Direct and Inverse Proportion (Questions from Past Papers)

Name:

SOLUTIONS

GCSE (1 - 9)

Buy me a coffee

Direct and Inverse Proportion

Solutions by
Kenneth Stafford
MATHS TUTOR
ken@kennethstafford.co.uk

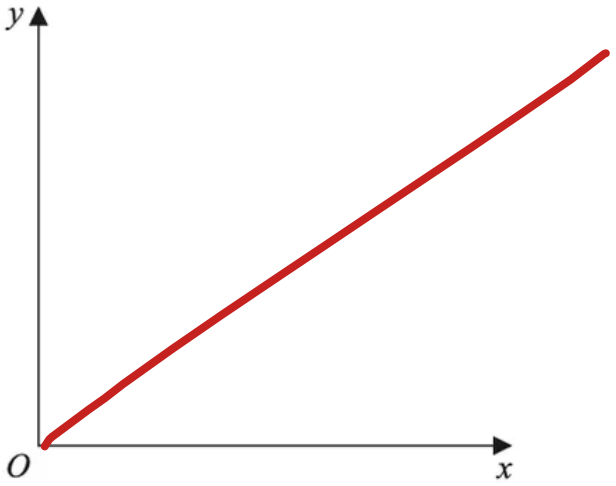
These questions are compiled from *released* Pearson Edexcel GCSE maths exam papers
They contain exam questions from up until the ***November 2021*** exam series
More recent exam papers do exist but are withheld for mock exams
As new exam papers are released these worksheets will gradually be updated
The ***most current*** version of these worksheets will always be available at: kennethstafford.co.uk
These worksheets were made using examq.co.uk

Qu	Paper where the question appeared	Qu	Paper where the question appeared
1	Edexcel, GCSE, Autumn 2021, Paper 3H, Q8	12	Edexcel, GCSE, Autumn 2018, Paper 1H, Q4
2	Edexcel, GCSE, Autumn 2021, Paper 3H, Q9	13	Edexcel, GCSE, Autumn 2018, Paper 3H, Q5
3	Edexcel, GCSE, Autumn 2021, Paper 3H, Q17	14	Edexcel, GCSE, Autumn 2018, Paper 3H, Q14
4	Edexcel, GCSE, Autumn 2020, Paper 1H, Q18	15	Edexcel, GCSE, Summer 2018, Paper 1H, Q14
5	Edexcel, GCSE, Autumn 2020, Paper 3H, Q4	16	Edexcel, GCSE, Summer 2018, Paper 2H, Q12
6	Edexcel, GCSE, Autumn 2019, Paper 1H, Q11	17	Edexcel, GCSE, Autumn 2017, Paper 1H, Q13
7	Edexcel, GCSE, Autumn 2019, Paper 3H, Q16	18	Edexcel, GCSE, Autumn 2017, Paper 1H, Q16
8	Edexcel, GCSE, Summer 2019, Paper 1H, Q2	19	Edexcel, GCSE, Autumn 2017, Paper 2H, Q9
9	Edexcel, GCSE, Summer 2019, Paper 1H, Q20	20	Edexcel, GCSE, Summer 2017, Paper 1H, Q13
10	Edexcel, GCSE, Summer 2019, Paper 3H, Q9		
11	Edexcel, GCSE, Summer 2019, Paper 3H, Q17		

1

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

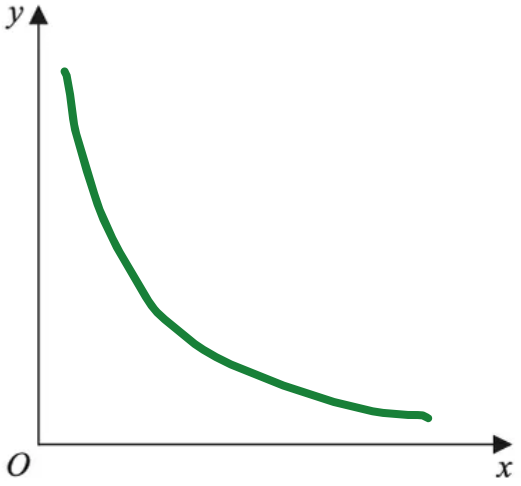
y is directly proportional to x



(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)

[Edexcel, GCSE, Autumn 2021, Paper 3H, Q8]

2

On Monday, 12 people took 5 hours to clean a number of cars.
On Tuesday, 15 people cleaned the same number of cars.

Assuming that all the people worked at the same rate,

(a) work out how many hours the 15 people took to clean the cars.

÷12 ↓ 12 people = 5 hours ↓ ×12
1 person = 60 hours
×15 ↓ 15 people = 4 hours ↓ ÷15

4 hours

(2)

The assumption is wrong.

