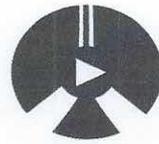


Name:

Exam Style Questions

Direct Proportion
Inverse Proportion



Corbettmaths

Equipment needed: Calculator and Pen

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Video Tutorial

www.corbettmaths.com/contents

Videos 254, 255



Answers and Video Solutions



1. y is directly proportional to x .

$$y = 30 \text{ when } x = 2.5$$

Work out the value of y when $x = 4$

$$y \propto x$$

$$y = kx$$

$$30 = k \times 2.5$$

$$k = 12$$

$$y = kx$$

$$y = 12x$$

$$\text{when } x = 4$$

$$y = 12 \times 4$$

$$y = 48$$

$$y = \frac{48}{(3)}$$

2. y is directly proportional to the square of x .
When $y = 24$, $x = 2$

Find the value of y when $x = 4$.

$$y \propto x^2$$

$$y = kx^2$$

$$24 = k \times 2^2$$

$$24 = k \times 4$$

$$k = 6$$

$$y = 6x^2$$

$$\text{when } x = 4$$

$$y = 6 \times 4^2$$

$$y = 96$$

$$y = \frac{96}{(3)}$$

3. The cost of a circular table is directly proportional to the square of the radius.
A circular table with a radius of 40cm cost £50

What is the cost of a circular table with a radius of 60cm?

$$C \propto r^2$$

$$C = kr^2$$

$$50 = k \times 40^2$$

$$50 = k \times 1600$$

$$k = \frac{1}{32} \text{ (or } 0.03125)$$

$$C = \frac{1}{32} r^2$$

$$C = \frac{1}{32} \times 60^2$$

$$C = 112.50$$

$$\begin{array}{r} \text{£} \dots\dots\dots 112.50 \\ \hline \text{(3)} \end{array}$$

4. The time taken, t seconds, that it takes a water heater to boil water is inversely proportional to the power, p watts, of the water heater.

When $P = 2000\text{W}$, $T = 252$ seconds.

Find the time it takes to boil water when $P = 800\text{W}$

$$t \propto \frac{1}{p}$$

$$t = \frac{k}{p}$$

$$252 = \frac{k}{2000}$$

$$k = 504000$$

$$t = \frac{504000}{p}$$

$$t = \frac{504000}{8000}$$

$$t = 63$$

$$\begin{array}{r} 63 \\ \dots\dots\dots \text{seconds} \\ \text{(3)} \end{array}$$

5. H varies directly to the cube of c.
When $H = 40$, $c = 2$

(a) Express H in terms of c.

$$H \propto c^3$$

$$H = kc^3$$

$$40 = k \times 2^3$$

$$40 = k \times 8$$

$$k = 5$$

(b) Find the value of H when $c = 5$

$$H = 5 \times 5^3$$

$$H = 625$$

(c) Find the value of c when $H = 5000$

$$5000 = 5c^3$$

$$1000 = c^3$$

$$c = 10$$

$$H = \frac{5c^3}{(3)}$$

$$H = \frac{625}{(1)}$$

$$c = \frac{10}{(1)}$$

6. The force, F newtons, exerted by a magnet on a metal object is inversely proportional to the square of the distance d cm.

When $d = 2$ cm, $F = 50$ N

- (a) Express F in terms of d .

$$F \propto \frac{1}{d^2}$$

$$F = \frac{k}{d^2}$$

$$50 = \frac{k}{2^2}$$

$$50 = \frac{k}{4}$$

$$k = 200$$

$$F = \frac{200}{d^2} \quad (3)$$

- (b) Find the force when the distance between the magnet and metal object is 10cm

$$F = \frac{200}{10^2}$$

$$F = 2$$

$$F = 2 \text{ N} \quad (1)$$

- (c) Find the distance between the magnet and metal object when the force is 8N

$$8 = \frac{200}{d^2}$$

$$8d^2 = 200$$

$$d^2 = 25$$

$$d = 5 \text{ cm} \quad (1)$$

- (d) Explain what happens to F when d is halved.

\therefore $\left\{ \begin{array}{l} d = 5 \text{ cm} \quad F = 8 \text{ N} \\ d = 10 \text{ cm} \quad F = 2 \text{ N} \end{array} \right. \times 4$

When the distance is halved, the force is 4 times bigger. (1)

7. The table shows a set of values for x and y .
 y is directly proportional to the square root of x .

x	16	
y	9	54

Complete the table.

$$y \propto \sqrt{x}$$

$$y = k\sqrt{x}$$

$$9 = k \times \sqrt{16}$$

$$9 = 4k$$

$$k = 2.25$$

$$y = 2.25\sqrt{x}$$

$$54 = 2.25\sqrt{x}$$

$$\sqrt{x} = 24$$

$$x = 576$$

(4)

8. A and B are positive numbers.
 A is inversely proportional to B .
 When $A = 4$, $B = 36$

Find the value of A when $B = A$

$$A \propto \frac{1}{B}$$

$$A = \frac{144}{B}$$

$$A = \frac{k}{B}$$

$$A = \frac{144}{A}$$

$$4 = \frac{k}{36}$$

$$A^2 = 144$$

$$k = 144$$

$$A = 12$$

$$A = \frac{12}{\dots\dots\dots}$$

(4)

