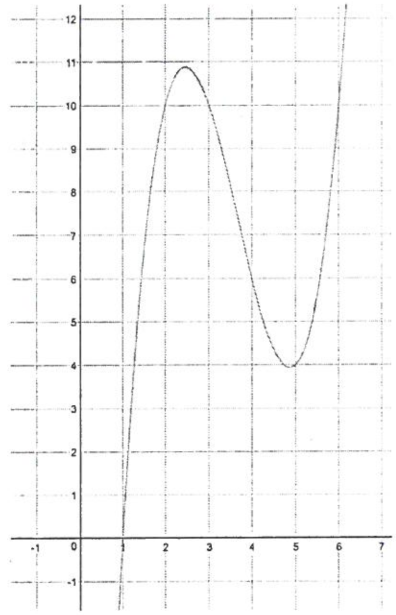
Notes 15.5 General Power Rule to find the Derivative

1. Let $f(x) = x^3 - 11x^2 + 36x - 26$



a) Find the instantaneous rate of change at x = 2.

$$\frac{f(x) - f(2)}{x-2} = \frac{(x^3 - 11x^2 + 36x - 26) - 10}{x-2}$$

$$\begin{array}{r|rrrr} 2 & 1 & -11 & 36 & -36 \\ & \downarrow & 2 & -18 & 36 \\ \hline & 1 & -9 & 18 & 0 \end{array}$$

$x^2 - 9x + 18$

$(2)^2 - 9(2) + 18$

$\boxed{4}$

Let $g(x) = 3x^2 - 22x + 36$

b) Find g(2) $3(2)^2 - 22(2) + 36 = \boxed{4}$

c) At the extreme points on the graph, the tangent line should be horizontal, so the instantaneous rate of change equals 0.
Find where g(x) = 0 $0 = 3x^2 - 22x + 36$

$\boxed{x = 4.87 \text{ and } x = 2.46}$

Power Rule to find Derivative
If $f(x) = x^n$, then $f'(x) = nx^{n-1}$
Multiply by the original exponent and decrease the exponent by 1.

d) Calculate quickly the rate of change at which f(x) is changing at x = 5.
(in other words, calculate the derivative using the power rule, then evaluate at x=5)

for f(x) above: $f'(x) = 3x^2 - 22x + 36$

* does this look familiar?

so $f'(5) = 3(5)^2 - 22(5) + 36$

$\boxed{f'(5) = 1}$

Using the power rule, calculate the derivative $f'(x)$.

2. $f(x) = 12x^4$

$\boxed{f'(x) = 48x^3}$

3. $f(x) = 11x^3 - 3x^2 - 13x + 37$

$\boxed{f'(x) = 33x^2 - 6x - 13}$

For #3, use the fact that the derivative is 0 at an extreme point to find the x-coordinates of all extreme points.

* because tangent line would be horizontal, & slope of a horizontal line is 0.

$0 = 33x^2 - 6x - 13$

$\boxed{x = 0.73 \text{ and } x = -0.54}$

For #3, find the equation of the line tangent to the graph at x = 2.

$y = mx + b$

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

$f(2) = 11(2)^3 - 3(2)^2 - 13(2) + 37$

$f(2) = 87$

$f'(2) = 33(2)^2 - 6(2) - 13$

$f'(2) = 107$

$87 = 107(2) + b$

$87 = 214 + b$

$-127 = b$

$\boxed{y = 2x - 127}$