GCSE MATHEMATICS

Direct & Inverse Proportion

AQA These questions have been taken or modified from previous AQA GCSE Mathematics Papers.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The marks for questions are shown in brackets.
- The quality of your written communication is specifically assessed in questions that are indicated with an asterisk (*).

Advice
- Read each question carefully before you start to answer it.
- In all calculations, show clearly how you work out your answer.
- Use the number of marks for the question as a guide to the amount of time you need to spend.
- Look at previous parts of the question, e.g. a), b), c) i) as there may be information there you need to answer later parts.
- Check your answer is realistic and appropriate.
- For calculator decimal numbers always write your full calculator display in the working out area and then, if you need to, round the answer on the answer line.

1 A is directly proportional to the square of R.
When $R = 30$, $A = 2826$

1 (a) Form an equation connecting A and R.

$A \propto R^2 \rightarrow A = kR^2$

$2826 = k \times 30^2$

$k = 2826 / 30^2 \quad k = 3.14$

Answer $A = 3.14R^2$ *(3 marks)*

1 (b) Work out the value of A when $R = 15$

$A = 3.14 \times 15^2$

Answer 706.5 *(2 marks)*

2 y is directly proportional to R^2
When $R = 4$, $y = 24$

Work out the value of R when $y = 1350$ **[5 marks]**

$y \propto R^2 \rightarrow y = kR^2$

$24 = k \times 4^2 \quad k = \frac{24}{16} = 1.5$

$y = 1.5R^2$

$1350 = 1.5R^2$

$R^2 = 900$

$R = \sqrt{900} = 30$

Answer 30

3 A is proportional to the square of L. When $A = 4$, $L = 4$

Work out the value of A when $L = 25$

$A \propto L^2 \rightarrow A = kL^2$

$4 = k \times 4^2 \quad k = 4/16 = 1/4$

$A = 1/4 L^2$

$A = 1/4 \times 25^2$

Answer 156.25 *(4 marks)*

4 M is directly proportional to r^3

When $r = 5$, $M = 200$

4 (a) Work out the value of M when $r = 8$

$M \propto r^3 \rightarrow M = kr^3$

$200 = k \times 5^3$

$k = \frac{200}{5^3} = 8/5 \quad M = 8/5 r^3$

$M = 8/5 \times 8^3$

Answer 819.2 *(4 marks)*

4 (b) Work out the value of r when $M = 3125$

$3125 = \frac{8}{5} \times r^3$

$3125 \times 5/8 = r^3$

$r^3 = 1953.125$

$r = \sqrt[3]{1953.125}$

Answer 12.5 *(3 marks)*

5 y is directly proportional to the square of x.

$y = 28$ when $x = 2$

5 (a) Obtain an equation connecting y and x.

$y \propto x^2 \rightarrow y = kx^2$

$28 = k \times 2^2 \quad k = \frac{28}{4}$

$k = 7$

Answer $y = 7x^2$ *(3 marks)*

5 (b) y is directly proportional to the square of x.

x is inversely proportional to w.

Tick a box to show which **one** of the statements below is correct.

y is directly proportional to w	☐
y is directly proportional to the square of w	☐
y is inversely proportional to w	☐
y is inversely proportional to the square of w	☑

(1 mark)

6 y is **inversely** proportional to x.

When $y = 5$, $x = 9$

6 (a) Work out an equation connecting y and x.

$y \propto \frac{1}{x} \rightarrow y = \frac{k}{x}$

$5 = \frac{k}{9}$ $k = 45$

Answer $y = \frac{45}{x}$ *(3 marks)*

6 (b) Work out the value of y when $x = 15$

$y = \frac{45}{15}$

Answer 3 *(2 marks)*

7 y is inversely proportional to x.
When $y = 2$, $x = 5$

Work out an equation connecting y and x. **[3 marks]**

$y \propto x \rightarrow y = \frac{k}{x}$

$2 = \frac{k}{5}$ $k = 10$

Answer $y = \frac{10}{x}$

8 W is inversely proportional to x.
When $W = 6$, $x = 20$

Work out the value of W when $x = 24$

$W \propto \frac{1}{x} \rightarrow W = \frac{k}{x}$

$6 = \frac{k}{20}$ $k = 120$

$W = \frac{120}{x}$

$W = \frac{120}{24}$

Answer 5 *(4 marks)*

9 R is inversely proportional to A.

$R = 12.1$ when $A = 1.5$

9 (a) Work out a formula connecting R and A.

