Math 171 - Test 2

October 17, 2013

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (11 points) The graph of the equation $4y^2 = x^3 + xy^2$ is called a *cissoid*. Find an equation of the line tangent to the cissoid at the point $(2, -2)$.

2. (7 points) Find all critical numbers of the function $f(x) = 3x^{2/5} - 2x^{7/5}$.

3. (9 points) A dog runs away from a 10-ft lampost at a rate of $4\,\text{ft/sec}$. At what rate is the distance between the light bulb and the dog changing at the moment when the dog is $12\,\text{ft}$ from the post?

4. (6 points) Let $f(x) = x^2 - 3x + 4$. Find a number c that satisfies the conclusion of the Mean Value Theorem for f on $[-1, 2]$.

5. (12 points) An object is launched upward with an initial speed of $64\,\text{ft/sec}$ over the side of a 192-ft cliff. (Use $g = 32\,\text{ft/sec}^2$.)

(a) Determine the function that gives the object's height at time t.

(b) What is the object's velocity after 4 seconds?

(c) What is the object's maximum height?

(d) When will the object hit the ground?

(e) Determine the object's acceleration function.

6. (12 points) Differentiate. Do not simplify.

   (a) $\dfrac{d}{dw} \ \sqrt[3]{w^2 + w}$

   (b) $\dfrac{d}{dt} \left(\dfrac{t+5}{t^2+5} \right)^2$

   (c) $\dfrac{d}{dx} \ \cos^2(6x)$

7. (6 points) Suppose f and g are increasing, differentiable functions. Is $f+g$ an increasing function? Explain your reasoning. Is $f - g$ an increasing function?

8. (12 points) Consider the function $f(x) = x^4 - 18x^2 + 9$. Determine open intervals on which f is increasing/decreasing. Also identify all relative extreme values.

9. (6 points) Sketch the graph of a nonconstant function f that is continuous on $[-3, 4]$, differentiable on $(-3, 4)$, and that satisfies $f(-3) = f(4) = 2$. Then identify a point on the graph that satisfies the conclusion of Rolle's Theorem.
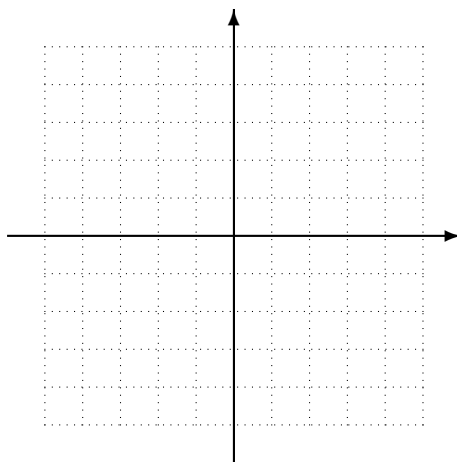
10. (6 points) Find $g''(x)$ if $g(x) = (x^3 + 4x)^5$.

11. (8 points) Find the absolute maximum and minimum values of $g(x) = x + 2\cos x$ on the interval $[0, 2]$.

12. (5 points) Determine the higher-order derivative: $\dfrac{d^3}{dx^3}\left(2x^8 - 5x^4 - 5\sin x\right)$