9. C is directly proportional to the square root of y.
When $C = 12.8$, $y = 16$

(a) Express C in terms of y.

$$C \propto \sqrt{y} \quad k = 3.2$$

$$C = k \sqrt{y} \quad C = 3.2 \sqrt{y}$$

$$12.8 = k \times 4$$

$$C = \frac{3.2 \sqrt{y}}{\dots} \quad (3)$$

(b) Find C when $y = 400$

$$C = 3.2 \times \sqrt{400}$$

$$= 3.2 \times 20$$

$$= 64$$

$$C = \frac{64}{\dots} \quad (1)$$

10. The time taken, t, for passengers to be checked-in for a flight is inversely proportional to the square of the number of staff, s, working.

It takes 30 minutes passengers to be checked-in when 10 staff are working.

(a) Find an equation connecting t and s.

$$t \propto \frac{1}{s^2} \quad 30 = \frac{k}{10^2}$$

$$t = \frac{k}{s^2} \quad 30 = \frac{k}{100}$$

$$k = 3000$$

$$t = \frac{3000}{s^2} \dots \quad (3)$$

(b) What is the minimum number of staff that must be working so that the time taken is under 60 minutes?

$$60 = \frac{3000}{s^2}$$

$$60 s^2 = 3000$$

$$s^2 = 50$$

$$s = \sqrt{50} \quad s = 7.0710\dots$$

$$s = \sqrt{50}$$

$$\frac{8}{\dots} \quad (3)$$

11. The cost of a trip is directly proportional to the square root of the distance.

The cost is £495 when the distance is 324 miles.

Find a formula connecting the cost, C , and the distance d .

$$C \propto \sqrt{d}$$

$$C = k \times \sqrt{d}$$

$$495 = k \times \sqrt{324}$$

$$495 = k \times 18$$

$$k = 27.5$$

$$\underline{C = 27.5 \sqrt{d}}$$

(3)

12. w is inversely proportional to y^2

$w = 54$ when $y = c$

Find the value of w when $y = 3c$

$$w \propto \frac{1}{y^2}$$

$$w = \frac{k}{y^2}$$

$$54 = \frac{k}{c^2}$$

$$k = 54c^2$$

$$w = \frac{54c^2}{y^2}$$

$$w = \frac{54c^2}{(3c)^2}$$

$$w = \frac{54c^2}{9c^2}$$

$$w = 6$$

$$\underline{6}$$

(3)

13. a is directly proportional to \sqrt{c}

w is inversely proportional to a^3

When $c = 49$, $a = 35$

When $a = 2$, $w = 16$

Find the value of w when $c = 4$

$$a \propto \sqrt{c}$$

$$a = k\sqrt{c}$$

$$35 = k\sqrt{49}$$

$$35 = k \times 7$$

$$k = 5$$

$$a = 5\sqrt{c}$$

when $c = 4$

$$a = 5 \times \sqrt{4}$$

$$a = 10$$

when $a = 10$

$$w = \frac{128}{10^3}$$

$$= 0.128$$

$$w \propto \frac{1}{a^3}$$

$$w = \frac{k}{a^3}$$

$$16 = \frac{k}{2^3}$$

$$16 = \frac{k}{8}$$

$$k = 128$$

$$w = \frac{128}{a^3}$$

$$w = \frac{0.128}{\dots\dots\dots} \quad (6)$$

14. The number of days, D , to complete research is inversely proportional to the number of researchers, R , who are working.

The research takes 125 days to complete if 16 people work on it.

Find how many people are needed to complete the research in 40 days.

$$D \propto \frac{1}{R}$$

$$D = \frac{k}{R}$$

$$125 = \frac{k}{16}$$

$$k = 2000$$

$$D = \frac{2000}{R}$$

$$40 = \frac{2000}{R}$$

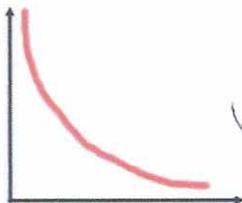
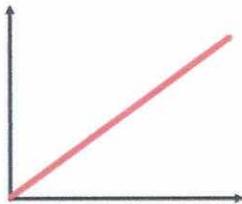
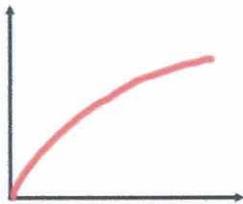
$$40R = 2000$$

$$R = 50$$

50

(5)

15. Match each graph to the correct relationship.



$$y \propto \frac{1}{x}$$

$$y \propto \sqrt{x}$$

$$y \propto x^2$$

(3)

16. x and y are positive numbers.
 y is inversely proportional to the square of x .

x	2	4	b
y	30	a	480

120

Find the values of a and b .

$$y \propto x^2$$

$$y = kx^2$$

$$30 = k \times 2^2$$

$$30 = k \times 4$$

$$k = 7.5$$

$$y = 7.5x^2$$

$$y = 7.5 \times 4^2$$

$$a = 120$$

$$480 = 7.5b^2$$

$$b^2 = 64$$

$$b = 8 \quad (\text{as positive numbers})$$

$$a = 120$$

$$b = 8$$

(4)

