Dr Oliver Mathematics
Worked Examples
Curve with equation $y = pq^x$

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1. The sketch graph shows a curve with equation $y = pq^x$. (3)

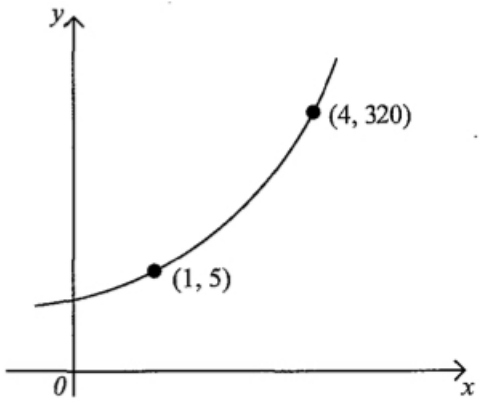

Diagram **NOT** accurately drawn

The curve passes through the points $(1, 5)$ and $(4, 320)$.
Calculate the value of p and the value of q.

Solution

An example of simultaneous equations ...

Let us do $(1, 5)$: what does that mean? Well,

$$\begin{aligned} x = 1, y = 5 &\Rightarrow 5 = p \times q^1 \\ &\Rightarrow 5 = p \times q \\ &\Rightarrow \boxed{5 = pq \quad (1)}. \end{aligned}$$

So, let us do $(4, 320)$: what does that mean? Well,

$$\begin{aligned} x = 4, y = 320 &\Rightarrow 320 = p \times q^4 \\ &\Rightarrow \boxed{320 = pq^4 \quad (2)}. \end{aligned}$$

Addition? *No.*

Subtraction? *No.*

A linear combination of — *No.*

Multiplying? *No* – but you're getting warmer ...

Division? That's right: we do (2) divided (1):

$$\frac{320}{5} = \frac{pq^4}{pq} \Rightarrow q^3 = 64$$
$$\Rightarrow q = \sqrt[3]{64}$$
$$\Rightarrow q = 4.$$

Now,

$$q = 4 \Rightarrow 5 = 4p$$
$$\Rightarrow p = 1.25 \text{ or } \tfrac{5}{4} \text{ or } 1\tfrac{1}{4}.$$

Hence,

$$\underline{\underline{p = 1.25}} \text{ and } \underline{\underline{q = 4}}.$$