

**First Exam**

*Monday, September 21, 2015*

This exam is closed book, but you may use calculators. Make sure your name is on all pages. Show all work, and show it in a logical and organized manner. Each entire problem is worth 25 points.

1. A company pays \$40,000 monthly for the lease on a factory building that produces suitcases, and it costs the company \$25 in materials and labor to manufacture each suitcase.
  - (a) Write down the total cost  $y$  to manufacture  $x$  suitcases as a function of the number  $x$  of suitcases produced.
  - (b) What is the  $y$ -intercept of the graph of this function?
  - (c) What is the slope (rate of change of  $y$  relative to  $x$ )?
2. \$100 is put into a bank account at the beginning of 2015. The account pays 4% compounded annually (paid at the end of the year).
  - (a) Write down a formula for the amount  $A(t)$  in the account as a function of  $t$  years.
  - (b) How much will be in the account at the beginning of 2035?
  - (c) Compute the average rate of change of money in the account between the beginning of 2015 and the beginning 2035.
  - (d) Compute the average rate of change of money in the account between the beginning of 2034 and the beginning of 2035.
  - (e) Comment on the difference between your answers in (c) and (d).
3. An amateur athletic event hopes to make money to support a local charity. The organizers need to pay \$1,000 for equipment rental and \$2000 for police protection along the race course, while it costs \$5 per participant for materials given to the participants. It is decided to charge an entry fee of \$25 per participant.
  - (a) Write down the cost  $C(n)$  to put on the event as a function of the number  $n$  of participants.
  - (b) Write down the revenue  $R(n)$  as a function of the number  $n$  of participants.
  - (c) How many participants must register for the organizers to be able to give money to the charity? Give the smallest possible number.
4. One of the main contaminants of a nuclear accident, such as that at Chernobyl, is strontium 90, which decays exponentially at a rate of 2.5% per year.
  - (a) Write the ratio of strontium-90 remaining,  $P$ , as a function of years  $t$ , since the nuclear accident.
  - (b) Draw a graph of  $P$ .
  - (c) Estimate the half-life of strontium-90.
  - (d) After the Chernobyl disaster, it was predicted that the region would not be safe for human habitation for 100 years. Estimate the percent of original strontium-90 remaining at that time.