

## The Product Rule

As mentioned previously, the product rule is used, unsurprisingly, when we have a product of two functions.

### The product rule:

$$\text{If } y = uv \text{ then } \frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

This is quite easy to remember. Differentiate one of the things but leave the other. Then do the other way round. Then add!

Since addition is commutative, it doesn't matter which way round we do it.

1. If  $y = x^2 \sin x$ , determine  $\frac{dy}{dx}$

2. If  $y = xe^{2x}$ , determine the coordinates of the turning point.

**Product + Chain Rule Examples**

1. If  $y = e^{4x} \sin^2 3x$ ,

show that  $\frac{dy}{dx} = e^{4x} \sin 3x (A \cos 3x + B \sin 3x)$ ,

where  $A$  and  $B$  are constants to be determined.

2. Given that  $f(x) = x^2\sqrt{3x-1}$ , find  $f'(x)$

## Test Your Understanding

Edexcel C3 Jan 2012 Q1a

Differentiate with respect to  $x$ , giving your answer in its simplest form,

(a)  $x^2 \ln(3x)$ , (4)

Edexcel C3 June 2013 Q5(c)

$$\frac{dy}{dx} = \frac{1}{6x(x-1)^{\frac{1}{2}}}$$

Find  $\frac{d^2y}{dx^2}$ , simplifying your answer.