	1.385837	1.484164	2.773165
0.467001	1.375287	1.473155	2.758507
0.468001	1.364818	1.462229	2.743939
0.469001	1.354431	1.451386	2.729463
0.470001	1.344125	1.440625	2.715076
0.471001	1.333898	1.429946	2.700779
0.472001	1.323751	1.419347	2.686570
0.473001	1.313681	1.408828	2.672449
0.474001	1.303689	1.398388	2.658415
0.475001	1.293775	1.388027	2.644467
0.476001	1.283936	1.377744	2.630604
0.477001	1.274174	1.367538	2.616826
0.478001	1.264486	1.357408	2.603133
0.479001	1.254872	1.347354	2.589523
0.480001	1.245332	1.337376	2.575995
0.481001	1.235865	1.327472	2.562549
0.482001	1.226471	1.317641	2.549185
0.483001	1.217148	1.307885	2.535902
0.484001	1.207896	1.298200	2.522698
0.485001	1.198715	1.288588	2.509574
0.486001	1.189603	1.279047	2.496529
0.487001	1.180561	1.269577	2.483561
0.488001	1.171588	1.260177	2.470672
0.489001	1.162682	1.250846	2.457859
0.490001	1.153845	1.241585	2.445122
0.491001	1.145074	1.232392	2.432460
0.492001	1.136369	1.223267	2.419874
0.493001	1.127730	1.214209	2.407362
0.494001	1.119156	1.205217	2.394924
0.495001	1.110647	1.196292	2.382559
0.496001	1.102202	1.187433	2.370267
0.497001	1.093821	1.178638	2.358046
0.498001	1.085502	1.169908	2.345897
0.499001	1.077247	1.161242	2.333819
0.500001	1.069053	1.152639	2.321812



0.501001	1.060920	1.144099	2.307874
0.502001	1.052848	1.135621	2.298005
0.503001	1.044837	1.127205	2.286205
0.504001	1.036886	1.118850	2.274473
0.505001	1.028993	1.110557	2.262809
0.506001	1.021160	1.102323	2.251212
0.507001	1.013386	1.094150	2.239681
0.508001	1.005669	1.086035	2.228216
0.509001	0.998009	1.077980	2.216817
0.510001	0.990407	1.069982	2.205483
0.511001	0.982861	1.062043	2.194213
0.512001	0.975371	1.054161	2.183007
0.513001	0.967936	1.046336	2.171865
0.514001	0.960557	1.038567	2.160786
0.515001	0.953232	1.030855	2.149769
0.516001	0.945961	1.023198	2.138815
0.517001	0.938744	1.015596	2.127922
0.518001	0.931580	1.008048	2.117090
0.519001	0.924470	1.000555	2.106319
0.520001	0.917411	0.993116	2.095607
0.521001	0.910405	0.985730	2.084956
0.522001	0.903450	0.978396	2.074364
0.523001	0.896546	0.971116	2.063831
0.524001	0.889693	0.963887	2.053356
0.525001	0.882891	0.956710	2.042939
0.526001	0.876136	0.949584	2.032579
0.527001	0.869434	0.942510	2.022277
0.528001	0.862780	0.935485	2.012031
0.529001	0.856175	0.928511	2.001842
0.530001	0.849618	0.921536	1.991708
0.531001	0.843108	0.914710	1.981629
0.532001	0.836647	0.907883	1.971606
0.533001	0.830232	0.901105	1.961637
0.534001	0.823864	0.894375	1.951722
0.535001	0.817543	0.887692	1.941861
0.536001	0.811268	0.881057	1.932054
0.537001	0.805038	0.874469	1.922299
0.538001	0.798854	0.867927	1.912597
0.539001	0.792714	0.861431	1.902947
0.540001	0.786619	0.854982	1.893349
0.541001	0.780569	0.848578	1.883803
0.542001	0.774562	0.842219	1.874307
0.543001	0.768599	0.835904	1.864862

