Step 3- multiply diagonally and add

If we take the example of f(x) = xsin(x)

Step 1-

u = x and $v = \sin(x)$ the order doesn't matter

Step 2 and 3 -



The product rule is f(x) = u(x)v(x) then f'(x) = vu' + uv'

Again, the order of this doesn't matter

Now let's look at fractions in the form $f(x) = \frac{u(x)}{v(x)}$ the order of this does matter the numerator should always be u(x) and denominator v(x), this is the **quotient rule** O Again 3 steps Step1- state u(x) = v(x) = 0 Of O Step2- differentiate u(x) by v(x)Step3- differentiate u(x) by v(x)Step3- differentiate u(x) by v(x)For example, let's take $f(x) = \frac{3x^2}{\cos(x)}$ Put this in the form $f(x) = \frac{u(x)}{v(x)}$ $u(x) = 3x^2$ $v(x) = \cos(x)$

Find the derivatives

$$u(x) = 3x^{2} \qquad v(x) = \cos(x)$$

$$u'(x) = 6x \qquad v'(x) = -\sin(x)$$
So $f(x) = \frac{u(x)}{v(x)}$ $f'(x) = \frac{vu' - uv'}{v^{2}}$
So $f(x) = \frac{3x^{2}}{\cos(x)}$ $f'(x) = \frac{(6x\cos(x) - 3x^{2}\sin(x))}{\cos^{2}(x)} = \frac{6x\cos(x) + 3x^{2}\sin(x)}{\cos^{2}(x)}$

Robert Airey