Math 20A
Final Examination
December 12, 2012
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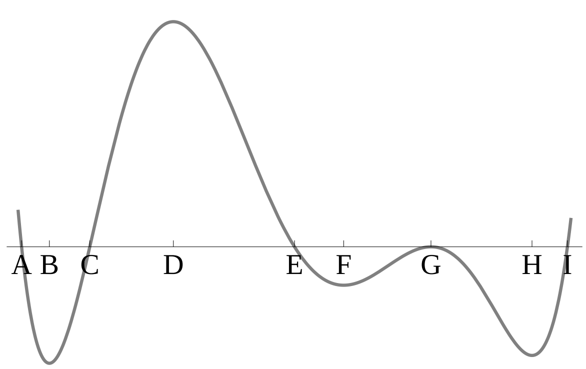
Version A

Instructions

1. **No calculators or other electronic devices are allowed during this exam.**
2. **You may use one page of notes, but no books or other assistance during this exam.**
3. **Write your *Name*, *PID*, and *Section* on the front of your Blue Book.**
4. **Write the *Version* of your exam at the top of the page on the front of your Blue Book.**
5. **Write your solutions clearly in your Blue Book**
   (a) **Carefully indicate the number and letter of each question and question part.**
   (b) **Present your answers in the same order they appear in the exam.**
   (c) **Start each question on a new side of a page.**
6. **Read each question carefully, and answer each question completely.**
7. **Show all of your work; no credit will be given for unsupported answers.**

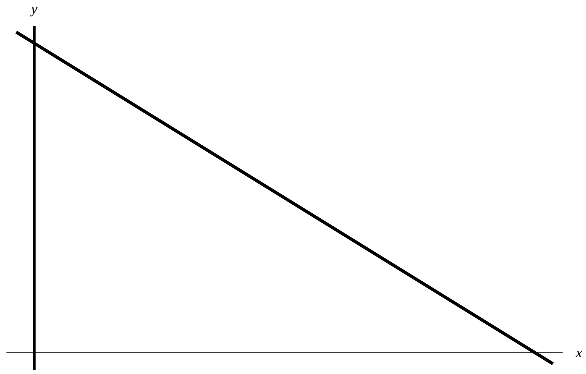
0. (1 point) Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard.

1. (10 points) The graph of a function f is given below. Let the function F be defined by $F(x) = \int_A^x f(t)\,dt$. Determine the points at which $F(x)$ has each of the following features and briefly justify each answer:
   (a) a critical point
   (b) a local maximum
   (c) a local minimum
   (d) its absolute maximum
   (e) an inflection point?



Note: Problems 2 – 8 are on the other side of this page.

2. (6 points) Find the equation of the line through the point $(4, 7)$ such that the triangle bounded by this line and the axes in the first quadrant has minimal area.



3. (6 points) A 25-foot ladder is leaning against a wall. The bottom of the ladder slides away from the wall at 3 feet per second. How fast is the area of the triangle formed by the ladder, wall, and floor changing when the bottom of the ladder is 20 feet from the wall? (Note: $20^2 = 400$, $15^2 = 225$, and $25^2 = 625$; thus, $20^2 + 15^2 = 25^2$.)

4. (6 points) Evaluate the following expressions.

   (a) $\displaystyle\int \left(\frac{\omega^2 + 1}{\omega} + \frac{1}{\omega^2 + 1} \right) d\omega$

   (b) $\displaystyle\int_{-e}^{-1} \frac{2012}{x}\, dx$

   (c) $\displaystyle\frac{d}{dx} \cos\left(\sin\left(x^2\right)\right)$

5. (8 points) An object moves along a straight line. Its velocity (in meters per second) is given by

$$v(t) = t^2 + t - 6\,.$$

   (a) Determine the displacement of the object over the interval $[0, 3]$.

   (b) Determine the distance that the object travels over the interval $[0, 3]$.

6. (6 points) Use a linear approximation to estimate $\tan\left(\frac{\pi}{4} + 0.0002\right) - 1$.

7. (6 points) Find the limit $\displaystyle\lim_{x \to 0^+} x^{\sin(2x)}$.

8. (a) (4 points) Find the derivative $F'(x)$ of the function $F(x) = \displaystyle\int_x^{\pi} \sqrt{1 + \sec(2t)}\, dt$.

   (b) (4 points) Find the derivative $h'(x)$ if $h(x) = \displaystyle\int_1^{1/x} \arctan(2t)\, dt$.