

**April 24, 2002**

Your name \_\_\_\_\_

All the problems are marked with their value. The total number of points available is 114. Throughout the test, **show your work.**

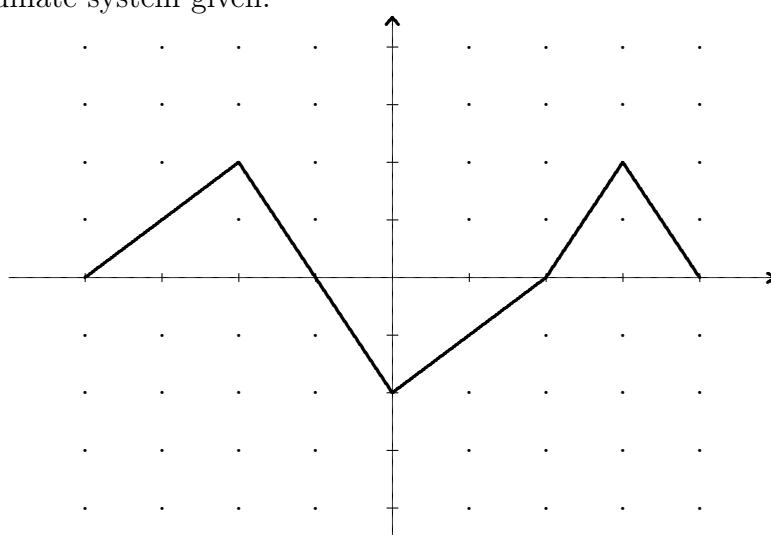
1. (10 points) Find the interval(s) over which the function  $f(x) = 2x^3 + 3x^2 - 36x + 17$  decreasing?

2. (10 points) Find the absolute maximum value of the function  $f(x) = e^{-x^2+x}$  on the interval  $-2 \leq x \leq 3$ .

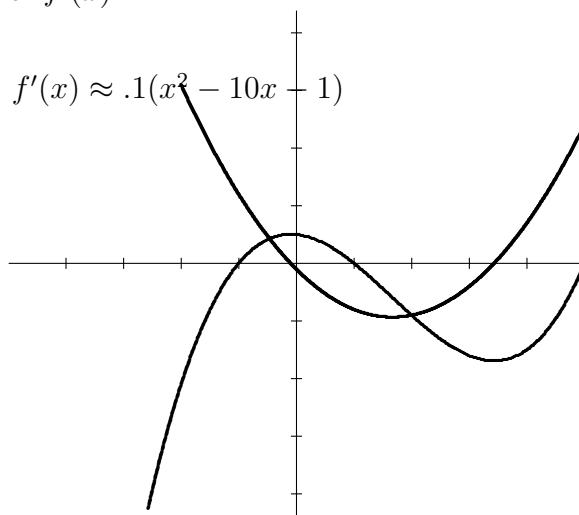
3. (10 points) Let  $g(x) = \ln((2x - 3)(2x + 1)(x + 3)(x - 5))$ . Find the (implied) domain of  $g$ .

4. (10 points) Sketch an example of a continuous function  $f(x)$  that has domain  $[-4, 4]$ , and satisfies the following requirements.
- (a)  $f(-4) = f(-1) = f(2) = 0$ .
  - (b)  $f$  is increasing on  $[-4, -2]$ .
  - (c)  $f$  has a singular point at  $x = 3$ .
  - (d)  $f$  has a relative maximum at  $x = 3$  and a value of 2 at  $x = 3$ .

Use the coordinate system given.

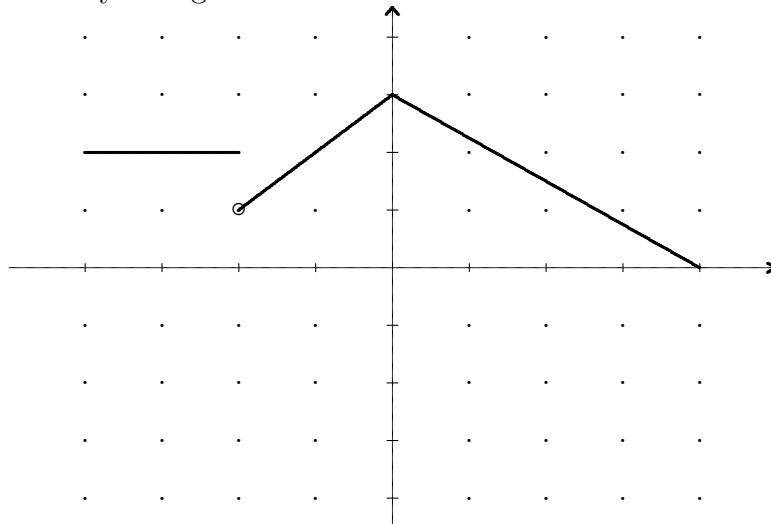


5. (10 points) Let  $f$  be the function whose graph is shown below. On the same axes, plot the graph of  $f'(x)$ .



6. (10 points) Sketch an example of a function  $f(x)$  that has domain  $[-4, 4]$ , and satisfies the following requirements. Please note: this problem has been slightly modified from the original, which interchanged the 1 and the 2 in the first two conditions.
- (a)  $\lim_{x \rightarrow -2^+} f(x) = 1$ .
  - (b)  $\lim_{x \rightarrow -2^-} f(x) = 2$ .
  - (c)  $f(2) = 0, f(0) = 3$
  - (d)  $f$  is linear on the interval  $[0, 4]$ .
  - (e)  $f$  has an absolute maximum at  $x = 0$ .

Use the coordinate system given.



7. (10 points) Solve the equation  $2 + 3 \cdot 5^{2x+1} = 77$ .

8. (10 points) Compound Interest. Find the time required for an 8% investment compounded quarterly to triple.

9. (12 points) Compute the following limits.

(a)  $\lim_{x \rightarrow \infty} \frac{3x^3 - 5x^2 + 10}{2x^3 + 10x - 5}.$

(b)  $\lim_{x \rightarrow 2} \frac{x - 2}{x^2 - 4}.$

(c)  $\lim_{x \rightarrow 9} \frac{\sqrt{x} - 3}{x - 9}.$

10. (12 points) Find the following derivatives.

(a)  $\frac{d}{dx} xe^x$

(b)  $\frac{d}{dx} \frac{\ln(x)}{x}$

(c)  $\frac{d}{dx} e^{\ln(x^5+x^2-2x)}$

11. (10 points) Let

$$f(x) = \begin{cases} -x/2 + 2 & \text{if } x \leq -1 \\ x + 3 & \text{if } -1 < x < 3 \\ x^2 - 5x & \text{if } 3 \leq x \end{cases}$$

Find an equation for the line tangent to the graph of  $f$  at the point  $(4, -4)$ .