GCSE · Edexcel · Maths

3 hours 53 questions

Exam Questions

Direct & Inverse Proportion

Direct Proportion / Inverse Proportion

Medium (17 questions)	/64
Hard (20 questions)	/67
Very Hard (16 questions)	/62
Total Marks	**/193**

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Medium Questions

1 Yesterday it took 5 cleaners $4\frac{1}{2}$ hours to clean all the rooms in a hotel.

There are only 3 cleaners to clean all the rooms in the hotel today.

Each cleaner is paid £8.20 for each hour or part of an hour they work.

How much will each cleaner be paid today?

(3 marks)

2 p is inversely proportional to t.

When $t = 4, p = 12$

Find the value of p when $t = 6$

(3 marks)

3 d is inversely proportional to c

When $c = 280,\ d = 25$

Find the value of d when $c = 350$

(3 marks)

4 y is inversely proportional to x

When $x = 1.5$, $y = 36$

Find the value of y when $x = 6$

(3 marks)

5 (a) At a depth of x metres, the temperature of the water in an ocean is $T°C$. At depths below 900 metres, T is inversely proportional to x.

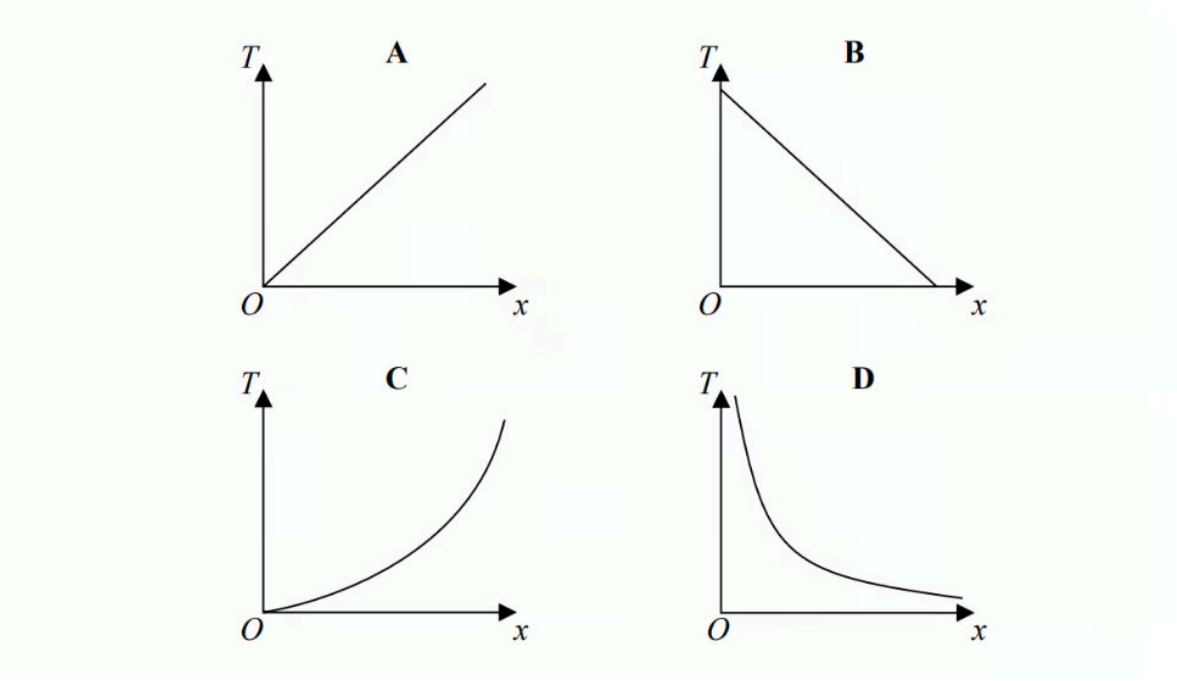
T is given by

$$T = \frac{4500}{x}$$

Work out the difference in the temperature of the water at a depth of 1200 metres and the temperature of the water at a depth of 2500 metres.

(3 marks)

(b) Here are four graphs.



One of the graphs could show that T is inversely proportional to x.

Choose the letter corresponding to this graph.