0.544001	0.762679	0.829635	1.855466
0.545001	0.756802	0.823409	1.846123
0.546001	0.750967	0.817227	1.836826
0.547001	0.745175	0.811089	1.827582
0.548001	0.739424	0.804993	1.818385
0.549001	0.733715	0.798941	1.809237
0.550001	0.728047	0.792931	1.800137
0.551001	0.722420	0.786963	1.791084
0.552001	0.716834	0.781037	1.782079
0.553001	0.711288	0.775152	1.773122
0.554001	0.705781	0.769308	1.764211
0.555001	0.700315	0.763505	1.755346
0.556001	0.694888	0.757743	1.746528
0.557001	0.689499	0.752021	1.737755
0.558001	0.684150	0.746339	1.729029
0.559001	0.678839	0.740697	1.720347
0.560001	0.673566	0.735094	1.711710
0.561001	0.668331	0.729529	1.703117
0.562001	0.663133	0.724004	1.694569
0.563001	0.657972	0.718517	1.686064
0.564001	0.652849	0.713068	1.677604
0.565001	0.647762	0.707657	1.669186
0.566001	0.642712	0.702284	1.660812
0.567001	0.637698	0.696948	1.652480
0.568001	0.632719	0.691649	1.644191
0.569001	0.627777	0.686387	1.635944
0.570001	0.622869	0.681161	1.627738
0.571001	0.617997	0.675971	1.619574
0.572001	0.613159	0.670818	1.611452
0.573001	0.608356	0.665700	1.603370
0.574001	0.603587	0.660617	1.595329
0.575001	0.598852	0.655570	1.587228
0.576001	0.594151	0.650557	1.579368
0.577001	0.589483	0.645579	1.571447
0.578001	0.584849	0.640636	1.563566
0.579001	0.580247	0.635726	1.555724
0.580001	0.575679	0.630850	1.547922
0.581001	0.571142	0.626009	1.540158
0.582001	0.566638	0.621200	1.532432
0.583001	0.562167	0.616425	1.524745
0.584001	0.557726	0.611682	1.517096
0.585001	0.553318	0.606972	1.509484
0.586001	0.548940	0.602295	1.501910

0.587001	0.544594	0.597649	1.494373
0.588001	0.540279	0.593036	1.486874
0.589001	0.535994	0.588454	1.479410
0.590001	0.531739	0.583904	1.471984
0.591001	0.527515	0.579386	1.464593
0.592001	0.523321	0.574898	1.457239
0.593001	0.519156	0.570441	1.449920
0.594001	0.515021	0.566014	1.442637
0.595001	0.510915	0.561618	1.435389
0.596001	0.506839	0.557252	1.428176
0.597001	0.502791	0.552917	1.420998
0.598001	0.498772	0.548610	1.413855
0.599001	0.494781	0.544334	1.406746
0.600001	0.490818	0.540086	1.399671
0.601001	0.486884	0.535868	1.392630
0.602001	0.482977	0.531679	1.385623
0.603001	0.479098	0.527518	1.378649
0.604001	0.475246	0.523386	1.371708
0.605001	0.471422	0.519282	1.364801
0.606001	0.467625	0.515206	1.357926
0.607001	0.463854	0.511158	1.351084
0.608001	0.460110	0.507138	1.344274
0.609001	0.456393	0.503145	1.337496
0.610001	0.452702	0.499180	1.330751
0.611001	0.449036	0.495241	1.324037
0.612001	0.445397	0.491330	1.317355
0.613001	0.441784	0.487445	1.310704
0.614001	0.438196	0.483587	1.304084
0.615001	0.434633	0.479755	1.297495
0.616001	0.431095	0.475950	1.290937
0.617001	0.427583	0.472170	1.284409
0.618001	0.424095	0.468417	1.277912
0.619001	0.420632	0.464689	1.271445
0.620001	0.417193	0.460986	1.265008
0.621001	0.413779	0.457309	1.258601
0.622001	0.410389	0.453656	1.252224
0.623001	0.407022	0.450029	1.245875
0.624001	0.403679	0.446426	1.239557
0.625001	0.400360	0.442849	1.233267
0.626001	0.397065	0.439295	1.227006
0.627001	0.393792	0.435766	1.220773
0.628001	0.390543	0.432261	1.214570
0.629001	0.387317	0.428779	1.208394



