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GCSE MATHS

Ratio, proportion and rates of change

Edexcel 1MA1 | Subtopic collection Topic 34

Direct and inverse proportion

Higher tier

Past paper question booklet

63	2003-2025	Higher
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

17. The force, F, between two magnets is inversely proportional to the square of the distance, x, between them.

Leave blank

When $x = 3$, $F = 4$.

(a) Find an expression for F in terms of x.

$F =$ .....

(3)

(b) Calculate F when $x = 2$.

.....

(1)

(c) Calculate x when $F = 64$.

.....

(2)

21. M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

.....

Q21

(Total 4 marks)

25. y is directly proportional to x.

When $x = 500$, $y = 10$

(a) Find a formula for y in terms of x.

$y =$ .....

(3)

(b) Calculate the value of y when $x = 350$

$y =$ .....

(1)

Q25

(Total 4 marks)

1. Here is a list of ingredients for making a trifle for 4 people.

Trifle for 4 people	
120 g	of raspberry jelly
8	sponge fingers
420 m*l*	of custard
180 g	of tinned fruit

Rob is going to make a trifle for 6 people.
Work out the amount of each ingredient he needs.

..... g of raspberry jelly

..... sponge fingers

..... m*l* of custard

..... g of tinned fruit **Q1**

(Total 3 marks)

26. P is inversely proportional to V.

When $V = 8$, $P = 5$

(a) Find a formula for P in terms of V.

$P =$ .....

(3)

(b) Calculate the value of P when $V = 2$

.....

(1)

(Total 4 marks)

Q26

4. Here is a list of ingredients to make melon sorbet for **6** people.

Melon Sorbet
for 6 people

800 g	melon
4	egg whites
$\frac{1}{2}$	lime
100 g	caster sugar

Terry makes melon sorbet for 18 people.

(a) Work out how much caster sugar he uses.

..... g
(2)

Hedley makes melon sorbet.
He uses 2 limes.

(b) Work out how many people he makes melon sorbet for.

.....
(2)

Q4

(Total 4 marks)

1. Here is a list of ingredients for making **10** Flapjacks.

Ingredients for 10 Flapjacks
80 g rolled oats
60 g butter
30 m*l* golden syrup
36 g light brown sugar

Work out the amount of each ingredient needed to make **15** Flapjacks.

..... g rolled oats

..... g butter

..... m*l* golden syrup

..... g light brown sugar **Q1**

(Total 3 marks)

3 Build-a-mix makes concrete.

1 cubic metre of concrete has a weight of 2400 kg.

15% of the concrete is water.

The rest of the ingredients of concrete are cement, sand and stone.
The weights of these ingredients are in the ratio 1 : 2 : 5

(a) Work out the weight of cement, of sand and of stone in 1 cubic metre of concrete.

cement = ... kg

sand = ... kg

stone = ... kg

(4)

Build-a-mix needs to make 30 cubic metres of concrete.
Build-a-mix has only got 6.5 tonnes of cement.

*(b) Will this be enough cement for Build-a-mix to make 30 cubic metres of concrete?
You must show all of your working.

(3)

(Total for Question 3 is 7 marks)

1 Here is a list of ingredients needed to make 12 scones.

Ingredients for 12 scones

220 g self-raising flour
40 g butter
150 m*l* milk
2 tablespoons sugar

Viv is making scones for 15 people.
She is making 2 scones for each person.

Work out the amount of each ingredient she needs.

Self-raising flour ..... g

Butter ..... g

Milk ..... m*l*

Tablespoons of sugar .....

(Total for Question 1 is 3 marks)

6 Here are the ingredients needed to make 12 shortcakes.

Shortcakes

Makes **12** shortcakes

50 g of sugar
200 g of butter
200 g of flour
10 m*l* of milk

Liz makes some shortcakes.
She uses 25 m*l* of milk.

(a) How many shortcakes does Liz make?

.....

(2)

Robert has
500 g of sugar
1000 g of butter
1000 g of flour
500 m*l* of milk

(b) Work out the greatest number of shortcakes Robert can make.

.....

(2)

(Total for Question 6 is 4 marks)

13 y is directly proportional to x.

When $x = 600$, $y = 10$

(a) Find a formula for y in terms of x.

$y =$ .....

(3)

(b) Calculate the value of y when $x = 540$

$y =$ .....

(1)

(Total for Question 13 is 4 marks)

1 Here are the ingredients needed to make 16 gingerbread men.

Ingredients
to make **16** gingerbread men

180 g flour
40 g ginger
110 g butter
30 g sugar

Hamish wants to make 24 gingerbread men.

