First Examination
Tuesday, January 30, 2007

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. You may keep this exam sheet.

1. (25 points) If $F'(x) = f(x)$ is as in the graph in figure 1, and $F(0) = 0$, then draw a corresponding graph of $F(x)$. Be sure to label the axes on your graph.
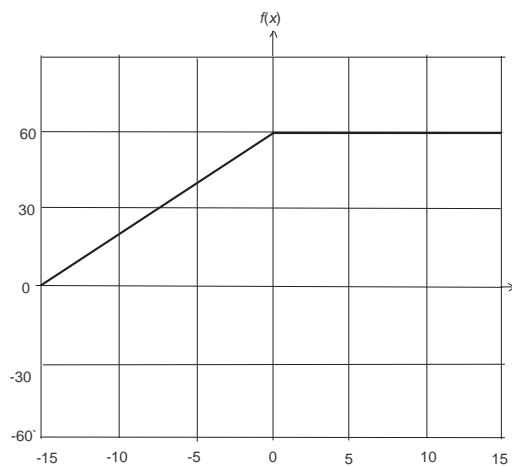

Figure 1: The figure for problem 1

2. (10 points apiece) Compute:

   (a) $\displaystyle \int x^2 + 2x + 1 \, dx$

   (b) $\displaystyle \frac{d}{dx} \int_{t=0}^{t=x} \sin(e^{t^2+t}) \, dt$

   (c) $\displaystyle \frac{d}{dt} \int_{x=0}^{x=t} \sin(e^{x^2+x}) \, dx$

   (d) $\displaystyle \frac{d}{dx} \int_{t=x^2}^{t=x^2+1} t^2 e^t \, dt$

3. (35 points) A small runway near Erath warns "Caution: short runway – 2500 feet." Suppose that your Cessna 170B plane must approach the runway at 67 miles per hour, and suppose a deceleration of 3.45 ft./sec.^{2} can be applied once the plane is over the runway. Can your plane land on this small runway? Show the following work in answering this question:

   (a) Write down the distance travelled on the runway as a function of time.

   (b) Show how you find the total time it takes to stop your airplane.

   (c) Show how you can use the above to compute the distance it takes to stop the airplane.