Day 1 - Notes (Wednesday 2/17/10)

$f(x) = 2x - 3$

$m_{tan} =$ ____________

$g(x) = 4x^2 + 7$

$m_{tan} =$ ____________

Day 1 - Hmwk (Wednesday 2/17/10)

$f(x) = 7x + 11$

$m_{tan} =$ ____________

$g(x) = 3x^2 - 5$

$m_{tan} =$ ____________

Day 2 - Classwork (Thursday 2/18/10)

$f(x) = 3x^2$ at $x = 1$

$m_{tan} =$ ____________

$f(x) = x^2 + x$ at $x = 2$

$m_{tan} =$ ____________

$f(x) = \dfrac{1}{x+1}$ at $x = -5$

$m_{tan} =$ ____________

$f(x) = x^3$ at $x = 3$

$m_{tan} =$ ____________

Day 2 - Homework (Thursday 2/18/10)

1. $f(x) = x^2 + 1$ at $x = 2$

$m_{tan} =$ ____________

Day 2 - Hmwk(Thru 2/18/10) (Cont)

2. $f(x) = x^3 - 2$ at $x = 1$

$m_{tan} =$ ____________

3. $f(x) = 3x^2 - 2x + 5$ at $x = 4$

$m_{tan} =$ ____________

4. $f(x) = 3/x$ at $x = 3$

$m_{tan} =$ ____________

5. $f(x) = \dfrac{x}{x-2}$ at $x = 3$

$m_{tan} =$ ____________

Day 3 - Clwk/Hmwk (Friday 2/19/10)

1. $f(x) = x^3 - 2$ at $x = 1$

$m_{tan} =$ ____________

2. $f(x) = 3x^2 - 2x + 5$ at $x = 5$

$m_{tan} =$ ____________

3. $f(x) = \dfrac{3}{x^2}$ at $x = 3$

$m_{tan} =$ ____________

4. $f(x) = \dfrac{x}{x-1}$ at $x = 4$

$m_{tan} =$ ____________

5. $f(x) = 4 - x^2$ at $x = -1$

$m_{tan} =$ ____________

6. $f(x) = \frac{1}{2}x^2 - 3x - 2$

$m_{tan} =$ ____________

Derivatives – Slope of a Tangent

The expression found when determining the expression for the slope of a tangent (m_{tan}) for a function is called the **derivative** of the function. The derivative is used to find the instantaneous rate of change for any value of the independent variable. The various symbols for the derivative are:

$$f'(x) \qquad y' \qquad D_x(f(x)) \qquad D_x y \qquad {}^{dy}\!/_{dx}.$$

The following are examples of several functions and their respective derivatives.

1) $f(x) = 3x^2$
$f'(x) = 6x$

2) $f(x) = x^2 + x$
$f'(x) = 2x + 1$

3) $f(x) = x^3$
$f'(x) = 3x^2$

4) $f(x) = x^2 + 1$
$f'(x) = 2x$

5) $f(x) = x^3 - 2$
$f'(x) = 3x^2$

6) $g(x) = 3x^2 - 2x + 5$
$g'(x) = 6x - 2$

Using the six examples from above and without using the Limit Definition of the Slope of a Tangent Line, establish some short-cut rules for finding derivatives of functions. Use these rules to find the derivatives (the expression for the slope of a tangent) of the following functions:

a) $g(x) = 6x^4$

$g'(x) = 24x^3$

b) $f(x) = 4x^2 + 2x$

$f'(x) = 8x + 2$

c) $f(x) = 4x^{5/3}$

$f'(x) = \frac{20}{3} x^{2/3}$

d) $f(x) = 3x^5 - 6x^3 + 2x + 4$

$= 15x^4 - 18x^2 + 2$

e) $f(x) = 3x^3 + 7x - 6$

$f'(x) = 9x^2 + 7$

f) $h(x) = \frac{3}{5}x^6 + 2x^3 - 9$

$h'(x) = \frac{18}{5}x^5 + ($

g) $f(x) = \sqrt{7}x^3 + 3x + 10\pi$

$f'(x) = 3\sqrt{7}x^2 + 3$

h) $f(x) = 4x^{11} - 6x^8 + 5x$

$f'(x) =$

$44x^{10} - 48x^7 + 5$

i) $h(x) = \frac{6}{7}x^{14} + \frac{4}{9}x^6$

$h'(x) = 12x^{13} +$

*This short-cut is called the ***Power Rule***

Power Rule

If $f(x) = x^n$, where n is a positive integer,
then $f'(x) = n \cdot x^{n-1}$ $\boxed{D_x(x^n) = n \cdot x^{n-1}}$

Sometimes you have to change the look of the function to be in the right form to take the derivative using the short-cut.

j) $g(x) = \sqrt[5]{x^3}$

$g(x) = x^{\frac{3}{5}}$

$g'(x) = \frac{3}{5} x^{-2/5}$

k) $h(x) = \frac{3}{7x^3} = \frac{3}{7} x^{-3}$

$h'(x) = \frac{-9}{7} x^{-4}$

l) $h(x) = \frac{5}{8x^5} + \frac{2}{21} x^{-7} = \frac{5}{8} x^{-5} +$

$h'(x) = \frac{-25}{8} x^{-6} -$

m) $f(x) = (x^4 + 2)(x - 3)$

$f(x) = x^5 - 3x^4 + 2x - 6$

$f'(x) = 5x^4 - 12x^3 + 2$

n) $f(t) = (t^5 + t)(t^5 + t)$

$f(t) = t^{10} + t^6 + t^6 + t^2$

$f(t) = t^{10} + 2t^6 + t^2$

$f'(t) = 10t^9 + 12t^5 + 2t$

o) $k(x) = \frac{x^2 + 6x + 5}{3}$

$k(x) = \frac{1}{3}x^2 + 2x + 5/3$

$k'(x) = \frac{2}{3}x + 2$

Determine the equation of the tangent line of $f(x) = 3x^5 - 6x^3 + 2x + 4$ at x = 0.

$f'(x) = 15x^4 - 18x^2 + 2 = m_{tan}$

$f'(0) = 0 - 0 + 2 = 2 = m$

$f(0) = 0 - 0 + 0 + 4 = 4 \longrightarrow (0, 4)$

$\boxed{y = 2x + 4}$