Work out how much of each of the ingredients he needs.

.....g flour

.....g ginger

.....g butter

.....g sugar

(Total for Question 1 is 3 marks)

Question 13

7 160 cm of gold wire has a weight of 17.8 grams.

Work out the weight of 210 cm of the gold wire.

..... grams

(Total for Question 7 is 3 marks)

2 Here is a list of ingredients for making apple crumble for 2 people.

Apple Crumble
for 2 people

10 ounces apples
4 ounces flour
2 ounces sugar
1 ounce butter
1 tablespoon water
1 teaspoon baking powder

1 ounce	=	28 grams
1 tablespoon	=	15 m*l*
1 teaspoon	=	5 m*l*

Anne is going to make apple crumble for 5 people.

(a) Work out how much flour she needs.
Give your answer in grams.

..... grams
(3)

David is making an apple crumble.
He uses 140 grams of butter.

(b) Work out how many people he is making apple crumble for.

.....

(2)

(Total for Question 2 is 5 marks)

***2** 225 grams of flour are needed to make 9 cakes.

Marian wants to make 20 of these cakes.
She has 475 grams of flour.

Does Marian have enough flour to make 20 cakes?
You must show all your working.

(Total for Question 2 is 3 marks)

***2** Here is a list of ingredients for making 18 mince pies.

Ingredients for 18 mince pies
225 g of butter
350 g of flour
100 g of sugar
280 g of mincemeat
1 egg

Elaine wants to make 45 mince pies.

Elaine has

1 kg of butter
1 kg of flour
500 g of sugar
600 g of mincemeat
6 eggs

Does Elaine have enough of each ingredient to make 45 mince pies?
You must show clearly how you got your answer.

(Total for Question 2 is 4 marks)

22 h is inversely proportional to the square of r.

When $r = 5$, $h = 3.4$

Find the value of h when $r = 8$

$h =$ .....

(Total for Question 22 is 3 marks)

1 Here is a list of ingredients for making 12 cheese scones.

Ingredients for 12 cheese scones
240 g flour 60 g butter 30 g cheese 150 m*l* milk

Jason is going to make 30 cheese scones.

Work out the amount of each ingredient he needs.

flour..... g

butter..... g

cheese..... g

milk..... m*l*

(Total for Question 1 is 3 marks)

5 Here are the ingredients needed to make 16 chocolate biscuits.

Chocolate biscuits

Makes **16** chocolate biscuits

100 g of butter
50 g of caster sugar
120 g of flour
15 g of cocoa

Sabrina has 250 g of butter
300 g of caster sugar
600 g of flour
and 60 g of cocoa

Work out the greatest number of chocolate biscuits Sabrina can make.
You must show your working.

.....

(Total for Question 5 is 3 marks)

17 T is inversely proportional to d^2

$T = 160$ when $d = 8$

Find the value of T when $d = 0.5$

.....

(Total for Question 17 is 3 marks)

1 This is a list of ingredients for making chicken soup for 4 people.

Ingredients for **4** people

60 g	butter
300 g	chicken
150 m*l*	cream
1	onion
640 m*l*	chicken stock

Bill is going to make chicken soup for 6 people.

Work out the amount of each ingredient he needs.

..... g butter

..... g chicken

..... m*l* cream

..... onion

..... m*l* chicken stock

(Total for Question 1 is 3 marks)

21 y is directly proportional to the square of x.

When $x = 3$, $y = 36$

Find the value of y when $x = 5$

.....

(Total for Question 21 is 4 marks)

5 Here is a list of ingredients for making cherry scones.

Makes 8 cherry scones
200 grams flour
60 grams margarine
40 grams sugar
60 grams cherries
160 m*l* milk

Chen wants to make 20 cherry scones.

(a) Work out how much milk he will need.

.....m*l*

(2)

Sophie has 80 grams of sugar and 300 grams of flour.
She has plenty of the other ingredients.

*(b) What is the greatest number of cherry scones she can make?
You must show all your working.

(3)

(Total for Question 5 is 5 marks)

4 Lewis has a copper pipe with a length of 150 cm and a mass of 800 grams.

He cuts a piece of the copper pipe with a length of 90 cm.

Work out the mass of this piece of copper pipe.

..... grams

(Total for Question 4 is 2 marks)

4 Lewis has a copper pipe with a length of 150 cm and a mass of 800 grams.

He cuts a piece of the copper pipe with a length of 90 cm.