(1 mark)

6 (a) T is directly proportional to the cube of r

$T = 21.76$ when $r = 4$

Find a formula for T in terms of r

(3 marks)

(b) Work out the value of T when $r = 6$

(1 mark)

7 y is inversely proportional to x.

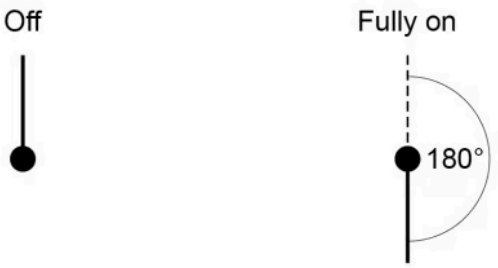
Complete the table.

x	12	6	
y		4	8

(2 marks)

8 The diagrams show the position of a tap when off and fully on.

The tap is fully on when the angle of turn is $180°$



When fully on, water flows out of the tap at 14 litres per minute. The rate at which water flows out is in direct proportion to the angle of turn. The tap is turned $135°$

The water flows into a tank with a capacity of 79.8 litres. Will it take **less than** $7\frac{1}{2}$ minutes to fill the tank?

You **must** show your working.

(4 marks)

9 (a) To complete a task in 15 days a company needs

4 people each working for 8 hours per day.

The company decides to have

5 people each working for 6 hours per day.

Assume that each person works at the same rate.

How many days will the task take to complete? You **must** show your working.

(3 marks)

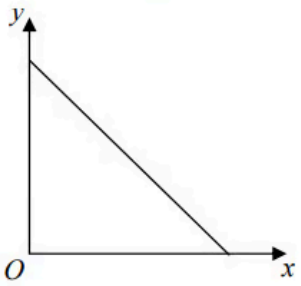
(b) Comment on how the assumption affects your answer to part (a).

(1 mark)

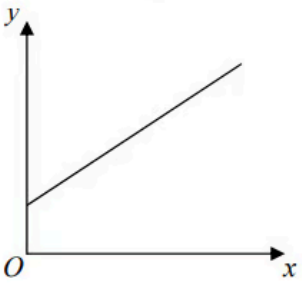
10 y is directly proportional to x.

Which graph shows this?

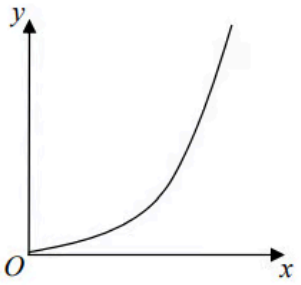
A



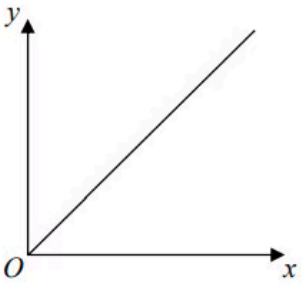
B



C



D



(1 mark)

11 Carol makes birthday cards. Each card takes the same amount of time to make.

She makes 3 cards in 48 minutes.
She has an order for 80 cards.

Can she complete this order in 3 days if she works 8 hours each day?
Show how you decide.

..... because .....

(5 marks)

12 y is inversely proportional to x.
$y = 0.04$ when $x = 80$.

Find the value of y when $x = 32$.

$y =$ .....

(3 marks)

13 The table shows values of x and y.

x	4	16	36
y	6	3	2

Show that these values fit the relationship that y is inversely proportional to $\sqrt{x}$.

(2 marks)

14 (a) Sam and two friends put letters in envelopes on Monday.
The three of them take two hours to put 600 letters in envelopes.

On Tuesday Sam has three friends helping.

Working at the same rate, how many letters should the **four** of them be able to put in envelopes in two hours?

(2 marks)

(b) Working at the same rate, how much longer would it take **four** people to put 1000 letters in envelopes than it would take **five** people?

(4 marks)

(c) Sam says

It took two hours for three people to put 600 letters in envelopes.
If I assume they work all day, then in one day three people will put 7200 letters in envelopes because 600 × 12 = 7200.

Why is Sam's assumption not reasonable? What effect has Sam's assumption had on her answer?

(2 marks)

15 (a) Donald swims 3 lengths of a swimming pool in 93 seconds.

i) Use this information to show that he could swim 100 lengths in under 55 minutes.

[4]

ii) What assumption did you make in part (i)?