0.630001	0.384113	0.425322	1.202247
0.631001	0.380932	0.421888	1.196127
0.632001	0.377774	0.418478	1.190036
0.633001	0.374638	0.415091	1.183972
0.634001	0.371524	0.411727	1.177935
0.635001	0.368432	0.408386	1.171926
0.636001	0.365361	0.405067	1.165944
0.637001	0.362313	0.401772	1.159989
0.638001	0.359286	0.398499	1.154060
0.639001	0.356280	0.395248	1.148158
0.640001	0.353296	0.392020	1.142283
0.641001	0.350333	0.388813	1.136434
0.642001	0.347390	0.385629	1.130611
0.643001	0.344469	0.382466	1.124814
0.644001	0.341568	0.379325	1.119043
0.645001	0.338688	0.376205	1.113297
0.646001	0.335828	0.373107	1.107577
0.647001	0.332988	0.370030	1.101883
0.648001	0.330168	0.366974	1.096213
0.649001	0.327369	0.363939	1.090569
0.650001	0.324589	0.360924	1.084949
0.651001	0.321829	0.357931	1.079354
0.652001	0.319088	0.354957	1.073784
0.653001	0.316367	0.352004	1.068238
0.654001	0.313665	0.349072	1.062717
0.655001	0.310982	0.346159	1.057219
0.656001	0.308318	0.343266	1.051746
0.657001	0.305673	0.340393	1.046296
0.658001	0.303047	0.337540	1.040871
0.659001	0.300440	0.334707	1.035468
0.660001	0.297851	0.331892	1.030089
0.661001	0.295280	0.329098	1.024734
0.662001	0.292728	0.326322	1.019401
0.663001	0.290194	0.323565	1.014092
0.664001	0.287678	0.320828	1.008805
0.665001	0.285179	0.318109	1.003542
0.666001	0.282699	0.315408	0.998300
0.667001	0.280236	0.312727	0.993082
0.668001	0.277791	0.310064	0.987885
0.669001	0.275363	0.307419	0.982711
0.670001	0.272952	0.304792	0.977559
0.671001	0.270559	0.302184	0.972429
0.672001	0.268183	0.299593	0.967320



C.673001	0.265823	0.297020	0.962234
0.674001	0.263481	0.294465	0.957169
0.675001	0.261155	0.291928	0.952125
0.676001	0.258846	0.289408	0.947103
0.677001	0.256553	0.286905	0.942102
0.678001	0.254277	0.284420	0.937122
C.679001	0.252017	0.281952	0.932162
C.680001	0.249773	0.279501	0.927224
0.681001	0.247545	0.277067	0.922307
0.682001	0.245334	0.274650	0.917410
0.683001	0.243138	0.272249	0.912533
0.684001	0.240958	0.269866	0.907677
C.685001	0.238793	0.267498	0.902841
0.686001	0.236644	0.265147	0.898025
0.687001	0.234511	0.262813	0.893229
C.688001	0.232393	0.260495	0.888453
0.689001	0.230290	0.258192	0.883697
0.690001	0.228202	0.255906	0.878961
0.691001	0.226129	0.253636	0.874244
0.692001	0.224072	0.251381	0.869546
0.693001	0.222029	0.249143	0.864868
0.694001	0.220001	0.246919	0.860209
0.695001	0.217987	0.244712	0.855569
0.696001	0.215988	0.242519	0.850948
0.697001	0.214004	0.240342	0.846346
0.698001	0.212034	0.238181	0.841763
0.699001	0.210078	0.236034	0.837199
0.700001	0.208137	0.233903	0.832653
0.701001	0.206209	0.231786	0.828125
0.702001	0.204296	0.229684	0.823616
0.703001	0.202396	0.227597	0.819126
0.704001	0.200510	0.225525	0.814653
0.705001	0.198638	0.223467	0.810198
0.706001	0.196780	0.221423	0.805762
0.707001	0.194935	0.219394	0.801343
0.708001	0.193104	0.217380	0.796942
0.709001	0.191286	0.215379	0.792559
C.710001	0.189481	0.213393	0.788193
0.711001	0.187690	0.211421	0.783845
0.712001	0.185911	0.209462	0.779514
C.713001	0.184146	0.207518	0.775200
0.714001	0.182394	0.205587	0.770904
C.715001	0.180654	0.203670	0.766625