Work out the mass of this piece of copper pipe.

..... grams

(Total for Question 4 is 2 marks)

24 p is inversely proportional to t.

When $t = 4$, $p = 12$

Find the value of p when $t = 6$

.....

(Total for Question 24 is 3 marks)

3 Here is a list of ingredients for making a peach dessert for **6** people.

Peach dessert for **6** people.	
150 g	jelly
10	sponge fingers
500 m*l*	custard
200 g	peaches

Bob is going to make a peach dessert for **15** people.

Work out the amount of each ingredient he needs.

..... g jelly

..... sponge fingers

..... m*l* custard

..... g peaches

(Total for Question 3 is 3 marks)

2 Tony has a hosepipe.
The length of the hosepipe is 20 m.

Tony stores the hosepipe on a reel.
The weight of the reel is 1.4 kg.

$\frac{1}{2}$ metre of the hosepipe has a weight of 150 grams.

Work out the total weight of the hosepipe and the reel.

..... kg

(Total for Question 2 is 3 marks)

Question 29

15 D is directly proportional to x.

$D = 36$ when $x = 5$

Work out the value of D when $x = 8$

$D =$ .....

(Total for Question 15 is 2 marks)

1 Here are the ingredients needed to make 10 pancakes.

Pancakes	
Ingredients to make **10** pancakes	
300 m*l*	of milk
120 g	of flour
2	eggs

Matthew makes 30 pancakes.

(a) Work out how much flour he uses.

.....g
(2)

Tara makes some pancakes.
She uses 750 m*l* of milk.

(b) Work out how many pancakes she makes.

.....
(2)

(Total for Question 1 is 4 marks)

3 Here are the ingredients needed to make 20 cookies.

Cookies

Ingredients to make **20** cookies.

250 g butter
120 g caster sugar
300 g flour

Sam is going to make some cookies.

She has these ingredients.

625 g butter 360 g caster sugar 1000 g flour

Work out the greatest number of cookies that Sam can make with her ingredients.
You must show your working.

.....

(Total for Question 3 is 3 marks)

18 y is inversely proportional to the square of x.
When $x = 5$, $y = 15$

Write a formula for y in terms of x.

.....

(Total for Question 18 is 3 marks)

5 Here are the ingredients needed to make **8** shortbread biscuits.

Shortbread biscuits makes **8** biscuits
120 g butter 60 g caster sugar 180 g flour

Tariq is going to make some shortbread biscuits.
He has the following ingredients

330 g butter 200 g caster sugar 450 g flour

Work out the greatest number of shortbread biscuits that Tariq can make with his ingredients.
You must show all your working.

..... biscuits

(Total for Question 5 is 3 marks)

1 Here are the ingredients needed to make leek and potato soup for 4 people.

Leek and potato soup

Serves 4

4 leeks

350 g potatoes

600 m*l* vegetable stock

300 m*l* milk

Jenny wants to make soup for 6 people.

Work out the amount of each ingredient she needs.

..... leeks

..... g potatoes

..... m*l* vegetable stock

..... m*l* milk

(Total for Question 1 is 3 marks)

19 y is proportional to x^2.

When $x = 5$, $y = 100$

Work out the value of y when $x = 3$

$y =$ .....

(Total for Question 19 is 3 marks)

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

x	1	2	5	10
y				1

(Total for Question 24 is 4 marks)

3 Stephanie uses her grandmother's recipe to make apple amber.
Here is the list of ingredients to make 8 portions.

Apple amber
(makes 8 portions)
$2\frac{1}{2}$ pounds apples
10 ounces sugar
4 eggs

Stephanie wants to make 12 portions of apple amber.

(a) Work out how much sugar she needs.

..... ounces
(2)

Stephanie has 2 kg of apples.

(b) Show that she has enough apples to make 12 portions of apple amber.
You must show your working.

(3)

(Total for Question 3 is 5 marks)

20 y is inversely proportional to the square root of x.

When $x = 4$, $y = 9$

Work out the value of y when $x = 6$
Give your answer correct to 3 significant figures.

.....

(Total for Question 20 is 3 marks)

24 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 $d = 10$

.....

(Total for Question 24 is 3 marks)

2 Here are the ingredients needed to make 30 biscuits.

Biscuits

Ingredients to make **30** biscuits

400 g of flour
320 g of butter
180 g of sugar

Helen wants to make 20 biscuits.

