# Lecture 18

Wednesday, October 2, 2024      3:51 AM

With the product law, we can find the derivative of any polynomials:

Ex:
$x^3 = (x^2)x$
So, $(x^3)' = (x^2)'x + x^2(x') = (2x)x + x^2 = 3x^2$

Ex:
$x^4 = (x^3)x$
So, $(x^4)' = (x^3)'x + x^3(x') = (3x^2)x + x^3 = 4x^3$

More generally, $(x^n)' = nx^{n-1}$ for any positive integer $n$.

Quotient law:
$$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$$

Ex:
$$\left(\frac{1}{x}\right)' = \cdots = -\frac{1}{x^2}$$
$$\left(\frac{x}{x+1}\right)' = \cdots$$

Work on some problems on the worksheet.

Derivative of an exponential function
$f(x) = b^x$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{b^{x+h} - b^x}{h} = b^x \lim_{h \to 0} \frac{b^h - 1}{h} = b^x f'(0)$$