0.716001	0.178928	0.201766	0.762362
0.717001	0.177214	0.199876	0.758117
0.718001	0.175512	0.198000	0.753889
0.719001	0.173824	0.196137	0.749677
0.720001	0.172147	0.194287	0.745481
0.721001	0.170483	0.192450	0.741303
0.722001	0.168832	0.190627	0.737141
0.723001	0.167192	0.188816	0.732995
0.724001	0.165565	0.187019	0.728865
0.725001	0.163950	0.185234	0.724752
0.726001	0.162347	0.183462	0.720654
0.727001	0.160756	0.181703	0.716573
0.728001	0.159176	0.179956	0.712506
0.729001	0.157609	0.178222	0.708453
0.730001	0.156053	0.176501	0.704424
0.731001	0.154508	0.174792	0.700406
0.732001	0.152976	0.173095	0.696404
0.733001	0.151454	0.171410	0.692417
0.734001	0.149944	0.169738	0.688445
0.735001	0.148446	0.168078	0.684489
0.736001	0.146959	0.166430	0.680548
0.737001	0.145483	0.164793	0.676622
0.738001	0.144018	0.163169	0.672711
0.739001	0.142564	0.161557	0.668815
0.740001	0.141121	0.159956	0.664935
0.741001	0.139689	0.158367	0.661069
0.742001	0.138268	0.156789	0.657217
0.743001	0.136857	0.155223	0.653381
0.744001	0.135458	0.153669	0.649559
0.745001	0.134069	0.152126	0.645752
0.746001	0.132690	0.150594	0.641959
0.747001	0.131322	0.149074	0.638181
0.748001	0.129965	0.147565	0.634416
0.749001	0.128618	0.146067	0.630667
0.750001	0.127281	0.144580	0.626931
0.751001	0.125954	0.143104	0.623209
0.752001	0.124638	0.141639	0.619502
0.753001	0.123332	0.140185	0.615808
0.754001	0.122036	0.138741	0.612123
0.755001	0.120749	0.137309	0.608462
0.756001	0.119473	0.135887	0.604810
0.757001	0.118207	0.134475	0.601171
0.758001	0.116950	0.133075	0.597546



0.759001	0.115703	0.131684	0.593935
0.760001	0.114466	0.130305	0.590337
0.761001	0.113239	0.128935	0.586752
0.762001	0.112021	0.127576	0.583181
0.763001	0.110813	0.126227	0.579623
0.764001	0.109614	0.124888	0.576078
0.765001	0.108424	0.123560	0.572540
0.766001	0.107244	0.122241	0.569027
0.767001	0.106073	0.120933	0.565522
0.768001	0.104912	0.119634	0.562029
0.769001	0.103759	0.118346	0.558549
0.770001	0.102616	0.117067	0.555081
0.771001	0.101481	0.115798	0.551627
0.772001	0.100356	0.114539	0.548185
0.773001	0.099240	0.113289	0.544756
0.774001	0.098132	0.112049	0.541339
0.775001	0.097034	0.110819	0.537935
0.776001	0.095944	0.109598	0.534543
0.777001	0.094863	0.108386	0.531163
0.778001	0.093790	0.107184	0.527796
0.779001	0.092726	0.105991	0.524441
0.780001	0.091671	0.104808	0.521098
0.781001	0.090624	0.103634	0.517767
0.782001	0.089586	0.102469	0.514448
0.783001	0.088556	0.101313	0.511141
0.784001	0.087535	0.100166	0.507846
0.785001	0.086522	0.099028	0.504563
0.786001	0.085517	0.097899	0.501292
0.787001	0.084520	0.096779	0.498032
0.788001	0.083532	0.095668	0.494784
0.789001	0.082551	0.094566	0.491548
0.790001	0.081579	0.093472	0.488323
0.791001	0.080615	0.092387	0.485110
0.792001	0.079658	0.091311	0.481908
0.793001	0.078710	0.090244	0.478717
0.794001	0.077770	0.089185	0.475538
0.795001	0.076837	0.088134	0.472371
0.796001	0.075912	0.087092	0.469214
0.797001	0.074995	0.086059	0.466069
0.798001	0.074085	0.085034	0.462934
0.799001	0.073183	0.084017	0.459811
0.800001	0.072289	0.083008	0.456699
0.801001	0.071402	0.082008	0.453597



0.802001	0.070523	0.081016	0.450567
0.803001	0.069651	0.080032	0.447427
0.804001	0.068787	0.079056	0.444359
0.805001	0.067930	0.078088	0.441300
0.806001	0.067081	0.077128	0.438253
0.807001	0.066238	0.076176	0.435216
0.808001	0.065403	0.075232	0.432190
0.809001	0.064575	0.074296	0.429175
0.810001	0.063754	0.073368	0.426169
0.811001	0.062941	0.072447	0.423175
0.812001	0.062134	0.071534	0.420190
0.813001	0.061335	0.070629	0.417216
0.814001	0.060542	0.069732	0.414253
0.815001	0.059756	0.068842	0.411297
0.816001	0.058978	0.067959	0.408356
0.817001	0.058206	0.067085	0.405423
0.818001	0.057441	0.066217	0.402500
0.819001	0.056682	0.065357	0.399587
0.820001	0.055931	0.064505	0.396684
0.821001	0.055186	0.063660	0.393790
0.822001	0.054448	0.062822	0.390907
0.823001	0.053716	0.061992	0.388034
0.824001	0.052991	0.061168	0.385170
0.825001	0.052273	0.060352	0.382316
0.826001	0.051561	0.059543	0.379472
0.827001	0.050856	0.058741	0.376638
0.828001	0.050157	0.057947	0.373813
0.829001	0.049464	0.057159	0.370998
0.830001	0.048778	0.056378	0.368192
0.831001	0.048093	0.055604	0.365396
0.832001	0.047424	0.054837	0.362609
0.833001	0.046756	0.054077	0.359832
0.834001	0.046095	0.053324	0.357064
0.835001	0.045440	0.052578	0.354305
0.836001	0.044791	0.051838	0.351555
0.837001	0.044148	0.051106	0.348815
0.838001	0.043511	0.050379	0.346084
0.839001	0.042881	0.049660	0.343362
0.840001	0.042256	0.048947	0.340649
0.841001	0.041637	0.048241	0.337945
0.842001	0.041024	0.047541	0.335251
0.843001	0.040417	0.046848	0.332565
0.844001	0.039816	0.046161	0.329888