(a) How much sugar does Helen need?

..... g
(2)

John has 1 kg of flour and enough of the other ingredients.

(b) Work out the greatest number of biscuits John can make.

.....
(2)

(Total for Question 2 is 4 marks)

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

Find the value of T when $d = 0.5$

.....

(Total for Question 20 is 3 marks)

13 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.

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

.....

(2)

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

.....

(2)

(Total for Question 13 is 4 marks)

Question 43

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

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

Find the value of y when $x = 64$

.....

(Total for Question 16 is 3 marks)

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

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

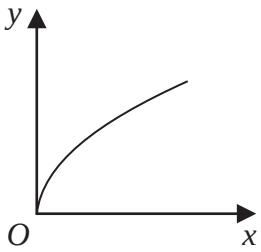
Find a formula for y in terms of x.
Give your answer in its simplest form.

.....

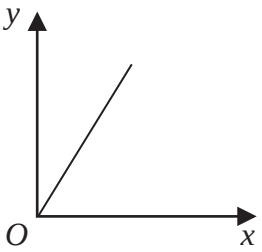
(Total for Question 14 is 5 marks)

12

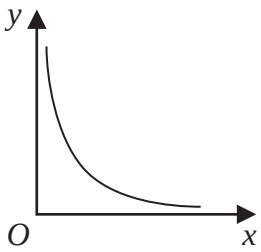
Graph A



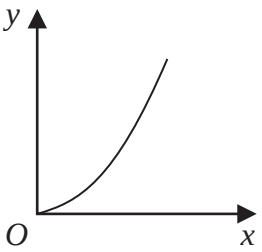
Graph B



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
$y \propto x$	
$y \propto x^2$	
$y \propto \sqrt{x}$	
$y \propto \frac{1}{x}$	

(Total for Question 12 is 2 marks)

Question 46

November 2018 | 1MA1/3H | Original Q14

14 y is inversely proportional to x^3

$y = 44$ when $x = a$

Show that $y = 5.5$ when $x = 2a$

(Total for Question 14 is 3 marks)

20 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

.....

(Total for Question 20 is 4 marks)

9 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

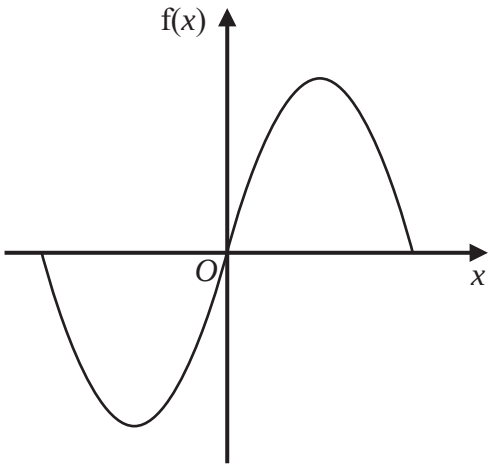
Work out the total number of days taken to make all the boxes.

.....

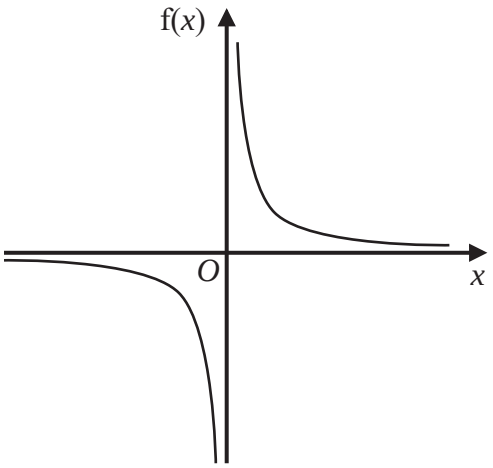
(Total for Question 9 is 3 marks)

