

MATH 2250  
PRACTICE Exam # 3

Name \_\_\_\_\_

Important things:

- Remember, you must show your work to receive credit. Your work must be **neat**. If I can't read it (or can't find it), I can't grade it.
- You don't have to work through the test in order. Go in the order you want to.
- You are allowed to use a TI-30 calculator as long as it is NOT a TI-30X Pro. No other calculators are permitted, and sharing of calculators is not permitted.
- I hope you do a great job!

Problem	Score	Out of
1		14
2		14
3		16
4		12
5		14
6		18
7		12
Total		100

**I will be academically honest in all my academic work and will not tolerate academic dishonesty of others.**

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

1. (14 points) Find the absolute maximum and minimum values of  $f(x) = 6x^{3/2} - 4x^{1/2}$  on the interval  $[0, 4]$ .

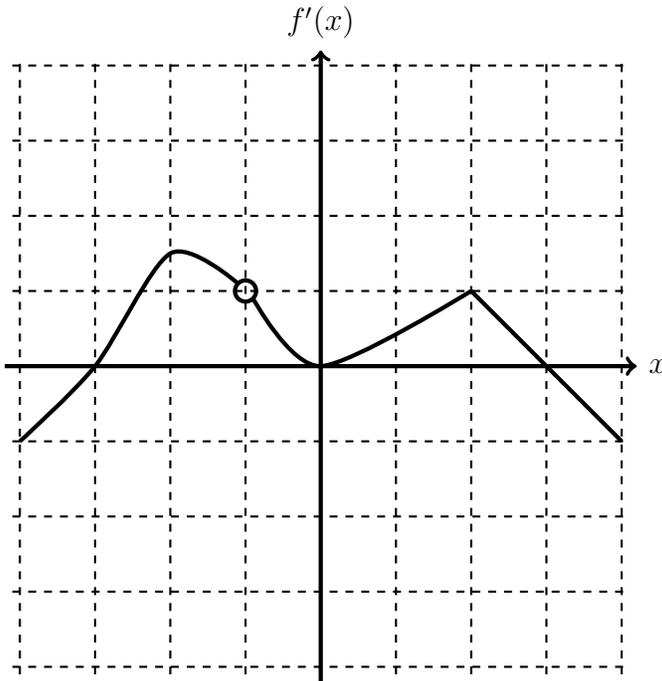
2. (a) (3 points) State the Matching Derivative Property.

(b) (3 points) Explain how the Matching Derivative Property follows from the Zero Derivative Property.

(c) (8 points) Assume  $f$  is differentiable. Which of the following statements does NOT follow from the Mean Value Theorem?

- i. If  $f$  has a secant line of slope 0, then  $f$  has a tangent line of slope 0.
- ii. If  $f(3) < f(7)$ , then  $f'(c) > 0$  for some  $c$  in  $(3, 7)$ .
- iii. If  $f$  has a tangent line of slope 0, then  $f$  has a secant line of slope 0.
- iv. If  $f'(x) > 0$  for all  $x$ , then every secant line has positive slope.

3. The graph below is the graph of the derivative of  $f$ . Use it to answer the questions that follow, keeping in mind that the graph below is the graph of  $y = f'(x)$ . The domain of the function  $f(x)$  is the interval  $(-4, 4)$ .



- (a) (4 points) Determine the critical numbers of  $f(x)$ .
- (b) (4 points) Determine intervals where  $f(x)$  is increasing and decreasing.
- (c) (4 points) Determine intervals where  $f(x)$  is concave up and concave down.
- (d) (4 points) Determine all inflection points of  $f(x)$ .

4. (12 points) Use the Second Derivative Test to determine all relative extrema for the function  $f(x) = \frac{x^2 - 8x}{x + 1}$ .

5. Determine the following limits. If your answer for a limit is  $\infty$  or  $-\infty$ , include some explanation of your choice.

(a) (6 points)  $\lim_{x \rightarrow 0} \frac{\sin(x) - x \cos(x)}{x - \sin(x)}$

(b) (8 points)  $\lim_{x \rightarrow 1} (1 + \ln(x))^{1/(x-1)}$

6. (18 points) Jane is 4 mi offshore in a boat and wishes to reach a coastal village 5 mi down a straight shoreline from the point nearest the boat. She can row 2 mph and walk 5 mph. Where should she land her boat to reach the village in the least amount of time?

7. (a) (5 points) What is the formula for the differential of the function  $y = f(x)$ ?

(b) (7 points) The surface area of an 8 centimeter tall, cylindrical can, *without base and lid*, is measured to be  $40\pi$  square centimeters, with an error that is at most 2% of the actual surface area. Use a differential to approximate the percentage error in the radius of the cylinder that is caused by the error in measuring the surface area of the can.

Extra space for work. If you want me to read/grade the work on this page you should write me a note on the corresponding question's page.