[1]

(5 marks)

(b) Donald tries to swim the 100 lengths in under 55 minutes.

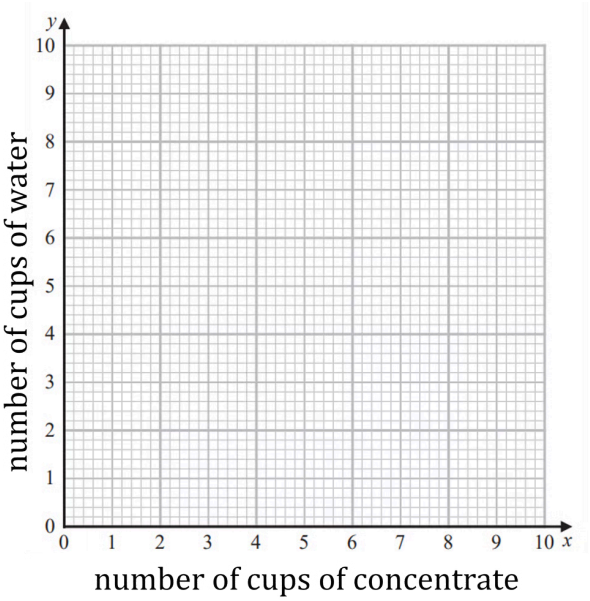
Suggest one reason why he might not achieve this.

(1 mark)

16 (a) To make orange juice

the number of cups of concentrate (x) : the number of cups of water (y) = 3 : 7

Use this information to draw a graph to show the relationship between the number of cups of concentrate and the number of cups of water needed to make orange juice.



(2 marks)

(b) (i) Find the gradient of the line drawn in part (a).

(ii) Explain what this gradient represents.

(2 marks)

17 (a) A group of volunteers are making and selling jewellery to fundraise for charity.

In one hour, they can make 1200 necklaces or 1440 bracelets.

They start working at 11 am. They take no breaks.

They make 1800 necklaces and then switch to making bracelets. How many bracelets will the volunteers make by 4 pm?

(4 marks)

(b) State one assumption that you have made in part (a).

(1 mark)

Hard Questions

1 y is directly proportional to the square of x.

When $x = 3, y = 36$

Find the value of y when $x = 5$

(4 marks)

2 h is inversely proportional to the square of r.

When $r = 5, h = 3.4$

Find the value of h when $r = 8$

(3 marks)

3 Given that $y \propto \frac{1}{x^2}$, complete this table of values.

x	1	2	5	10
y				1

(4 marks)

4 The intensity of the sound, I watts/m^2, received from a loudspeaker is inversely proportional to the square of the distance, d metres, from the loudspeaker.

When $d = 2, I = 30$

Work out the value of I when $d = 10$

(3 marks)

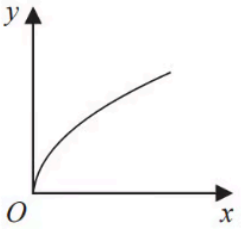
5 T is inversely proportional to d^2
$T = 12$ when $d = 8$

Find the value of T when $d = 0.5$

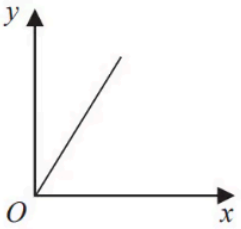
(3 marks)

6

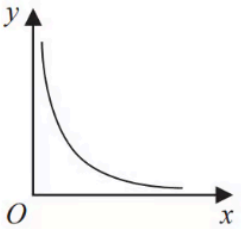
Graph A



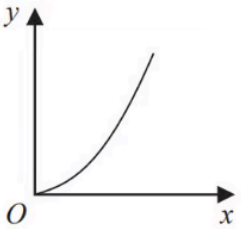
Graph B



Graph C



Graph D



The graphs of y against x represent four different types of proportionality.

Match each type of proportionality in the table to the correct graph.

Type of proportionality	**Graph letter**
$y \propto x$	
$y \propto x^2$	
$y \propto \sqrt{x}$	
$y \propto \frac{1}{x}$	

(2 marks)

7 A company has to make a large number of boxes.

The company has 6 machines.
All the machines work at the same rate.
When all the machines are working, they can make all the boxes in 9 days.

