

VCU
MATH 200
CALCULUS I

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TEST 3



July 7, 2014

Name: _____

Score: _____

Directions. Answer the questions in the space provided. Unless noted otherwise, you must show and explain your work to receive full credit. Put your final answer in a box when appropriate.

This is a closed-book, closed-notes test. Calculators, computers, etc., are not used.

1. (30 points) Find the indefinite integrals.

$$(a) \int (e^x + x^4 + 3) dx =$$

$$(b) \int \frac{1}{\sqrt{x}} dx =$$

$$(c) \int 5x^{-1} dx =$$

$$(d) \int \sec^2(x) dx =$$

$$(e) \int \frac{1}{1+x^2} dx =$$

2. (10 pts.)

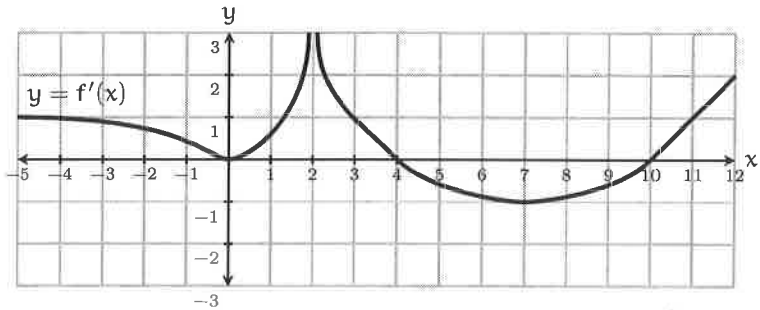
(a) Is the following equation true or false? Explain.

$$\int x \cos(x) dx = \frac{x^2}{2} \sin(x) + C$$

(b) If $f(x)$ and $g(x)$ are differentiable functions, then

$$\int f'(g(x))g'(x) dx =$$

3. (15 pts.) The derivative $f'(x)$ of a function $f(x)$ is graphed below. Answer the questions about $f(x)$. (The domain of $f(x)$ is $(-5, 12)$.)



- State the intervals on which $f(x)$ increases.
- State the intervals on which $f(x)$ decreases.
- List all critical points of $f(x)$.
- At which of its critical points does $f(x)$ have a local maximum?
- At which of its critical points does $f(x)$ have a local minimum?
- State the intervals on which the function $f(x)$ is concave up.
- State the intervals on which the function $f(x)$ is concave down.
- Based on this information, sketch a possible graph of $f(x)$ on the coordinate axis above.

4. (20 pts.) Find the limits.

(a) $\lim_{x \rightarrow 0} \frac{8x^2}{\cos(x) - 1} =$

(b) $\lim_{x \rightarrow \infty} (\ln(x))^{1/x} =$

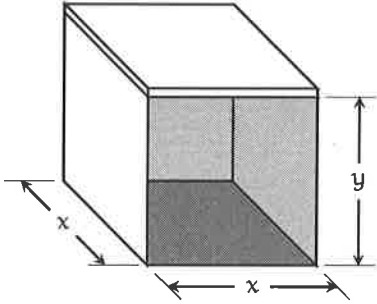
5 (15 pts.) You need to build a shed with an open front and square base (as illustrated), and containing a volume of 10,000 cubic feet. The cost of construction materials as follows:

Roof: \$10 per square foot;

Walls: \$8 per square foot;

Floor: \$5 per square foot.

What dimensions x and y will minimize the total cost of materials?



6. (10 pts.) Suppose $f(x)$ is a function for which
 $f'(x) = \frac{1}{2} \sec(x) \tan(x)$ and $f(0) = 1$. Find $f(x)$.