(b) How might this affect the time taken for the 15 people to clean the cars?

It will either take more time or less time.

(1)

(Total for Question 9 is 3 marks)

[Edexcel, GCSE, Autumn 2021, Paper 3H, Q9]

3

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.

$x = ky^2$

$y = pz^3$

$x = k(pz^3)^2$

$x = kp^2z^6$

$32 = kp^2(2)^6$

$32 = kp^2(64)$

$\frac{32}{64} = kp^2$

$kp^2 = \frac{1}{2}$

$x = \frac{1}{2}z^6$

(Total for Question 17 is 4 marks)

[Edexcel, GCSE, Autumn 2021, Paper 3H, Q17]

4

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

y is increased by 44%

Work out the percentage increase in x.

$x = k\sqrt{y}$

$x = k\sqrt{1.44y}$

$x = k\sqrt{1.44} \cdot \sqrt{y}$

$x = k \times 1.2 \times \sqrt{y}$

1.2 so 20%

20 %

(Total for Question 18 is 3 marks)

[Edexcel, GCSE, Autumn 2020, Paper 1H, Q18]

5

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.

$5 \times 9 = 45 m^2$

$45 m^2 = 3 kg$

$15 m^2 = 1 kg$

Her lawn : $10 \times 14 = 140 m^2$

$140 \div 15 = 9.3 kg$ needed

5 boxes = $5 \times 2 = 10 kg$.

Yes. She has enough

(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.

Yes. She no longer has enough as she now has 9kg and needs 9.3kg.

(1)

(Total for Question 4 is 5 marks)

[Edexcel, GCSE, Autumn 2020, Paper 3H, Q4]

6

There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p.

$\frac{12}{p} = \frac{5}{30}$

$12 \times 30 = 5p$

$5p = 360$

$p = \frac{360}{5} = 72$

72

(Total for Question 11 is 2 marks)

[Edexcel, GCSE, Autumn 2019, Paper 1H, Q11]

7

y is inversely proportional to the square of x.

$y = 8$ when $x = 2.5$

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

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

$8 = \frac{k}{2.5^2}$

$k = 8 \times 2.5^2$

$k = 50$

$y = \frac{50}{x^2}$

$\frac{8}{9} = \frac{50}{x^2}$

$x^2 = 50 \div \frac{8}{9}$

$x^2 = 56.25$

$x = -7.5$

(Total for Question 16 is 3 marks)

[Edexcel, GCSE, Autumn 2019, Paper 3H, Q16]

8

Deon needs 50 g of sugar to make 15 biscuits.

She also needs

three times as much flour as sugar
two times as much butter as sugar

Deon is going to make 60 biscuits.

(a) Work out the amount of flour she needs.

15 → ×4 → 60

Sugar = 50g
Flour = 150g
Butter = 100g

Flour = 600g
Butter = 400g

600 g

(3)

Deon has to buy all the butter she needs to make 60 biscuits.
She buys the butter in 250 g packs.

(b) How many packs of butter does Deon need to buy?

400 ÷ 250 = 1.6

2

(2)

(Total for Question 2 is 5 marks)

[Edexcel, GCSE, Summer 2019, Paper 1H, Q2]

9

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

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

$10 = \frac{k}{6}$

$k = 60$

$h = \frac{60}{p}$

$p = \frac{60}{h}$

$p = k\sqrt{t}$

$6 = k\sqrt{144}$

$6 = 12k$

$k = \frac{1}{2}$

$p = \frac{1}{2}\sqrt{t}$

$\frac{60}{h} = \frac{1}{2}\sqrt{t}$

$\frac{120}{h} = \sqrt{t}$

$\frac{120}{\sqrt{t}} = h$

$\frac{120}{\sqrt{t}}$

(Total for Question 20 is 4 marks)

[Edexcel, GCSE, Summer 2019, Paper 1H, Q20]

10

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.

6 x 9 = 54 "machine 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.

Day 1 = 54 − 3 = 51

Day 2 = 51 − 4 = 47

Day 3 = 47 − 5 = 42

Other days = 42 ÷ 6 = 7 more days

3 + 7 = 10

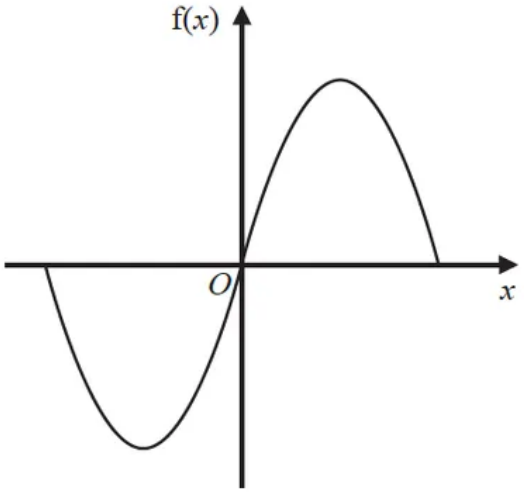
(Total for Question 9 is 3 marks)

