

Second Examination
Thursday, October 14, 1999

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is open book, open notes, and computer-on. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 33 points, and 1 point is “free”.

1. In each case, state whether the improper integral converges. Compute the values of those integrals that converge. Explain how you arrived at your answers.

(a) $\int_{x=4}^{\infty} x^{-2} dx$ (b) $\int_{x=0}^{\infty} e^{-x} \cos(x) dx$ (c) $\int_{x=0}^1 x^{-2} \cos(x) dx$

2. The weight per unit volume of the earth’s atmosphere h inches above the surface of the earth is given as approximately $4.61 \times 10^{-5} e^{-3.145 \times 10^{-6} h}$ pounds per cubic inch. Let us also assume that the weight per unit volume on Mars of Martian air h inches above the surface of Mars is approximately $9.23 \times 10^{-7} e^{-3.145 \times 10^{-6} h}$ pounds per cubic inch. Suppose all of the air is pumped out of a cubical glass enclosure one of whose side lengths is 30 inches.

- (a) What would the force be on one of the sides of this enclosure if the enclosure were on the surface of Mars?
(b) What would the force be if the enclosure were on the surface of the earth?
(c) How high above the earth would the object need to be for the force to equal the force that would be encountered on the surface of Mars?

3. Suppose the weight distribution of a particular kind of animal (involving several populations and subspecies) is given by the density function in Figure 1.

- (a) There are two common weights. Do most of the animals weigh within five pounds of these weights? Justify your answer by shading in an appropriate part of the graph and labelling it. (You may draw on the figure and hand it in.)
(b) Approximately how many percent of the animals weigh less than 30 pounds? Explain your answer.

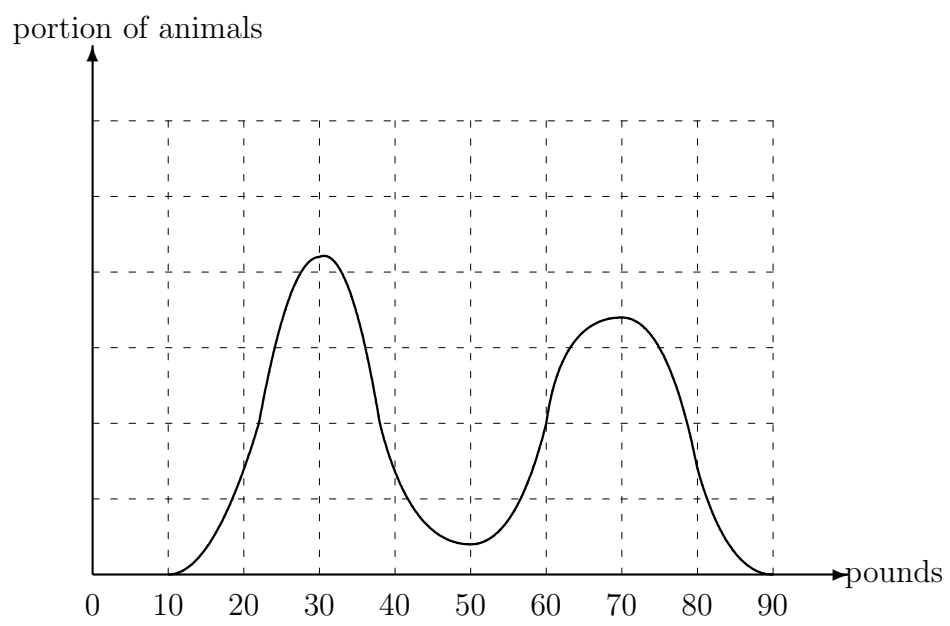


Figure 1: The distribution for problem 3