Math. 270-05
Fall, 2005
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Fifth Examination
Thursday, December 1, 2005

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 closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 25 points. You may keep this exam sheet.

1. A weather balloon is released, and its velocity in the eastward direction is measured. (That is, positive velocities represent motion to the east, and negative velocities represent motion to the west.) A graph of the balloon's velocity in miles per hour as a function of hours since the balloon's release is shown in Figure 1.

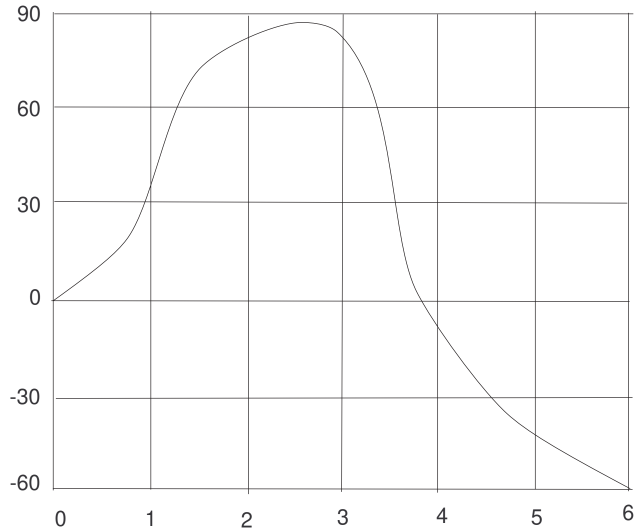

Figure 1: The eastward velocity of the weather balloon in Problem 1

   (a) Approximately how many hours after release is the balloon moving fastest in the eastward direction, and what is its approximate speed at that point?

   (b) Does the balloon ever change direction? If so, approximately how many hours after its release does it do so?

   (c) Approximately how far east does the balloon go from its starting position? (That is, what is the balloon's maximum distance east of its starting position?)

   (d) Approximately how many miles east of its starting position is the balloon

      i. 2 hours after release?

ii. 4 hours after release?

iii. 6 hours after release?

2. Compute exactly

$$\text{(a)} \int_{-1}^{1} xe^{-x^2} dx \qquad \text{(b)} \int_{-1}^{1} x^2 dx \qquad \text{(c)} \int_{-1}^{1} x^2 + x dx$$

3. Suppose f is odd, g is even, and

$$\int_1^2 f(x)dx = 1, \qquad \int_0^1 g(x)dx = 2, \qquad \text{and} \quad \int_1^2 g(x)dx = 3.$$

Then compute $\int_{-1}^{2} 2f(x) + g(x)dx$.

4. Compute the average value of x^2 over the interval 0 to 4.