# Math 211- Review problems

1. Find the following limits:

a. $\lim_{x\to 3} 2x^2 - 7x + 6$

b. $\lim_{x\to 5} \frac{x^2 - 25}{x - 5}$

c. $\lim_{x\to 3} \frac{x^2 - 7x + 12}{x^2 - 9}$

d. $\lim_{x\to \infty} \frac{5 - 4x^3}{2x^3 - 6x}$

e. $\lim_{x\to -\infty} \frac{7x^2 + 3}{2x^4 - 2x + 1}$

f. $\lim_{x\to \infty} \frac{3x^4 - 10x}{2 - x^3}$

2. a. Explain the concept of a derivative in terms of slope and tangent line.

b. What does a derivative measure?

3. Find the derivative of each function and simplify.

a. $y = 7x^3 - 6\sqrt{x} + \frac{3}{x^7} + 9$

b. $f(x) = \frac{1}{x} + \frac{1}{x^3} - \frac{4}{\sqrt{x}}$

c. $y = \frac{x}{2} + \frac{2}{x}$

d. $h(x) = 10x^{-3} + 9x^{\frac{7}{3}}$

e. $y = \frac{4}{3x^2}$

f. $y = \frac{4x - 3}{2x + 7}$

g. $y = (x^2 + 2)(3x^3 - 2x + 1)$

h. $y = (2x^3 + 3x - 1)^4$

4. Given $f(x) = \sqrt{4x+1}$, find the equation of the tangent line to this curve at $x = 2$.

5. a. If $u = 5x^2 + 1$, and $y = u^4$, use the chain rule to find $\frac{dy}{dx}$.

b. Use the general power rule to find $\frac{dy}{dx}$ if $y = (5x^2 + 1)^4$

c. Find $y'$ if $y = \frac{2}{\sqrt[3]{x^2+1}}$

6. Given $f(t) = 3t^2 + 6\sqrt{t}$, find $f''(4)$

7. It is estimated that t years from now the population of Albany, Wisconsin, will be

$$p(t) = 4t + 6t^{\frac{3}{2}} + 500$$

a. At what rate will the population be changing 4 years from now?
b. What is the estimated population 4 years from now?

8. $C(x) = \frac{1}{4}x^2 + 3x + 67$ is the total cost of producing $x$ units of a commodity, and

$p(x) = x^2 - 2x + 40$ is the price at which all $x$ units will be sold.

a. Find the marginal cost and marginal revenue.

b. Use the marginal cost to estimate the cost of producing the 4th unit.

c. Find the actual cost of producing the 4th unit.

d. Use the marginal revenue to estimate the revenue derived from sale of the 4th unit.

9. For $x$ items of a commodity, if $C(x) = 4x + 67$ is the total cost function and $R(x) = 2x^2 + 7x + 200$ is the revenue function, find the marginal profit function and the marginal profit when 21 items are sold.