PHYSICS 9B–01
MIDTERM 1
October 22, 1993

NAME:

(please print)

Social Sec. #:

General Instructions: This examination is closed book. Only a calculator is allowed. Please show all your work. Credit will only be given for *complete* solutions. Answers must have correct units. Please write clearly and comprehensibly. The grader must be able to follow your reasoning in order to assign partial credit. It is against the University Academic Code to present work other than your own on this exam.

There are seven problems on five pages. There are no blank pages. Please check now to make sure you have a complete exam. Note that not all the problems are worth the same number of points.

Important: After printing your name and social security number at the top of this cover sheet, please tear the cover sheet off and pass it to the aisle before beginning the exam. **DO NOT FORGET TO WRITE YOUR NAME ON PAGE 1 OF THE EXAMINATION AS WELL.**

Midterm 1: Physics 9B–01

NAME:

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[5 points] 1. What is the pressure (in N/m^2) exerted on the ground by a person of mass 70 kg whose feet together have an area 60 cm^2?

[5 points] 2. A horizontal pipe is filled with water and has a cross sectional area $A_1 = 0.01$ m^2 at one point and $A_2 = 0.02$ m^2 at another. If the velocity of the water in the pipe is 3 m/sec at point 1, how fast is it moving at point 2? What is the equation you used to solve this problem called?

[20 points] 3. A small rock of density 3000 kg/m^3 is released from rest at the top of a swimming pool of depth 2 meters. How long will it take for the rock to reach the bottom of the pool? The density of water is 1000 kg / m^3. Ignore viscosity, i.e. ignore any frictional slowing of the rock.

[20 points] 4. A dam is shaped like a right triangle, as shown in the figure. Its height is 100 m, and its maximum width (at the top) is also 100 m. If water fills up to the top, what is the total force on the dam? The density of water is 1000 kg/m^3.

[15 points] 5. Write down Bernoulli's equation. Use it to calculate the minimum area of the wing of an airplane if the airplane must be able to fly when the velocity of air beneath the wing is 40 m/s and above the wing is 80 m/s. The weight of the airplane is 10000 Newtons.

[10 points] 6. A rope of mass 0.50 kg is stretched between two supports 20 m apart. If the tension in the rope is 140 Newtons, how long will it take a pulse to travel from one support to the other?

[25 points] 7. The displacement $D(x,t)$ of a string is given by $D(x,t) = A\sin(kx - \omega t)$.

a. In which direction is the wave moving?

b. What are the dimensions (M, L, T) of A, k, and ω?

c. What is the maximum displacement?

d. What is the maximum velocity of a point on the string?

e. What are the wavelength, period, and velocity of the wave?