1. Differentiate the following using ***Differentiation Rules***

(a). $s(t) = (3t^3 - t^2 + 7)^{23}$

(b). $y = \dfrac{x(2x^4+4)^8}{\tan 2x}$ [Do not simplify!]

(c). $f(\theta) = \theta \sin(\theta^2 + 1)$

2. Find the equation of the tangent line to the curve $y = \sqrt[3]{2x^2 - 5}$ at $x = 4$.

3. Given $f(x) = g(3x^2)$, find f' in terms of g'.

4. If a stone is thrown vertically upward on the moon with a velocity of 8 m/s, its height after t seconds is given by $y = 8t - 0.83t^2$

(a). What is the velocity after 2 s?

(b). What is the velocity at impact?

5. A tank holds 1000 gallons of water, which drains from the bottom of the tank in 50 minutes. Torricelli's Law gives the volume V of water remaining in the tank after t minutes as $V = 1000\left(1 - \dfrac{1}{50}t\right)^2$ for $0 \le t \le 50$. Find the rate at which the water is draining from the tank after 10 minutes. Include units in your answer.

6. The cost function for a certain commodity is $C(x) = 60 + 0.12x - 0.0004x^2 + .000002x^3$.

(a). Find the marginal cost function.

(b). Find and interpret $C'(50)$.

(c). Compare $C'(50)$ with the cost of producing the 51st item.

7. Any Section 2.7 applications.

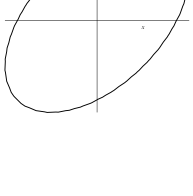
8. Given the curve drawn below and defined by $x^2 + y^2 = 3 + xy$

(a). Find $\dfrac{dy}{dx}$

(b). On the graph below, sketch any tangents lines to the curve where the slope is 0.

(c). Use part **(a)** to find these points on the curve where the slope is 0. Must show work for credit.

(d). Find $\dfrac{d^2y}{dx^2}$ in terms of x and y.



9. Given $f(x) = \sqrt{x} = x^{1/2}$

(a). Find the linearization $L(x)$ at $a = 25$

(b). Use this linearization $L(x)$ to approximate $\sqrt{24.7}$ [Simplify your answer.]

(c). Find the differential dy for x going from 25 to 25.5.

10. A ladder 8 feet long is leaning against the wall of a house. On the ground, the base of the ladder is being pulled away from the wall at a rate of $\frac{3}{2}$ ft/sec. How fast is the angle between the top of the ladder and the wall changing when the this angle is $\frac{\pi}{3}$.

11. A particle moves along the curve $xy^2 = 12$. As it reaches the point $(3, 2)$, the y-coordinate is decreasing at a rate of 2 cm/s. How fast is the x-coordinate of the particle position changing changing at that instant?

12. Find the critical numbers for $g(t) = 4t^3 - 3t^2 + 1$

13. Given $f(x) = 2\sqrt{x} - x$, find the absolute maximum and minimum *values* of $f(x)$ on the interval $[0, 2]$.

14. Given $f(x) = \dfrac{(x-1)^3}{x^2}$

(a). Find the intervals of increase or decrease.

(b). Find the local maximum and minimum values.

(c). Find the intervals of concavity and the inflection points.

15. Given $f(\theta) = \cos^2(\theta)$, on $0 \le \theta \le 2\pi$,

(a). Find the intervals of increase or decrease.

(b). Find the local maximum and minimum values.

(c). Find the intervals of concavity and the inflection points.

16. Section 3.3 #27

17. Apply the Mean Value Theorem to the function $f(x) = \sqrt{x-2}$ on the interval [2, 6] and find all values of c that satisfy the MVT.