17 Here are four graphs.

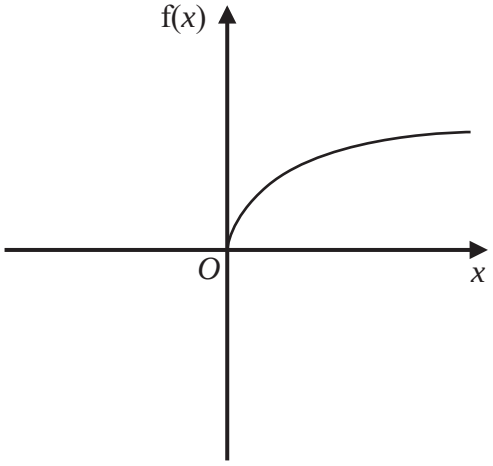
Graph A



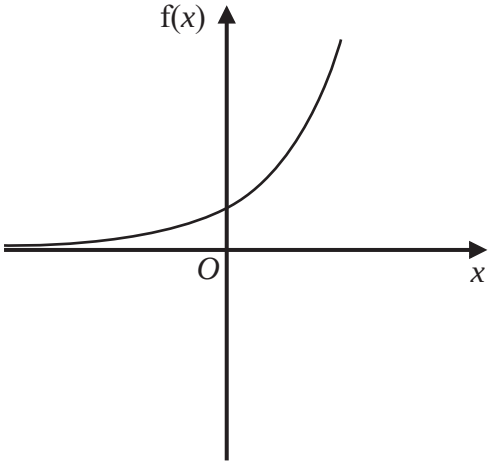
Graph B



Graph C



Graph D



The graphs represent four different types of function f.

Match each description of the function in the table to the letter of its graph.

Description of function	Graph
f(x) is inversely proportional to x	
f(x) is a trigonometrical function	
f(x) is an exponential function	
f(x) is directly proportional to $\sqrt{x}$	

(Total for Question 17 is 2 marks)

8 The number of days, d, that it will take to build a house is given by

$$d = \frac{720}{n}$$

where n is the number of workers used each day.

Ali's company will take 40 days to build the house.
Hayley's company will take 30 days to build the house.

Hayley's company will have to use more workers each day than Ali's company.

How many more?

.....

(Total for Question 8 is 3 marks)

16 y is inversely proportional to the square of x.

$y = 8$ when $x = 2.5$

Find the negative value of x when $y = \frac{8}{9}$

.....

(Total for Question 16 is 3 marks)

Question 52

18 x is proportional to $\sqrt{y}$ where $y > 0$

y is increased by 44%

Work out the percentage increase in x.

.....%

(Total for Question 18 is 3 marks)

4 Maisie knows that she needs 3 kg of grass seed to make a rectangular lawn 5 m by 9 m.

Grass seed is sold in 2 kg boxes.

Maisie wants to make a rectangular lawn 10 m by 14 m.
She has 5 boxes of grass seed.

(a) Has Maisie got enough grass seed to make a lawn 10 m by 14 m?
You must show all your working.

(4)

Maisie opens the 5 boxes of grass seed.

She finds that 4 of the boxes contain 2 kg of grass seed.
The other box contains 1 kg of grass seed.

(b) Does this affect whether Maisie has enough grass seed to make her lawn?
Give a reason for your answer.

.....

.....

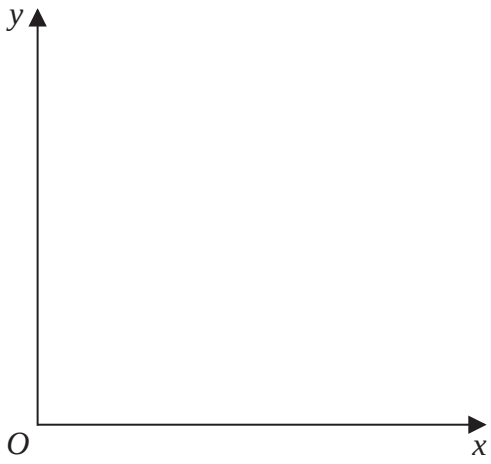
.....

(1)

(Total for Question 4 is 5 marks)

8 (a) Using the axes below, sketch a graph to represent the statement

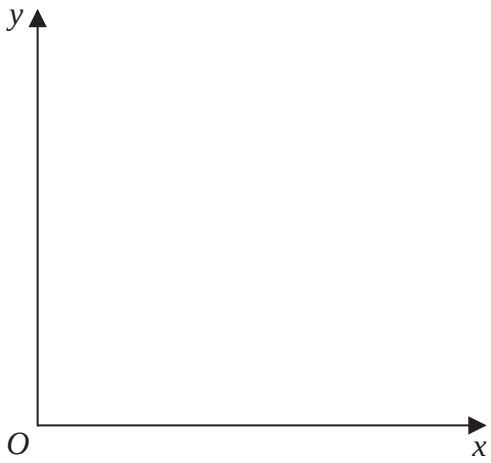
y is directly proportional to x



(1)

(b) Using the axes below, sketch a graph to represent the statement

y is inversely proportional to x



(1)

(Total for Question 8 is 2 marks)

Question 55

17 x is directly proportional to the square of y.
y is directly proportional to the cube of z.