$R \propto \frac{1}{A} \rightarrow R = \frac{k}{A}$

$12.1 = \frac{k}{1.5}$ $k = 18.15$

Answer $R = \frac{18.15}{A}$ or $\frac{363}{20A}$ *(3 marks)*

9 (b) Work out the value of R when $A = 4$

$R = \frac{18.15}{4}$

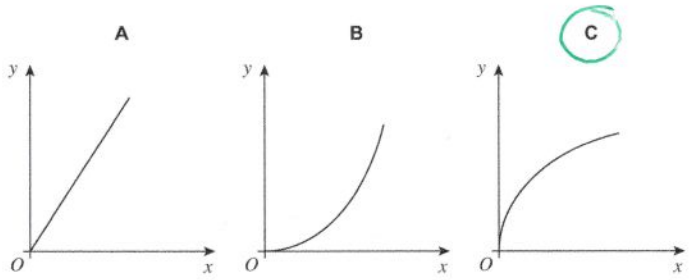
Answer 4.5375 *(2 marks)*

10 The fare, £y, for a journey is directly proportional to the square root of the distance, x miles.

10 (a) Which sketch graph represents this information?

Circle the correct letter.

[1 mark]



10 (b) A 100 mile journey costs £36

What is the cost of a 250 mile journey?
Give your answer to the nearest pound.

[4 marks]

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

$36 = k\sqrt{100}$ $36 = 10k$ $k = 3.6$

$y = 3.6\sqrt{x}$

$y = 3.6 \times \sqrt{250}$

$y = 56.92$

Answer £ 57

11 y is inversely proportional to x^2 where $x > 0$

When $x = 2$, $y = 20$

11 (a) Form an equation for y in terms of x.

[3 marks]

$y \propto \frac{1}{x^2} \rightarrow y = \frac{k}{x^2}$

$20 = \frac{k}{2^2}$ $k = 80$

Answer $y = \frac{80}{x^2}$

11 (b) Work out the value of x when $y = 5$

[2 marks]

$5 = \frac{80}{x^2}$ $5x^2 = 80$

$x^2 = 16$

$x = 4$

as $x > 0$

Answer 4

12 The number of people, n, who can safely be in a room is directly proportional to the area, A, of the room.

12 people can safely meet in a room of area 54 m^2

The table shows information about four rooms.

Room	P	Q	R	S
Area (m^2)	36	108	150	210
Cost of hire per day (£)	85	120	195	240

12 (a) Jack wants to hire a room for 28 people.

Which room should he hire to minimise his cost?
You **must** show your working.

[4 marks]

$n \propto A \rightarrow A = kn$ $\quad 54 = 12k$

$k = 54/12$ $\quad A = 4.5n$

$A = 4.5 \times 28 = 126$

Room R as $150 > 126$

Answer R

12 (b) How many **more** people can come to the meeting without increasing the cost of hire?

[2 marks]

$150/4.5 = 33.\dot{3} = 33$ $\quad 33 - 28 = 5$

Answer 5 more

13 (a) Here are four equations connecting y and x.
k is a constant.

$y = kx$ $\quad y = \frac{k}{x}$ $\quad y = kx^2$ $\quad y = \frac{k}{x^2}$

Match each equation to its statement.

y is **directly** proportional to x Equation $y = kx$

y is **directly** proportional to x^2 Equation $y = kx^2$

y is **inversely** proportional to x Equation $y = k/x$

y is **inversely** proportional to x^2 Equation $y = k/x^2$

(2 marks)

13 (b) y is **inversely** proportional to x.
When $x = 3$, $y = 8$

Work out the value of y when $x = 5$

$y \propto 1/x \rightarrow y = k/x$

$8 = k/3$ $\quad k = 24$ $\quad y = 24/x$

$y = 24/5$

Answer 4.8 *(3 marks)*