The table gives the number of machines working each day.

	day 1	day 2	day 3	all other days
Number of machines working	3	4	5	6

Work out the total number of days taken to make all the boxes.

(3 marks)

8 A is inversely proportional to C^2

A = 40 when C = 1.5

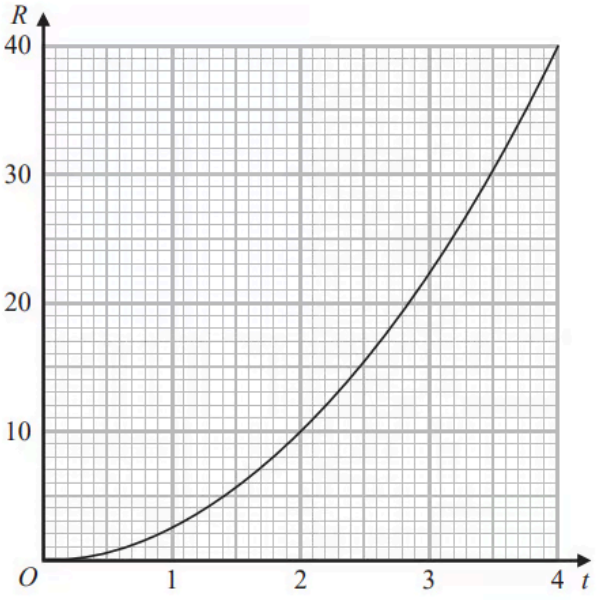
Calculate the value of C when A = 1000

C = ...

(3 marks)

9 (a) R is proportional to t^2

The graph shows the relationship between R and t for $0 \leqslant t \leqslant 4$



Find a formula for R in terms of t.

(3 marks)

(b) Given also that $R = \frac{8}{5x}$

show that t is inversely proportional to $\sqrt{x}$ for $t > 0$

(2 marks)

10 F is inversely proportional to the square of v.

Given that $F = 6.5$ when $v = 4$

find a formula for F in terms of v.

(3 marks)

11 (a) T is inversely proportional to m^2

$T = 30$ when $m = 0.5$

Find a formula for T in terms of m.

(3 marks)

(b) Work out the value of T when $m = 0.1$

(1 mark)

12 (a) The following table gives values of x and y where y is inversely proportional to the square of x.

x	1.5	2	3	4
y	16	9	4	2.25

Find a formula for y in terms of x.

(3 marks)

(b) Given that $x > 0$

find the value of x when $y = 144$

(2 marks)

13 (a) P is inversely proportional to $\sqrt{q}$

P = 10 when q = 0.0064

Find a formula for P in terms of q.

(3 marks)

(b) Find the value of q when P = 20

(2 marks)

14 (a) y is inversely proportional to $\sqrt{x}$

$y = 4$ when $x = 9$

Work out an equation connecting y and x.

(3 marks)

(b) Work out the value of y when $x = 25$

(2 marks)

15 15 machines work at the same rate.
Together, the 15 machines can complete an order in 8 hours.

3 of the machines break down after working for 6 hours.
The other machines carry on working until the order is complete.

In total, how many hours does **each** of the other machines work?

.....hours

(3 marks)

16 $V = \frac{k}{H}$ where k is a constant. Which **two** statements are correct?

Tick **two** boxes.

☐	V is directly proportional to H
☐	V is inversely proportional to H
☐	V is directly proportional to $\frac{1}{H}$
☐	V is inversely proportional to $\frac{1}{H}$

(1 mark)

17 $xy = c$ where c is a constant.
Choose the correct statement.

A. y is directly proportional to x

B. y is directly proportional to $\frac{1}{x}$

C. y is inversely proportional to $\frac{1}{x}$

D. x is directly proportional to y

(1 mark)

18 Three people take $2\frac{1}{2}$ hours to deliver leaflets to 270 houses.

Assuming all people deliver leaflets at the same rate, how long will it take five people to deliver leaflets to 405 houses?
Give your answer in hours and minutes.

