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

**(a).** $s(t) = \sqrt[3]{(t^3 + 3t^2 + 4)^2}$

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

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

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

**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 $g'$.

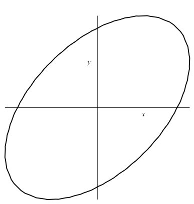
**4.** Given the curve drawn below and defined by $x^2 + y^2 = 3 + xy$

**(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 $y$.



**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 $V = 1000\left(1 - \frac{1}{50}t\right)^2$ 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 $C(x) = 60 + 0.12x - 0.0004x^2 + .000002x^3$. [Calculator*]

**(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.** 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 $y = 8t - 0.83t^2$, [Calculator*]

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

**(b).** What is the velocity at impact?

**8.** Any Section 2.7 applications.

**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.]

**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 <u>absolute</u> maximum and minimum <u>*values*</u> of $f(x)$ on the interval $[0, 9]$.

**14.** Given $f(x) = \dfrac{(x-1)^3}{x^2}$ $f'(x) = \dfrac{(x-1)^2(x+2)}{x^3}$ $f''(x) = \dfrac{6(x-1)}{x^4}$

**(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

*Similar non-calculator problems could be given.