Name _____

UWSP Math 111 Section 4

Exam 2 (over sections 3.6-4.4) (partial credit possible so show all your work)

1. (4 pts.) Find dy/dx by implicit differentiation $2x^2 + y^2 = 16$

Answer: dy/dx = _____

2. (8 pts.) Find d^2y/dx^2 if $xy - y^3 = 4$

Answer: d^2y/dx^2 = _____

3. (8 pts.) Find an equation of the tangent line to the graph of the function f defined by the equation at the indicated point. $X^2y^3 - y^2 + xy - 1 = 0$ (1,1)

Answer: y = _____

4. (10 pts.) A Sliding Ladder: The base of a 13 ft ladder leaning against a wall begins to slide away from the wall. At the instant of time when the base is 12 ft from the wall, the base is moving at the rate of 9 ft/sec. How fast is the top of the ladder sliding down the wall at that instant of time? Hint: Make a diagram of the ladder leaning against the wall and note $x^2 + y^2 = 169$ (where x is the base from the bottom of the ladder to the wall and y is the height). Find dy/dx when x = 12 and dx/dt = 9.

Answer: dy/dx = _____

5. (6 pts.) Find the interval(s) where the function is increasing and the interval(s) where it is decreasing.

$f(x) = x^3 - 3x^2$

Increasing interval(s) _____

Decreasing interval(s) _____

6. (6 pts.) Find the relative maxima and relative minima, if any, of f(x)

$f(x) = (1/3)\, x^3 - x^2 - 3x + 4$

Relative maxima ____(_____ , _____)___

Relative minima ____(_____ , _____)___

7. (6 pts.) Determine where the graph of the function is concave upward and where it is concave downward

$f(x) = 3\, x^2 - 6\, x - 24$

Concave upward _____

Concave downward _____

8. (6 pts.) Find the inflection point(s), if any, of $f(x) = 2\, x^3 - 3\, x^2 + 18\, x - 8$

Inflection point(s): ____(_____ , _____) _____ (_____ , _____) (_____ , _____)

9. (6 pts.) Find the relative extrema, if any, of $f(x) = 2x^2 - 8x + 7$ Use the Second Derivative Test if applicable for determining if it is a relative maximum or relative minimum.

Answer: (_____, _____) is a relative _____

10. (6 pts.) Sketch the graph of a function having the given properties.
$f(2) = 4$, $f'(2) = 0$, $f''(x) < 0$ on $(-\infty, \infty)$

11. & 12. (6 pts. each) Find the horizontal and vertical asymptotes of the graph of the function. (You need NOT sketch the graph)

11. $f(x) = 1 / (x+2)$

12. $f(x) = 2x^3 + x^2 + 1$

horizontal asymptote(s) _____

vertical asymptote(s) _____

horizontal asymptote(s) _____

vertical asymptote(s) _____

13. (10 pts.) Sketch the graph of the function $f(x) = (x^2 - 9) / (x^2 - 4)$

14. (4 pts.) Find the absolute maximum value and the absolute minimum value, if any, of each function.

$f(x) = x^2 - 2x - 3$ on $[0, 4]$

absolute maximum value _____

absolute minimum value _____

15. (4 pts.) $f(x) = 9x + (1/x)$ on $[1, 3]$

Absolute maximum value _____

Absolute minimum value _____

Extra credit

1. (3 pts.) A stone is thrown straight up from the roof of an 80 ft. building. The height (in feet) of the stone at any time t (in seconds), measured from the ground, is given by

$h(t) = -16\,t^2 + 64\,t + 80$

What is the maximum height the stone reaches? _____

2. (3 pts.) Maximizing Profits Acrosonic's total profit (in dollars) from manufacturing and selling x units of their model F loudspeaker systems is given by

   $P(x) = -0.02\,x^2 + 300\,x - 200{,}000 \quad (0 \le x \le 20{,}000)$

How many units of the loudspeaker system must Acrosonic produce to maximize its profits? _____

3. (4 pts.) The volume V of a cube with sides of length x in. is changing with respect to time. At a certain instant of time, the sides of the cube are 5 in. long and and increasing at the rate of 0.2 in./sec. How fast is the volume of the cube changing at that instant of time?

Answer: $dV/dt =$ _____