MTH 139-02

Exam 2 **Thursday, October 23, 2003**

Name:__________________________

Remember to **show your work**. Unsupported solutions will receive no credit.

> **The calculus is the greatest aid we have to the appreciation of physical truth in the broadest sense of the word.**
>
> **– W. F. Osgood, quoted in Bulletin American Mathematical Society**

1. (50 points) Differentiate each function. You do not need to simplify your answers.

   (a) $f(x) = 15x^9 - 3x^6 + 5$

   (b) $f(x) = 10e^x$

   (c) $g(x) = (5x^9 - 7x^3 + 2)^6$

   (d) $h(x) = (x^2 + 1)e^{3x}$

   (e) $f(x) = 5\ln(x)$

(f) $f(x) = \dfrac{5e^x}{3e^x + 1}$

(g) $f(t) = \sqrt{4t^3 + 3t}$

(h) $f(x) = e^{5x^2+9}$

(i) $w(p) = \dfrac{1}{p}$

(j) $f(x) = e^{\ln(x)}$.

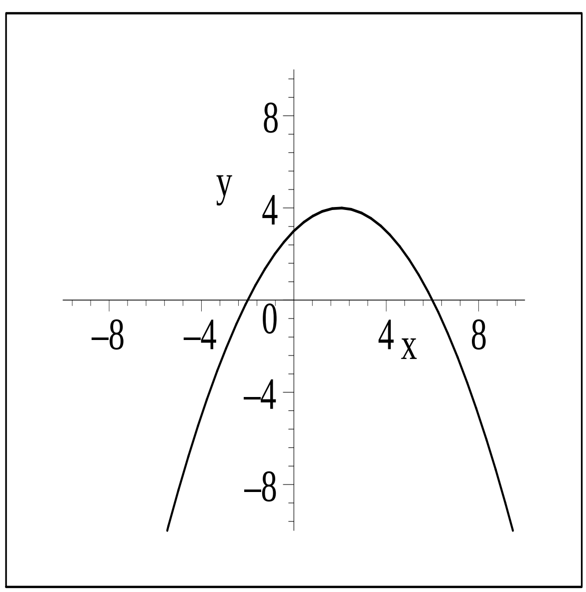
2. (10 points) Use the definition of the derivative to show that $\dfrac{d}{dx}(5x^2) = 10x$. **You must show your work to receive credit!**

3. (12 points) Be sure to **show all work**.

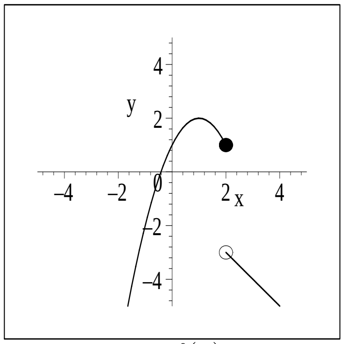
(a) Find all local extrema of $f(x) = 2x^3 - 3x^2 - 36x + 12$ and determine whether each is a maximum or a minimum.

(b) Find all global extrema of $f(x)$ on $[-1, 4]$.

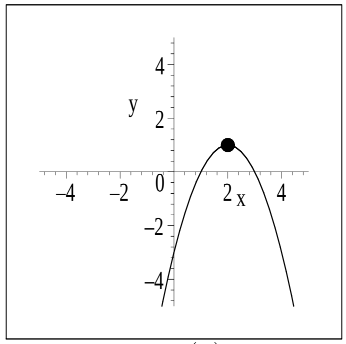
4. (6 points) Below is the graph of $y = f'(x)$. Sketch a possible graph of $y = f(x)$ on the same set of axes.



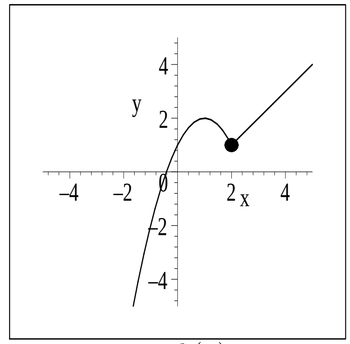
5. (12 points) Consider the functions graphed below.



$y = f(x)$



$y = g(x)$



$y = h(x)$

(a) Determine which of f, g, and h is/are continuous at $x = 2$. Specify for each function whether it is or is not.

(b) Determine which of f, g, and h is/are differentiable at $x = 2$. Specify for each function whether it is or is not.

6. (5 points) True or False.

(a) _______________ $\lim_{x\to 5}(4x^2 - 3) = 97$.

(b) _______________ If $f''(2) = 0$, then $x = 2$ is an inflection point.

(c) _______________ If f' is increasing, then f is concave up.

(d) _______________ If $f'(2) = 0$, then $f(2)$ is a local extremum.

(e) _______________ The function $f(x) = \dfrac{x+1}{x-1}$ is continuous at $x = 2$.

7. (5 points) Find all inflection points of $f(x) = x^4 - 12x^3 + 48x^2 - 28x + 10$.