**The Product Rule**

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

**The product rule:**

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.

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

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

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

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

**Test Your Understanding**

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

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

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