

1. Find the following limits and be sure to prove your answers. You may not use "dominance of powers."

$$a) \lim_{x \rightarrow \infty} \frac{x^2 - 3x}{4 + 8x^2}$$

$$b) \lim_{x \rightarrow \infty} \frac{\sin^2 x}{4 + 8x^2}$$

$$c) \lim_{x \rightarrow \infty} \frac{x^5 + 4x - 7}{4 + 8x^2}$$

2. Given the following information, draw an accurate graph:

$$\lim_{x \rightarrow \infty} f(x) = 3,$$

$$\lim_{x \rightarrow -\infty} f(x) = 3,$$

$$\lim_{x \rightarrow -2} f(x) = \infty,$$

$$f(0) = 4$$

$$f'(x) < 0 \text{ when } x < -2, \quad f'(x) < 0 \text{ when } x > -2$$

$$3. \text{ Given the function } y = \frac{2x-1}{x+3}$$

$$y' = \frac{7}{(x+3)^2}$$

$$y'' = \frac{-14}{(x+3)^3}$$

- Prove it is even, odd or neither
- Prove if it has horizontal, vertical, and/or slant asymptotes
- Use the derivatives to make first and second degree charts
- Find at least two points on the graph
- Use all of the information to draw an accurate graph, label points, asymptotes and axes

4. Suppose that a rectangle has its base along the x-axis and its upper vertices on the circle $x^2 + y^2 = 300$, what dimensions would yield the rectangle of greatest area?

5. Integrate the following:

$$a) \int (x^3 - 4x^2 + \frac{2}{x^3} + \frac{3}{\sqrt[3]{x^4}} - \cos x + \sin 7x - 3\pi) dx$$

$$b) \int (1 + \tan^2 x) dx$$

$$c) \int 6x(x^2 - 4) dx$$

$$d) \int 6 \cos x (\sin x - 4)^5 dx$$

6. Suppose you shoot a rocket straight up. The force of gravity is $a(t) = -32 \text{ ft/sec}^2$. You know that the initial velocity is 160 ft/sec and the initial position is 16 ft.

- Find the equation that describes the position of the rocket.
- When does the rocket hit its maximum height?
- What is the maximum height?
- When does the rocket return to the initial position?

7. Suppose that I want to use linearization to find $\tan \frac{3}{4}$.

- a) What am I asking you to do?
 - b) Draw a graph to show what you are doing. Mark your estimate of $\tan \frac{3}{4}$.
 - c) Linearize the function and find an approximate value for $\tan \frac{3}{4}$.
 - d) How far off is your estimate?
8. Use linearization to find $\sqrt[3]{26}$
9. I am trying to make a box with dimensions 8in X 8in X 8in. My cutting tool is dull and each side may be off by as much as $\frac{1}{2}$ in. What is the approximate error in the volume? Approximate the percent of error in volume.
10. Suppose I tell you to use Newton's Method to solve a problem.
- a) What am I asking you to do?
 - b) Suppose you want to know where $y = x^2 + 3x$ intersects $y = 5$. How can you use NM to solve this problem?
 - c) Draw both graphs and using $x_0 = 1$, show on the graph where x_1 would be.