[Edexcel, GCSE, Summer 2019, Paper 3H, Q9]

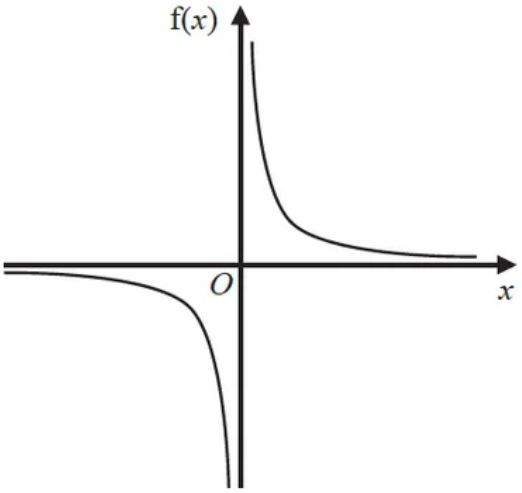
11

Here are four graphs.

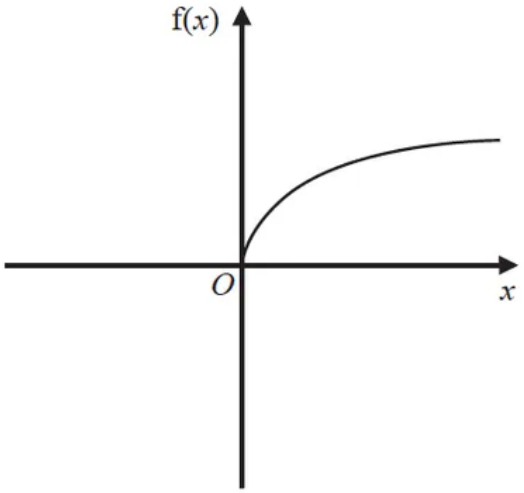
Graph A



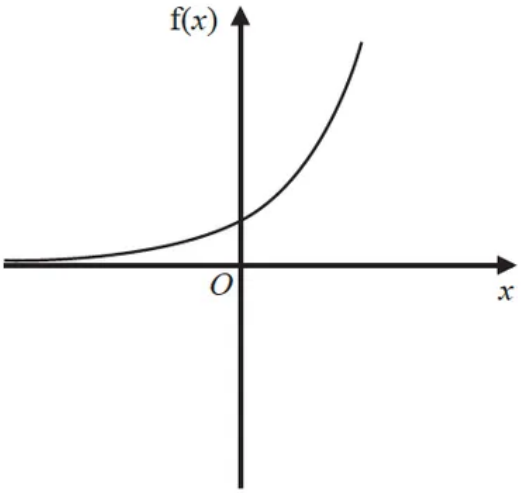
Graph B



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	B
f(x) is a trigonometrical function	A
f(x) is an exponential function	D
f(x) is directly proportional to $\sqrt{x}$	C

(Total for Question 17 is 2 marks)

[Edexcel, GCSE, Summer 2019, Paper 3H, Q17]

12

It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

÷5 ↓ 5 taps = 120 mins ↓ ×5

1 tap = 600 mins

×3 ↓ 3 taps = 200 mins ↓ ÷3

200 minutes

(2)

(b) State one assumption you made in working out your answer to part (a).

That all the taps work at the same rate.

(1)

(Total for Question 4 is 3 marks)

[Edexcel, GCSE, Autumn 2018, Paper 1H, Q4]

13

Lara is a skier.

She completed a ski race in 1 minute 54 seconds. = 114 seconds
The race was 475 m in length.

Lara assumes that her average speed is the same for each race.

(a) Using this assumption, work out how long Lara should take to complete a 700 m race.
Give your answer in minutes and seconds.

475 m = 114 seconds

÷475 ↓ ↓ ÷475

1 m = $\frac{114}{475}$

×700 ↓ ↓ ×700

700 m = 168 seconds

= 2 minutes 48s

2 minutes 48 seconds

(3)

Lara's average speed actually increases the further she goes.

(b) How does this affect your answer to part (a)?

Then she will take less time.

