

Math. 250-04
Spring, 1999
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Final Examination

Friday, May 7, 1999, 7:30AM–10:00AM

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. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 16 points, and 4 points are free.

1. Suppose that, if the price is \$100, 500 units of a product can be sold, and, if the price is \$110, 300 units can be sold. Also suppose that, if the price charged is \$100, manufacturers are willing to produce 900 units, and if the price is \$110, manufacturers are willing to produce 1000 units.
 - (a) Assuming the demand D is a linear function of price p , write down the demand function $D(p)$.
 - (b) Assuming the supply S is a linear function of price p , write down the supply function $S(p)$.
 - (c) Find the equilibrium price and quantity.
2. Suppose \$5,000 is invested in an account paying a nominal annual rate of 5.5%. How much is in the account after 20 years if the interest is compounded
 - (a) Annually? (b) Quarterly? (c) Continuously?

3. Compute

$$\int_{x=0}^5 f(x)dx,$$

where $f(x)$ is as in Figure 1.

4. Suppose the graph in Figure 1 represents the velocity in miles per hour of a walker strolling along a north-south line, where negative numbers mean the walker is going south and positive numbers mean the walker is going north. At approximately what time is the walker farthest to the south from the starting point, and how far south is he then?

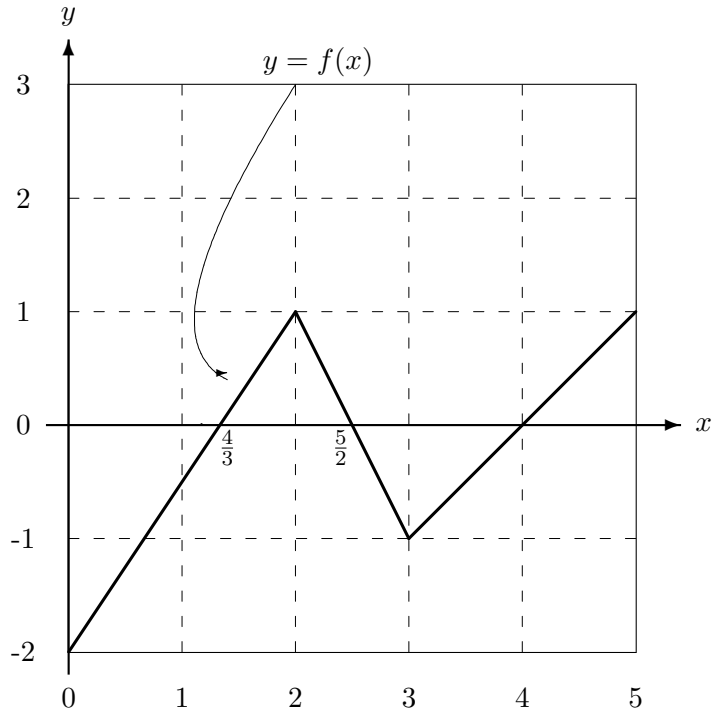


Figure 1: The graph for Problem 3

5. The percentage rate at which an animal loses heat in cold weather is proportional to the ratio of surface area of the animal to volume of the animal. A very rough approximation to this ratio is obtained if we assume that the animal is a sphere of radius r , so that the ratio Q of surface area to volume is

$$Q(r) = \frac{3}{r}.$$

- (a) Is Q an increasing or decreasing function of r ? What does this mean in terms of an animal? Would a small animal or a large animal be more likely to get too cold during cold weather?
- (b) At what rate is Q changing with respect to r when $r = 1/2$? At what rate is Q changing when $r = 1$?
- (c) Is there a maximum or minimum value of Q ? Why or why not?
6. If $f(x) = x^2 + x - 1$, then find the global maximum and global minimum of f over the interval $-1 \leq x \leq 1$.