Math 250 – Sect.2.2: The Derivative Rules

Differentiation Rules
Computing derivative values through use of the *definition of derivative* (the limit we learned), can be extremely tedious, and sometimes very difficult. There are several shortcuts that we can use to compute derivatives more easily.

1. The Derivative of a Constant: $\frac{d}{dx}[c] =$ __________

2. The Power Rule: $\frac{d}{dx}[x^n] =$ ______________

3. The Constant Multiple Rule: $\frac{d}{dx}[c \cdot f(x)] =$ _______________

4. The Sum/Difference Rule: $\frac{d}{dx}[f(x) \pm g(x)] =$ ______________

5. Derivative of Sine: $\frac{d}{dx}[\sin x] =$ _______________

6. Derivative of Cosine: $\frac{d}{dx}[\cos x] =$ ____________________

With these 6 rules together, we can differentiate many functions quickly and easily.

-examples- Find the derivative for each of the following.

a. $y = x^3 + 4x^2 + 9x - 15$

b. $y = x^4 - 5x^3 + 7x^2 - 2x + 8$

c. $f(x) = 4\sqrt{x} - \dfrac{5}{x^3} + \dfrac{x}{5}$

d. $g(t) = 2t^3 - \dfrac{4}{t} + t$

e. $y = \dfrac{3}{4x^5}$

f. $g(t)=\dfrac{5t^3-4\sqrt{t}}{t^2}$

g. $y=3\sin t-\dfrac{\cos t}{6}$

Applications.

1. Find the equation of the line tangent to the graph of $f(x)=-x^2+5x-3$ when $x=2$

2. Find where the curve in #1 has a horizontal tangent line.

RATES OF CHANGE: Remember that the derivative is a function that describes the slope of a curve. The slope of a curve can also represent the *rate of change* of one quantity with respect to another.

-example- A ball is thrown off a 450 ft. cliff with an initial velocity of -20 ft/sec. The position of the ball above the ground is given by the function:

$s(t) = \frac{1}{2}gt^2 + v_0 t + s_0$, where $g = -32\ ft/\sec^2$, v_0 = initial velocity, and s_0 = initial height

a. Write the function to represent the height of this ball at time t.

b. Find the AVERAGE VELOCITY of the ball during the first 3 seconds of flight.

c. Find the INSTANTANEOUS VELOCITY at time $t = 2$.

DRAW A GRAPH TO REPRESENT THIS: