Connected Proportion Mastery

Practice Worksheet (Edexcel GCSE 1MA1 Jun 2022 1H Style)

I DO

y is directly proportional to the square root of t.
$y = 15$ when $t = 9$

t is inversely proportional to the cube of x.
$t = 8$ when $x = 2$

Find a formula for y in terms of x.
Give your answer in its simplest form.

WE DO

p is directly proportional to the square root of q.
$p = 20$ when $q = 16$

q is inversely proportional to the square of r.
$q = 9$ when $r = 2$

Find a formula for p in terms of r.
Give your answer in its simplest form.

YOU DO 1

m is directly proportional to the square of n.
$m = 18$ when $n = 3$

n is directly proportional to the cube root of v.
$n = 4$ when $v = 8$

Find a formula for m in terms of v.
Give your answer in its simplest form.

YOU DO 2

a is inversely proportional to b.
$a = 4$ when $b = 3$

b is directly proportional to the square root of c.
$b = 5$ when $c = 25$

Find a formula for a in terms of c.
Give your answer in its simplest form.

CHALLENGE

y is directly proportional to the square of x.
$y = 50$ when $x = 5$

x is inversely proportional to the square root of z.
$x = 3$ when $z = 4$

z is directly proportional to w.
$z = 10$ when $w = 5$

Find a formula for y in terms of w.
Give your answer in its simplest form.

ANSWERS & WORKED SOLUTIONS

I Do

Step 1: Express the first relationship: $y = k\sqrt{t}$. Substitute $y = 15$ and $t = 9$ → $15 = k\sqrt{9}$ → $15 = 3k$ → $k = 5$. So, $y = 5\sqrt{t}$.

Step 2: Express the second relationship: $t = c / x^3$. Substitute $t = 8$ and $x = 2$ → $8 = c / 2^3$ → $8 = c / 8$ → $c = 64$. So, $t = 64 / x^3$.

Step 3: Substitute the formula for t into the formula for y. $y = 5\sqrt{(64 / x^3)}$.

Step 4: Simplify the root: $\sqrt{64} = 8$, and $\sqrt{(x^3)} = x^{1.5}$. So $y = 5 \times (8 / x^{1.5})$. **Answer: $y = 40 / \sqrt{\mathbf{x^3}}$** (or $40 / x^{1.5}$)

We Do

Step 1: $p = k\sqrt{q}$. Substitute $p = 20$, $q = 16$ → $20 = k\sqrt{16}$ → $20 = 4k$ → $k = 5$. So, $p = 5\sqrt{q}$.

Step 2: $q = c / r^2$. Substitute $q = 9$, $r = 2$ → $9 = c / 2^2$ → $9 = c / 4$ → $c = 36$. So, $q = 36 / r^2$.

Step 3: Substitute the formula for q into the formula for p. $p = 5\sqrt{(36 / r^2)}$.

Step 4: Simplify: $\sqrt{36} = 6$, and $\sqrt{(r^2)} = r$. So $p = 5 \times (6 / r)$. **Answer: p = 30 / r**

ANSWERS & WORKED SOLUTIONS (CONTINUED)

You Do 1

Step 1: $m = kn^2$. Substitute $m = 18$, $n = 3$ → $18 = k(3^2)$ → $18 = 9k$ → $k = 2$. So, $m = 2n^2$.

Step 2: $n = c\sqrt[3]{v}$. Substitute $n = 4$, $v = 8$ → $4 = c\sqrt[3]{8}$ → $4 = 2c$ → $c = 2$. So, $n = 2\sqrt[3]{v}$ (or $2v^{1/3}$).

Step 3: Substitute n into m. $m = 2(2v^{1/3})^2$.

Step 4: Simplify: $(2v^{1/3})^2 = 4v^{2/3}$. Then $m = 2(4v^{2/3}) = 8v^{2/3}$. **Answer: $m = 8v^{2/3}$** (or $8\sqrt[3]{v^2}$)

You Do 2

Step 1: a = k / b. Substitute a = 4, b = 3 → 4 = k / 3 → k = 12. So, a = 12 / b.

Step 2: b = c√c (wait, use 'j' for constant). b = j√c. Substitute b = 5, c = 25 → 5 = j√25 → 5 = 5j → j = 1. So, b = √c.

Step 3: Substitute b into a. **Answer: a = 12 / √c**

ANSWERS & WORKED SOLUTIONS (CONTINUED)

Challenge

Step 1: $y = kx^2$. Substitute $y = 50$, $x = 5 \rightarrow 50 = k(5^2) \rightarrow 50 = 25k \rightarrow k = 2$. So, $y = 2x^2$.

Step 2: $x = j / \sqrt{z}$. Substitute $x = 3$, $z = 4 \rightarrow 3 = j / \sqrt{4} \rightarrow 3 = j / 2 \rightarrow j = 6$. So, $x = 6 / \sqrt{z}$.

Step 3: $z = mw$. Substitute $z = 10$, $w = 5 \rightarrow 10 = m(5) \rightarrow m = 2$. So, $z = 2w$.

Step 4: Sub x into y: $y = 2(6 / \sqrt{z})^2 = 2(36 / z) = 72 / z$.

Step 5: Sub z into y: $y = 72 / (2w) = 36 / w$. **Answer: y = 36 / w**