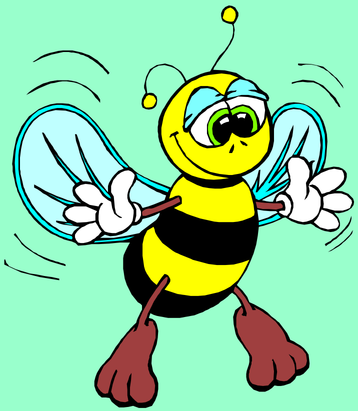

4. Derivatives of complex expressions

$$f(x) = g(x) + h(x) \qquad f(x) = g(x) \times h(x)$$

$$f(x) = \frac{g(x)}{h(x)}$$

The Derivative of Multiple Terms in x

So far we have differentiated functions with only one term in x.

Our basic rule still applies when we have multiple terms in x.

We simply have to ensure that each individual term has been prepared for differentiation. Then differentiate each term separately.

This means that if

$$f(x) = g(x) + h(x)$$

then

$$f'(x) = g'(x) + h'(x)$$

Example 4

Find the derivative of $f(x) = \frac{1}{2}x^4 - 3x^2 + \frac{3}{2x} + 9$

Solution:

1. Prepare for differen
   (ie must be if form **ax^n**)

2. **"Multiply by power then reduce power by 1" for each term**

3. Tidy up

$$f(x) = \tfrac{1}{2}x^4 - 3x^2 + \tfrac{3}{2}x^{-1} + 9$$

$$f'(x) = 4 \times \tfrac{1}{2}x^{(4-1)} - 2 \times 3x^{(2-1)} - 1 \times \tfrac{3}{2}x^{(-1-1)} + 0$$

$$f'(x) = 2x^3 - 6x - \tfrac{3}{2}x^{-2}$$

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

Heinemann , p.94, EX 6F, Q19-27

Example 5

Find the derivative of f(x) = (2x – 3) (3x + 6)

Solution:

1. Prepare for differentiation (ie expand brackets and simplify)

$$f(x) = 2x(3x+6) - 3(3x+6)$$

$$f(x) = 6x^2 + 12x - 9x - 18$$

$$f(x) = 6x^2 + 3x - 18$$

2. **“Multiply by power then reduce power by 1”**

$$f'(x) = 12x + 3$$

3. Tidy up

Heinemann , p.95, EX 6G, Q 1-6

Example 6

Find the derivative of $f(x) = \dfrac{x^3 - 4x^2 + x + 3}{x^2}$

NAB

Solution:

1. Re-write expression with each term in the numerator over the denominator

$$f(x) = \frac{x^3}{x^2} - \frac{4x^2}{x^2} + \frac{x}{x^2} + \frac{3}{x^2}$$

2. Prepare for differentiation (ie use laws of indices)

$$f(x) = x - 4 + x^{-1} + 3x^{-2}$$

3. **"Multiply by power then reduce power by 1"**

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

4. Tidy up

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

Heinemann , p.95, EX 6G, Q 17-24