17. A and B are positive numbers.
A is inversely proportional to the cube of B.

$$\text{When } A = \frac{10}{27}, B = 30$$

Find the value of A when B = A

$$A \propto \frac{1}{B^3}$$

$$A = \frac{k}{B^3}$$

$$\frac{10}{27} = \frac{k}{30^3}$$

$$\frac{10}{27} = \frac{k}{27000}$$

$$k = 10000$$

$$A = \frac{10000}{B^3}$$

$$A = \frac{10000}{A^3}$$

$$A^4 = 10000$$

$$A = 10$$

(5)

18. w is inversely proportional to the square root of y
 w is directly proportional to z cubed.

$$w : y : z = 3 : 2 : 5 \text{ when } y = 4$$

Work out $w : z$ when $y = 256$

$$y = 4$$

$$\begin{array}{ccc} w & y & z \\ 3 & 2 & 5 \\ 6 & 4 & 10 \end{array}$$

$$w = 6$$

$$z = 10$$

$$w \propto \frac{1}{\sqrt{y}}$$

$$w \propto z^3$$

$$w = \frac{k}{\sqrt{y}}$$

$$w = k \times z^3$$

$$6 = \frac{k}{\sqrt{4}}$$

~~6 = k~~

$$6 = k \times 10^3$$

$$6 = \frac{k}{2}$$

$$6 = 1000k$$

$$k = 12$$

$$k = 0.006$$

$$w = 0.006 z^3$$

$$\boxed{3 : 20}$$

$$w = \frac{12}{\sqrt{y}}$$

$$y = 256$$

$$w = \frac{12}{\sqrt{256}}$$

$$w = \frac{3}{4}$$

$$\frac{3}{4} = 0.006 z^3$$

$$125 = z^3$$

$$z = 5$$

$$w : z$$

$$\times 4 \quad \frac{3}{4} : 5 \quad \times 4$$

$$3 : 20$$

(5)

19. w is directly proportional to x cubed.

Find the percentage increase in w when x is increased by 10%

$$w \propto x^3$$

$$w = kx^3$$

$$1.1^3 = 1.331$$

$$33.1\%$$

(3)

20. A is directly proportional to the cube root of B .

B is increased by 75%

Work out the percentage increase in A .

$$A \propto \sqrt[3]{B}$$

$$A = k \times \sqrt[3]{B}$$

$$\sqrt[3]{1.75} = 1.2050711\dots$$

$$20.5\%$$

(3)

21. x is directly proportional to w^2
When $x = 50$, $w = 5$

y is directly proportional to x^3
When $x = 3$, $y = 4$

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

$$x \propto w^2$$

$$x = kw^2$$

$$50 = k \times 5^2$$

$$50 = k \times 25$$

$$k = 2$$

$$x = 2w^2$$

$$y \propto x^3$$
$$y = kx^3$$

$$4 = k \times 27$$

$$k = \frac{4}{27}$$

$$y = \frac{4}{27} x^3$$

$$y = \frac{4}{27} (2w^2)^3$$

$$y = \frac{4}{27} (8w^6)$$

$$y = \frac{32}{27} w^6$$

(4)

22. w is directly proportional to c squared.

When $w = 16$, $c = 2$

Find the value of c when $w = 28c - 49$

$$w \propto c^2$$

$$w = k c^2$$

$$16 = k \times 2^2$$

$$k = 4$$

$$w = 4 c^2$$

$$28c - 49 = 4c^2$$

$$4c^2 - 28c + 49 = 0$$

$$(2c - 7)(2c - 7) = 0$$

$$c = \frac{7}{2}$$

$$\text{or } c = 3.5$$

$$\underline{c = 3.5}$$

(4)

23. W is directly proportional to the square of x.

When the value of x is increased by 2, the value of W is three times larger.

Find the exact values of x.

$$W \propto x^2$$

$$W = kx^2$$

$$k(x+2)^2 = 3kx^2$$

$$(x+2)^2 = 3x^2$$

$$x^2 + 4x + 4 = 3x^2$$

$$0 = 2x^2 - 4x - 4$$

$$0 = x^2 - 2x - 2$$

Completing the square

$$(x-1)^2 - 1 - 2 = 0$$

$$(x-1)^2 - 3 = 0$$

$$(x-1)^2 = 3$$

$$x-1 = \pm\sqrt{3}$$

$$x = 1 \pm \sqrt{3}$$

$$x = 1 + \sqrt{3} \quad \text{or} \quad x = 1 - \sqrt{3}$$

quadratic formula

$$a = 1 \quad b = -2 \quad c = -2$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (6)$$

$$x = \frac{2 \pm \sqrt{4 - (-8)}}{2}$$

$$x = \frac{2 \pm \sqrt{12}}{2}$$

$$x = \frac{2 \pm 2\sqrt{3}}{2}$$

$$x = 1 \pm \sqrt{3}$$

$$x = 1 - \sqrt{3} \quad \text{or} \quad x = 1 + \sqrt{3}$$