0.845C01	0.039220	0.045431	0.327220
0.846C01	0.038631	0.044807	0.324561
0.847C01	0.038047	0.044139	0.321910
0.848C01	0.037469	0.043478	0.319269
0.849C01	0.036896	0.042823	0.316636
0.850C01	0.036329	0.042174	0.314012
0.851C01	0.035762	0.041532	0.311396
0.852C01	0.035213	0.040896	0.308789
0.853C01	0.034663	0.040266	0.306191
0.854C01	0.034118	0.039642	0.303601
0.855C01	0.033579	0.039024	0.301019
0.856C01	0.033045	0.038412	0.298447
0.857C01	0.032517	0.037807	0.295882
0.858C01	0.031994	0.037207	0.293326
0.859C01	0.031477	0.036613	0.290778
0.860C01	0.030965	0.036025	0.288238
0.861C01	0.030458	0.035444	0.285707
0.862C01	0.029956	0.034868	0.283184
0.863C01	0.029460	0.034297	0.280669
0.864C01	0.028969	0.033733	0.278163
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0.866C01	0.028002	0.032621	0.273173
0.867C01	0.027526	0.032074	0.270691
0.868C01	0.027056	0.031533	0.268216
0.869C01	0.026590	0.030997	0.265750
0.870C01	0.026130	0.030467	0.263291
0.871C01	0.025674	0.029942	0.260841
0.872C01	0.025223	0.029423	0.258398
0.873C01	0.024778	0.028910	0.255963
0.874C01	0.024337	0.028402	0.253536
0.875C01	0.023901	0.027899	0.251116
0.876C01	0.023470	0.027402	0.248704
0.877C01	0.023044	0.026911	0.246300
0.878C01	0.022623	0.026424	0.243904
0.879C01	0.022206	0.025943	0.241515
0.880C01	0.021794	0.025468	0.239134
0.881C01	0.021387	0.024998	0.236760
0.882C01	0.020985	0.024533	0.234394
0.883C01	0.020587	0.024073	0.232035
0.884C01	0.020194	0.023618	0.229684
0.885C01	0.019805	0.023169	0.227340
0.886C01	0.019421	0.022725	0.225004
0.887C01	0.019042	0.022286	0.222675



0.888001	0.018667	0.021852	0.220393
0.889001	0.018296	0.021423	0.218039
0.890001	0.017930	0.020999	0.215737
0.891001	0.017569	0.020580	0.213432
0.892001	0.017212	0.020166	0.211139
0.893001	0.016859	0.019758	0.208853
0.894001	0.016511	0.019354	0.206575
0.895001	0.016167	0.018955	0.204304
0.896001	0.015828	0.018561	0.202039
0.897001	0.015492	0.018172	0.199782
0.898001	0.015161	0.017787	0.197532
0.899001	0.014835	0.017408	0.195289
0.900001	0.014512	0.017033	0.193052
0.901001	0.014194	0.016663	0.190823
0.902001	0.013880	0.016298	0.188600
0.903001	0.013570	0.015937	0.186385
0.904001	0.013264	0.015582	0.184176
0.905001	0.012962	0.015231	0.181974
0.906001	0.012664	0.014884	0.179779
0.907001	0.012371	0.014542	0.177590
0.908001	0.012081	0.014205	0.175409
0.909001	0.011796	0.013872	0.173234
0.910001	0.011514	0.013544	0.171065
0.911001	0.011236	0.013221	0.168903
0.912001	0.010963	0.012901	0.166748
0.913001	0.010693	0.012587	0.164600
0.914001	0.010427	0.012277	0.162458
0.915001	0.010165	0.011971	0.160322
0.916001	0.009907	0.011670	0.158193
0.917001	0.009653	0.011373	0.156070
0.918001	0.009403	0.011080	0.153954
0.919001	0.009156	0.010792	0.151844
0.920001	0.008913	0.010508	0.149741
0.921001	0.008674	0.010228	0.147644
0.922001	0.008439	0.009953	0.145553
0.923001	0.008207	0.009682	0.143469
0.924001	0.007979	0.009415	0.141391
0.925001	0.007755	0.009152	0.139319
0.926001	0.007534	0.008894	0.137253
0.927001	0.007317	0.008639	0.135194
0.928001	0.007103	0.008389	0.133141
0.929001	0.006893	0.008143	0.131094
0.930001	0.006687	0.007901	0.129053