(1)

(Total for Question 5 is 4 marks)

[Edexcel, GCSE, Autumn 2018, Paper 3H, Q5]

14

y is inversely proportional to x^3

$y = 44$ when $x = a$

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

$y = \frac{k}{x^3}$

$44 = \frac{k}{a^3}$

$k = 44a^3$

$y = \frac{44a^3}{x^3}$

$y = \frac{44a^3}{(2a)^3}$

$y = \frac{44a^3}{8a^3}$

$y = \frac{44}{8}$

$y = 5.5$

(Total for Question 14 is 3 marks)

[Edexcel, GCSE, Autumn 2018, Paper 3H, Q14]

15

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.

$d = kx^2$

$24 = k(2)^2$

$k = \frac{24}{4}$

$k = 6$

$d = 6x^2$

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

$4 = \frac{k}{10^2}$

$k = 4 \times 100 = 400$

$y = \frac{400}{d^2}$

$y = \frac{400}{(6x^2)^2}$

$y = \frac{400}{36x^4}$

$y = \frac{100}{9x^4}$

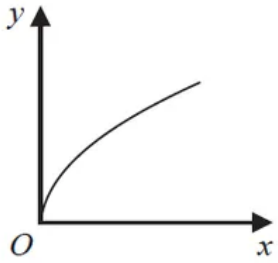
$y = \frac{100}{9x^4}$

(Total for Question 14 is 5 marks)

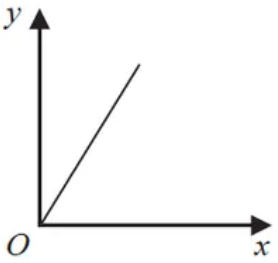
[Edexcel, GCSE, Summer 2018, Paper 1H, Q14]

16

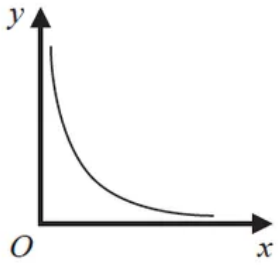
Graph A



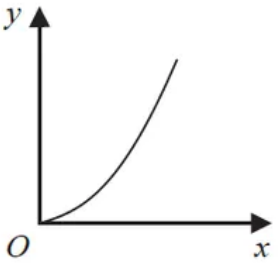
Graph B



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
$y \propto x$	B
$y \propto x^2$	D
$y \propto \sqrt{x}$	A
$y \propto \frac{1}{x}$	C

(Total for Question 12 is 2 marks)

[Edexcel, GCSE, Summer 2018, Paper 2H, Q12]

17

A factory makes 450 pies every day.
The pies are chicken pies or steak pies.

Each day Milo takes a sample of 15 pies to check.

The proportion of the pies in his sample that are chicken is the same as the proportion of the pies made that day that are chicken.

On Monday Milo calculated that he needed exactly 4 chicken pies in his sample.

(a) Work out the total number of chicken pies that were made on Monday.

$\frac{4}{15} = \frac{x}{450}$

$x = 450 \times \frac{4}{15} = 120$

120

(2)

On Tuesday, the number of steak pies Milo needs in his sample is 6 correct to the nearest whole number.

Milo takes at random a pie from the 450 pies made on Tuesday.

(b) Work out the lower bound of the probability that the pie is a steak pie.

$\frac{5.5}{15} = \frac{11}{30}$

$\frac{11}{30}$

(2)

(Total for Question 13 is 4 marks)

[Edexcel, GCSE, Autumn 2017, Paper 1H, Q13]

18

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

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

Find the value of y when $x = 64$

$y = k\sqrt[3]{x}$

$\frac{7}{6} = k\sqrt[3]{8}$

$\frac{7}{6} = 2k$

$k = \frac{7}{6} \times \frac{1}{2}$

$k = \frac{7}{12}$

$y = \frac{7}{12}\sqrt[3]{x}$

$y = \frac{7}{12}\sqrt[3]{64}$

$y = \frac{7}{12} \times 4$

$y = \frac{7}{3}$

(Total for Question 16 is 3 marks)

[Edexcel, GCSE, Autumn 2017, Paper 1H, Q16]

19

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?

5 cleaners = 4.5 hours

÷5 ↓ ↓ ×5

1 cleaner = 22.5 hours

×3 ↓ ↓ ÷3

3 cleaners = 7.5 hours (8 hours)

8 hours × 8.20 = 65.60

£ 65.60

(Total for Question 9 is 3 marks)

[Edexcel, GCSE, Autumn 2017, Paper 2H, Q9]

20

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.

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

$9 = \frac{k}{(1)^2}$

$k = 9$

$y = \frac{9}{x^2}$

(2)

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

$16 = \frac{9}{x^2}$

$x^2 = \frac{9}{16}$

$x = \sqrt{\frac{9}{16}}$

$x = +\frac{3}{4}$ or $-\frac{3}{4}$

$\frac{3}{4}$

(2)

(Total for Question 13 is 4 marks)

[Edexcel, GCSE, Summer 2017, Paper 1H, Q13]