231 EXAM 3

You may use your notebook during the last 15 minutes of this exam.

You may NOT use calculators, cell phones, loose papers, or peeking.

Math 231
November 12, 2013.

Name: * KEY *

By printing my name I pledge to uphold the honor code.

1. Which is the following is equal to the derivative of $f(x) = \dfrac{(x-1)(x-2)}{x-3}$?

A) $f'(x) = \dfrac{x^2-3x+2}{x-3}$

B) $f'(x) = \dfrac{(x-1)+(x-2)}{(x-3)^2}$

C) $f'(x) = \dfrac{x^2-6x+7}{(x-3)^2}$

D) $f'(x) = \dfrac{2x-3}{1}$

2. If $f'(x) < 0$ on an interval (a, b), circle ALL of the following that must also be true on the interval (a, b).

A) f is negative

B) f is decreasing

C) f' is decreasing

D) f'' is decreasing

3. If $f''(x) > 0$ on an interval (a, b), circle ALL of the following that must also be true on the interval (a, b).

A) f' is concave up

B) f' is increasing

C) f'' is positive

D) f'' is increasing

4. Suppose Alina wants to make a box with a square base whose sides and base are made of wood that costs 4 cents per square inch, and whose top is made of metal that costs 10 cents per square inch. If Alina has \$20.00 to spend on making this box, what constraint equation does this impose on the side length s of the base and the height h of the box?

A) $(4s)^2(10h) = 2000$

B) $s^2h = 2000$

C) $4(4sh + s^2) + 10s^2 = 2000$

D) $4s + 4h + 10s^2 = 2000$

5. Suppose $x = c$ is a local maximum of a function f. Circle ALL of the following that must be true as $x \to c+$ (for x sufficiently close to c).

A) $x - c > 0$

B) $f(x) - f(c) \leq 0$

C) $\dfrac{f(x) - f(c)}{x - c} \leq 0$

D) $\lim\limits_{x \to c^+} \dfrac{f(x) - f(c)}{x - c} \leq 0$

6. Suppose $f(x) = 9 - x^2$. What is the value of c that satisfies the conclusion of the Mean Value Theorem for this function on the interval $[0, 3]$?

A) $x = \frac{4}{3}$ B) $x = \frac{2}{3}$ C) $x = -\frac{2}{3}$ D) $x = \frac{3}{2}$

7. Given that r is an independent variable, s is a function of r, and q is a constant, calculate $\frac{d}{dr}(rs^2)$.

A) $s^2 + 2rs\frac{ds}{dr}$ B) $2s\frac{ds}{dr}$ C) $\frac{dr}{ds}s^2 + 2rs$ D) $s^2 + 2rs$

8. Suppose the radius r, height h, and volume V of a cylinder are functions of time t. How is $\frac{dV}{dt}$ related to $\frac{dr}{dt}$ if the height of the cylinder is constant?

A) $\frac{dV}{dt} = 2\pi rh + \pi r^2\frac{dr}{dt}$

B) $\frac{dV}{dt} = 2\pi rh$

C) $\frac{dV}{dt} = \pi(\frac{dr}{dt})^2\frac{dh}{dt}$

D) $\frac{dV}{dt} = 2\pi rh\frac{dr}{dt}$

9. Suppose $x = 2$ is a critical point of $f(x)$. Circle ALL of the following that would prove that $x = 2$ is a local maximum of $f(x)$.

A) Showing that $f'(2)$ is positive.

B) Showing that $f'(2)$ is negative.

C) Showing that $f''(2)$ is positive.

D) Showing that $f''(2)$ is negative.

10. Suppose Linda is 6 feet tall and walking away from a 10-foot streetlight. As she walks away from the streetlight, her shadow gets longer. What is the relationship between the rate of change of the length l of her shadow and the rate of change of her distance s from the streetlight?

A) $4\frac{dl}{dt} = 6\frac{ds}{dt}$ B) $10\frac{dl}{dt} = 6\frac{ds}{dt}$ C) $\frac{10}{6} = \frac{dl}{dt} + \frac{ds}{dt}$ D) $\frac{10}{6} = \frac{dl}{dt}\frac{ds}{dt}$