..... hours ..... minutes

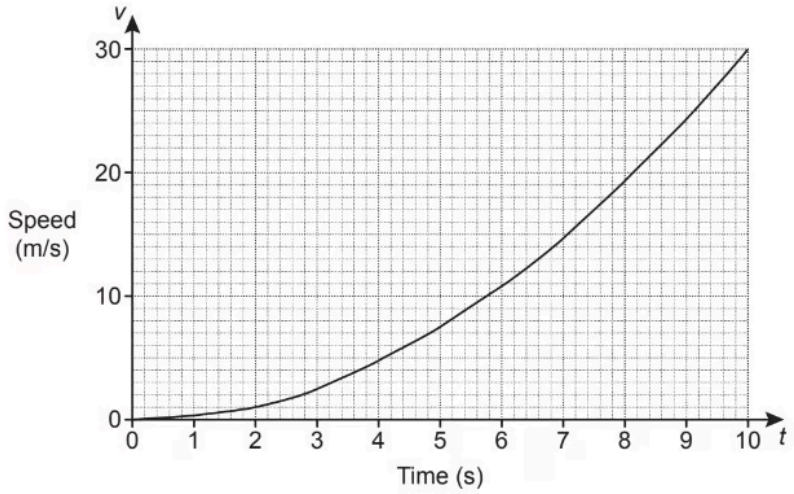
(4 marks)

19 y is inversely proportional to the square root of x.
y is 40 when x is 9.

Find a formula linking x and y.

(3 marks)

20 The graph shows the speed, v metres per second (m/s), of a car at time t seconds.



The speed of this car is directly proportional to the square of the time.

Find a formula linking v and t.

(3 marks)

Very Hard Questions

1 (a) The table shows a set of values for x and y.

x	1	2	3	4
y	9	$2\frac{1}{4}$	1	$\frac{9}{16}$

y is inversely proportional to the square of x.

Find an equation for y in terms of x.

(2 marks)

(b) Find the positive value of x when $y = 16$

(2 marks)

2 y is directly proportional to $\sqrt[3]{x}$

$y = 1\frac{1}{6}$ when $x = 8$

Find the value of y when $x = 64$

(3 marks)

3 y is inversely proportional to d^2
When $d = 10, y = 4$

d is directly proportional to x^2
When $x = 2, d = 24$

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

(5 marks)

4 A pendulum of length L cm has time period T seconds.
T is directly proportional to the square root of L.

The length of the pendulum is increased by 40%.

Work out the percentage increase in the time period.

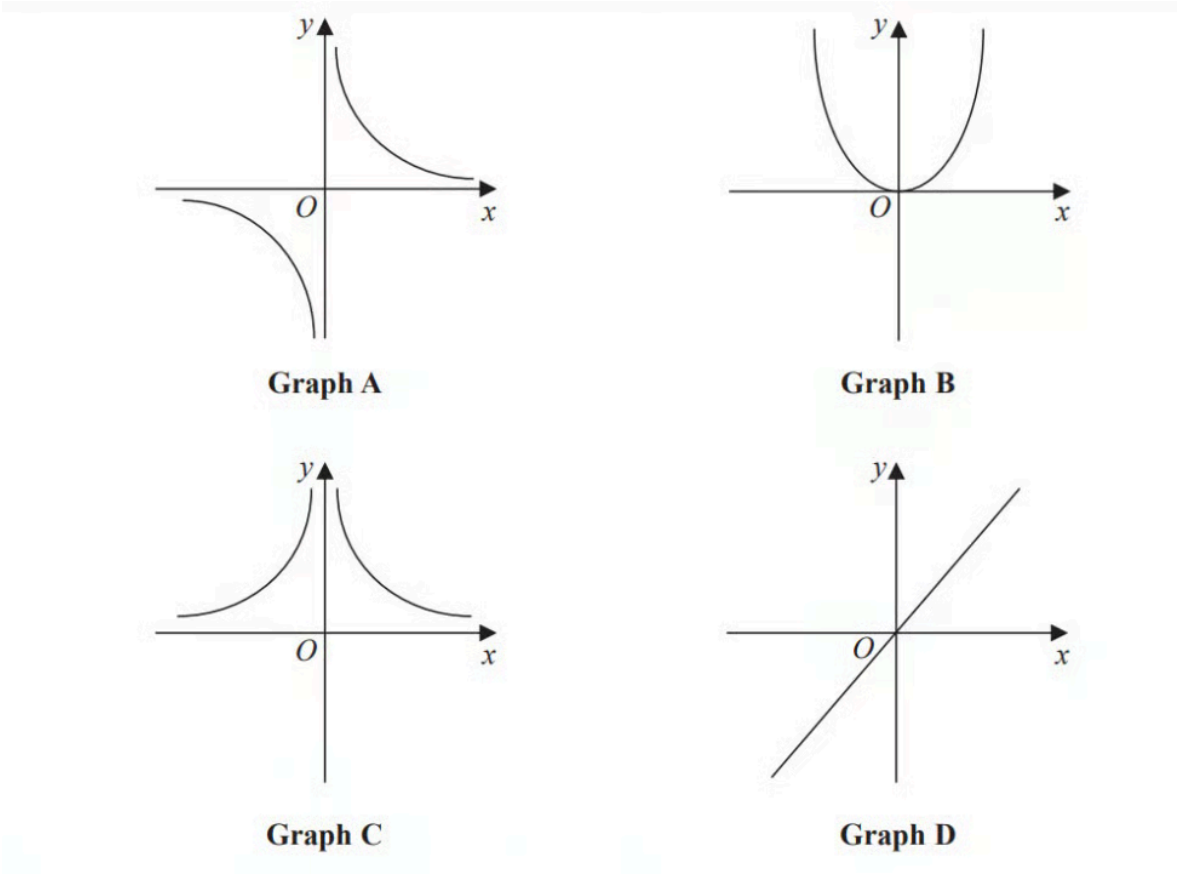
(3 marks)