$z = 2$ when $x = 32$

Find a formula for x in terms of z.

.....

(Total for Question 17 is 4 marks)

17 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.

.....

(Total for Question 17 is 4 marks)

13 p is inversely proportional to t

Complete the table of values.

t	100	25		2
p	1		5	

(Total for Question 13 is 3 marks)

Question 58

June 2023 | 1MA1/1H | Original Q13

13 y is directly proportional to x.

$y = 24$ when $x = 1.5$

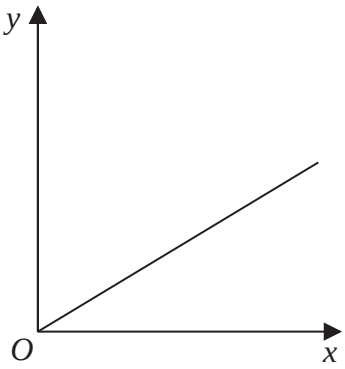
Work out the value of y when $x = 5$

$y =$ .....

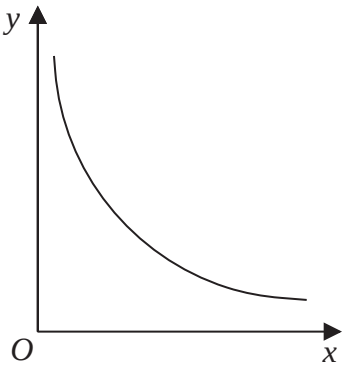
(Total for Question 13 is 3 marks)

11

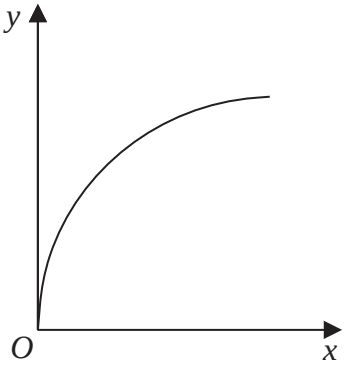
Graph **A**



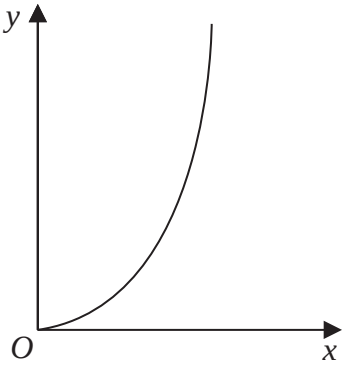
Graph **B**



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
$y \propto x^2$	
$y \propto x$	
$y \propto \frac{1}{x}$	
$y \propto \sqrt{x}$	

(Total for Question 11 is 2 marks)

14 y is proportional to x^2
$y = 3$ when $x = 0.5$

x is inversely proportional to w
$x = 2$ when $w = 0.2$

Find the value of y when $w = 2$

$y =$ .....

(Total for Question 14 is 5 marks)

12 f is inversely proportional to d^2

$f = 3.5$ when $d = 8$

(a) Find an equation for f in terms of d.

.....

(2)

(b) Find the positive value of d when $f = 10$
Give your answer correct to 3 significant figures.

$d =$ .....

(2)

(Total for Question 12 is 4 marks)

13 Here is a table of values of x and y.

x	2	4	6	8
y	0	4	8	12

Nadia says that y is directly proportional to x because the value of y increases by 4 as the value of x increases by 2

(a) Is Nadia correct?
You must give a reason for your answer.

.....

.....

.....

(1)

w is directly proportional to the square root of t.

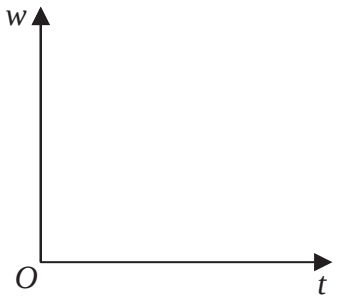
$w = 140$ when $t = 64$

(b) (i) Calculate the value of w when $t = 7.84$

$w =$ .....

(3)

(ii) On the axes below, sketch a graph to show the relationship between w and t.



(1)

(Total for Question 13 is 5 marks)

11 T is inversely proportional to w.

w is directly proportional to the cube root of d.

When $w = 6$, $T = 20$
When $w = 1$, $d = 8$

Find the value of d when $T = 48$

$d =$ .....

(Total for Question 11 is 5 marks)