

Math 151**Exam 2**

Justify all answers with neat and organized work. Clearly indicate your answers. 100 points possible.

1. (10 pts.) Let $f(x) = 2x^3 + 3x^2 - 12x$. Find the absolute maximum and absolute minimum values of f on the interval $[-3, 3]$.

2. (10 pts.) Let $f(x) = x^4 - 6x^2$. Find the intervals on which f is increasing and those on which f is decreasing.

3. (10 pts.) The graph of the *derivative* f' of a continuous function f is shown in Figure 3 on the last page.

(a) Find the intervals on which f is increasing and those on which f is decreasing.

(b) Find the intervals on which f is concave upward and those on which f is concave downward.

4. (10 pts.) Find this limit, if it exists. (Show the algebra to support your answer, but you don't have to quote limit laws.) If it doesn't exist, clearly explain why, and tell whether it can be expressed with the $+\infty$ or $-\infty$ symbol.

$$\lim_{x \rightarrow +\infty} \frac{(x-1)(x+2)}{(2x+1)(3x-2)}$$

5. (30 pts.) Find $\frac{dy}{dx}$. Please do *not* simplify your answers. Use parentheses carefully.

(a) $y = x^5(\cos x + \tan x)$

(b) $y = \frac{x}{\sin x + \cos x}$

(c) $y = \sin(\cos x)$

(d) $y = (3x-2)^{10}(5x^2-x+1)^{12}$

(e) $y = (1 + \sin^2 x)^6$

6. (10 pts.) If $x^3y + xy^3 = 6$, find dy/dx by implicit differentiation.

7. (10 pts.) Two cars start moving from the same point. One travels south at 25 mi/hr and the other travels west at 60 mi/hr. At what rate is the distance between the cars increasing two hours later?

8. (10 pts.) Find the differential dy . Then evaluate dy for the given values of x and dx .

$$y = x^4 + 2x, \quad x = 3, \quad dx = 0.05$$