5 D is directly proportional to the cube of n.
Mary says that when n is doubled, the value of D is multiplied by 6

Mary is wrong.
Explain why.

(1 mark)

6 These graphs show four different proportionality relationships between y and x.



Match each graph with a statement in the table below.

Proportionality relationship	**Graph letter**
y is directly proportional to x	
y is inversely proportional to x	
y is proportional to the square of x	
y is inversely proportional to the square of x	

(2 marks)

7 h is inversely proportional to p
p is directly proportional to $\sqrt{t}$

Given that $h = 10$ and $t = 144$ when $p = 6$
find a formula for h in terms of t

(4 marks)

8 y is inversely proportional to $\sqrt{x}$
x is directly proportional to T^3

Given that $y = 8$ when $T = 25$
find the exact value of T when $y = 27$

$T =$ .....

(4 marks)

9 (a) y is directly proportional to the cube of x

$y = 20h$ when $x = h \quad (h \neq 0)$

Find a formula for y in terms of x and h

$y =$ .....

(3 marks)

(b) Find x in terms of h when $y = 67.5\ h$
Give your answer in its simplest form.

x =.....

(2 marks)

10 (a) A is inversely proportional to the square of r.
$A = 5$ when $r = 0.3$.

Find a formula for A in terms of r.

(3 marks)

(b) Find the value of A when $r = 7.5A$

$A =$ .....

(3 marks)

11 Beth and Mia translate documents from Spanish into English.
A set of documents that would take Beth 8 days would take Mia 10 days.

Beth starts to translate the documents.
After 2 days Beth and Mia both work on translating the documents.

How many **more** days will it take to complete the work?
You **must** show your working.

.....days

(4 marks)

12 (a) y is directly proportional to x^3

$y = 17$ when $x = 4$

Work out an equation connecting y and x.

(3 marks)

(b) m is inversely proportional to $\sqrt{r}$.

The value of r is multiplied by 4.

Select what happens to the value of m.

A. $\times 2$

B. $\times 16$

C. $\div 2$

D. $\div 16$

(1 mark)

13 P, Q and R have positive values.

P is directly proportional to the square of Q.
When $P = 1.25$, $Q = 0.5$
Q is inversely proportional to R.
When $Q = 0.5$, $R = 6$

Work out the value of R when $P = 0.8$

(5 marks)

14 y is directly proportional to the square of x.

Find the percentage increase in y when x is increased by 15%.

(4 marks)

15 At a constant temperature, the volume of a gas V is inversely proportional to its pressure p.
By what percentage will the pressure of a gas change if its volume increases by 25%?

(4 marks)

16 x is directly proportional to y. y is directly proportional to z.

When $x = 10$, $y = 60$.
When $y = 8$, $z = 1.6$.

Find a formula for z in terms of x.

(4 marks)