0.931001	0.006484	0.007663	0.127018
0.932001	0.006285	0.007429	0.124989
0.933001	0.006089	0.007199	0.122966
0.934001	0.005897	0.006974	0.120949
0.935001	0.005708	0.006752	0.118939
0.936001	0.005523	0.006534	0.116934
0.937001	0.005341	0.006320	0.114935
0.938001	0.005162	0.006110	0.112942
0.939001	0.004987	0.005904	0.110955
0.940001	0.004815	0.005702	0.108974
0.941001	0.004647	0.005504	0.106998
0.942001	0.004482	0.005309	0.105029
0.943001	0.004320	0.005119	0.103065
0.944001	0.004161	0.004932	0.101107
0.945001	0.004006	0.004749	0.099155
0.946001	0.003854	0.004570	0.097208
0.947001	0.003705	0.004394	0.095268
0.948001	0.003560	0.004223	0.093333
0.949001	0.003417	0.004055	0.091403
0.950001	0.003278	0.003890	0.089479
0.951001	0.003142	0.003730	0.087561
0.952001	0.003009	0.003573	0.085649
0.953001	0.002879	0.003419	0.083742
0.954001	0.002753	0.003270	0.081840
0.955001	0.002629	0.003124	0.079944
0.956001	0.002509	0.002981	0.078054
0.957001	0.002391	0.002842	0.076169
0.958001	0.002277	0.002707	0.074289
0.959001	0.002165	0.002575	0.072415
0.960001	0.002057	0.002447	0.070546
0.961001	0.001952	0.002322	0.068683
0.962001	0.001849	0.002200	0.066825
0.963001	0.001750	0.002083	0.064973
0.964001	0.001653	0.001968	0.063125
0.965001	0.001560	0.001857	0.061284
0.966001	0.001469	0.001749	0.059447
0.967001	0.001381	0.001645	0.057615
0.968001	0.001296	0.001544	0.055789
0.969001	0.001214	0.001447	0.053968
0.970001	0.001135	0.001353	0.052153
0.971001	0.001058	0.001262	0.050342
0.972001	0.000985	0.001174	0.048537
0.973001	0.000914	0.001090	0.046736



C.974CC1	0.000846	0.001009	0.044941
C.975CC1	0.000780	0.000931	0.043151
C.976CC1	0.000718	0.000857	0.041366
C.977CC1	0.000658	0.000786	0.039586
C.978CC1	0.000601	0.000717	0.037811
C.979CC1	0.000546	0.000653	0.036041
C.980CC1	0.000495	0.000591	0.034276
C.981CC1	0.000446	0.000532	0.032517
C.982CC1	0.000399	0.000477	0.030762
C.983CC1	0.000355	0.000425	0.029012
C.984CC1	0.000314	0.000376	0.027266
C.985CC1	0.000276	0.000330	0.025526
C.986CC1	0.000240	0.000287	0.023791
C.987CC1	0.000206	0.000247	0.022061
C.988CC1	0.000175	0.000210	0.020335
C.989CC1	0.000147	0.000176	0.018614
C.990CC1	0.000121	0.000145	0.016898
C.991CC1	0.000098	0.000117	0.015187
C.992CC1	0.000077	0.000093	0.013480
C.993CC1	0.000059	0.000071	0.011779
C.994CC1	0.000043	0.000052	0.010082
C.995CC1	0.000030	0.000036	0.008390
C.996CC1	0.000019	0.000023	0.006702
C.997CC1	0.000011	0.000013	0.005019
C.998CC1	0.000005	0.000006	0.003341
C.999CC1	0.000001	0.000001	0.001667