YSGOL CREUDDYN
DAWN DYSG DAIONI

The Mathematics Department

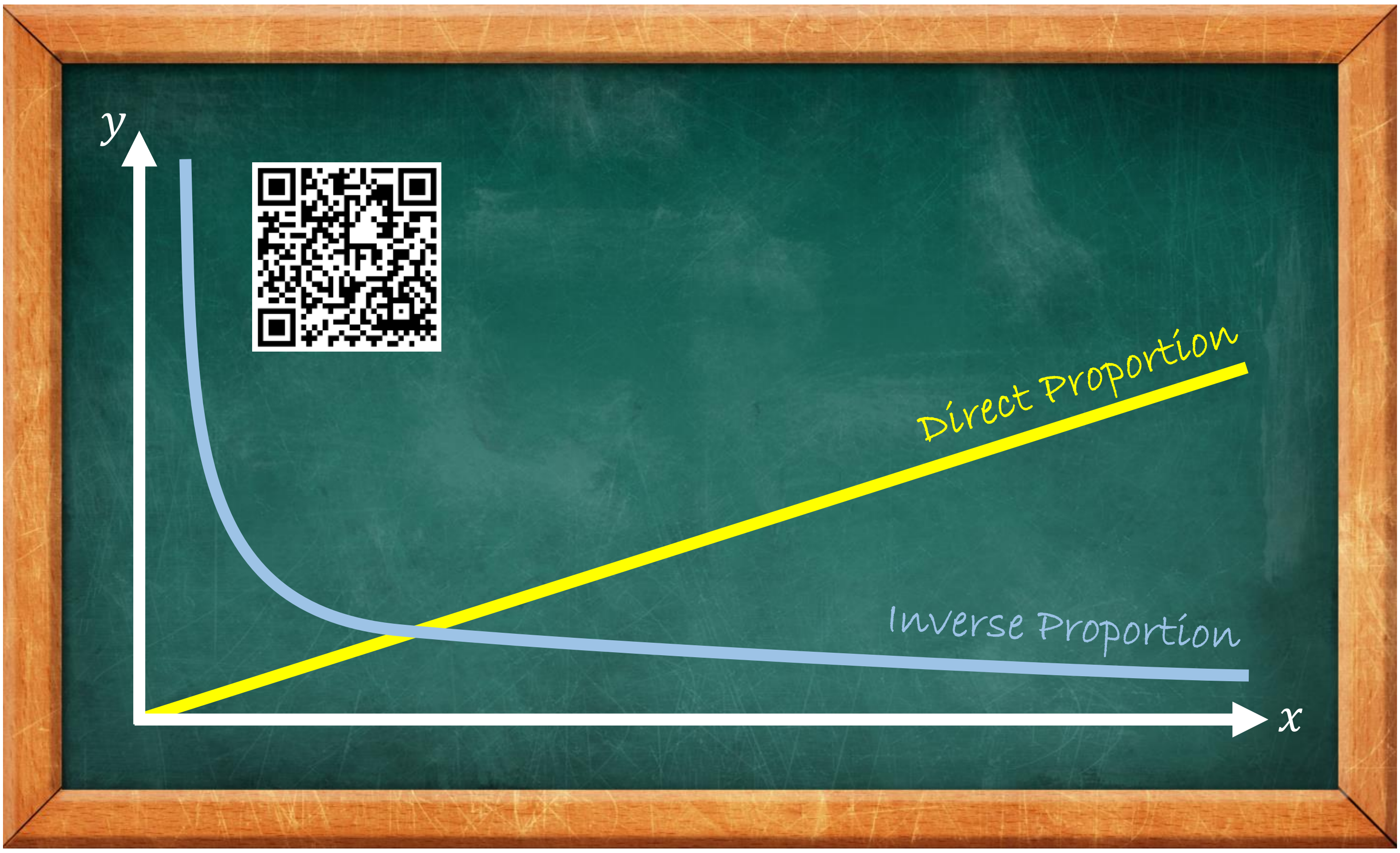
11

Developing Algebra 3

Higher Tier

Name:

Contents



The Mathematics Department

Welcome back to year 11! Here is a reminder of the guidelines for looking after your work.

- At the start of every lesson, write "Classwork", the date and a suitable title for the work. Each of these should be underlined.
- No blank pages should be left in the red mathematics book.
- Draw diagrams using a pencil and, where appropriate, using the correct equipment, e.g. ruler, protractor, compass.
- Show your method fully.
- Remember to include relevant units in your answers, e.g. cm, £, ml.

Keep your work in the **plastic wallet**.
Your wallet should include the following items at all times:

(a) Your red mathematics book.
(b) Your revision book for the year.
(c) Your tracking sheet for the year.
(d) The current workbook.
(e) The current additional tasks workbook.
(f) Any other work that is required at this moment.

Old workbooks should be stored safely at home.
(You will need to refer to these in the future.)

Equipment

- Black, red and blue biros.
- HB Pencil.
- Ruler (a 30 cm one is better).
- Eraser.
- Protractor.
- Compass.
- Scientific calculator (Casio fx-83GTCW).
- Highlighter.

The Revision Book

This will form the basis for your GCSE revision.

- Complete at least 4 pages in your revision book for each unit of work.
- You should include material you will need in the future for remembering the work quickly. This can include notes on the work; examples; important facts; and revision posters.

Workbooks

You will receive 1 copy of the workbook and 1 copy of the additional tasks workbook at the start of each new unit of work. (If you lose the workbook, a new one will cost 50p.)

A Welsh copy of the workbook, and additional supporting materials, can be found on the department's website, www.mathemateg.com

Content of the workbooks

When you see a QR code (like the one on the left), scan it using your mobile device in order to reach a Welsh YouTube video hosted on the following channel.

www.youtube.com/adolygumathemateg

The letters in circles, for example (I), show the tier of the work in the GCSE specification.

Tier	**Foundation**	**Intermediate**	**Higher**
GCSE Grades	U, G, F, E, D	U, E, D, C, B	U, C, B, A, A*

All the workbooks contain a variety of exercises, labelled as follows.

Skill
Exercises on new topics.

Applying
Answering a question in context, or solving a problem.

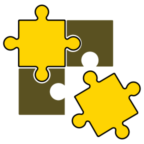
Extension
A more difficult question.

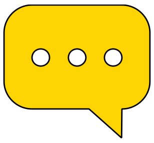
Revision
Revision of material from previous workbooks.

Evaluation
There are evaluation boxes at the end of each chapter to revise the completed work.

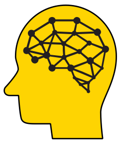
Key words	Corrections	I am happy with...	I need to revise...
Write down the new or important mathematical terms from the chapter.	What do you need to remember when completing this type of work in the future?	Write down the topics you had success with.	Write down the topics you need to look at again.

Curriculum for Wales Proficiencies


Conceptual understanding


Communication using symbols


Strategic competence


Logical reasoning

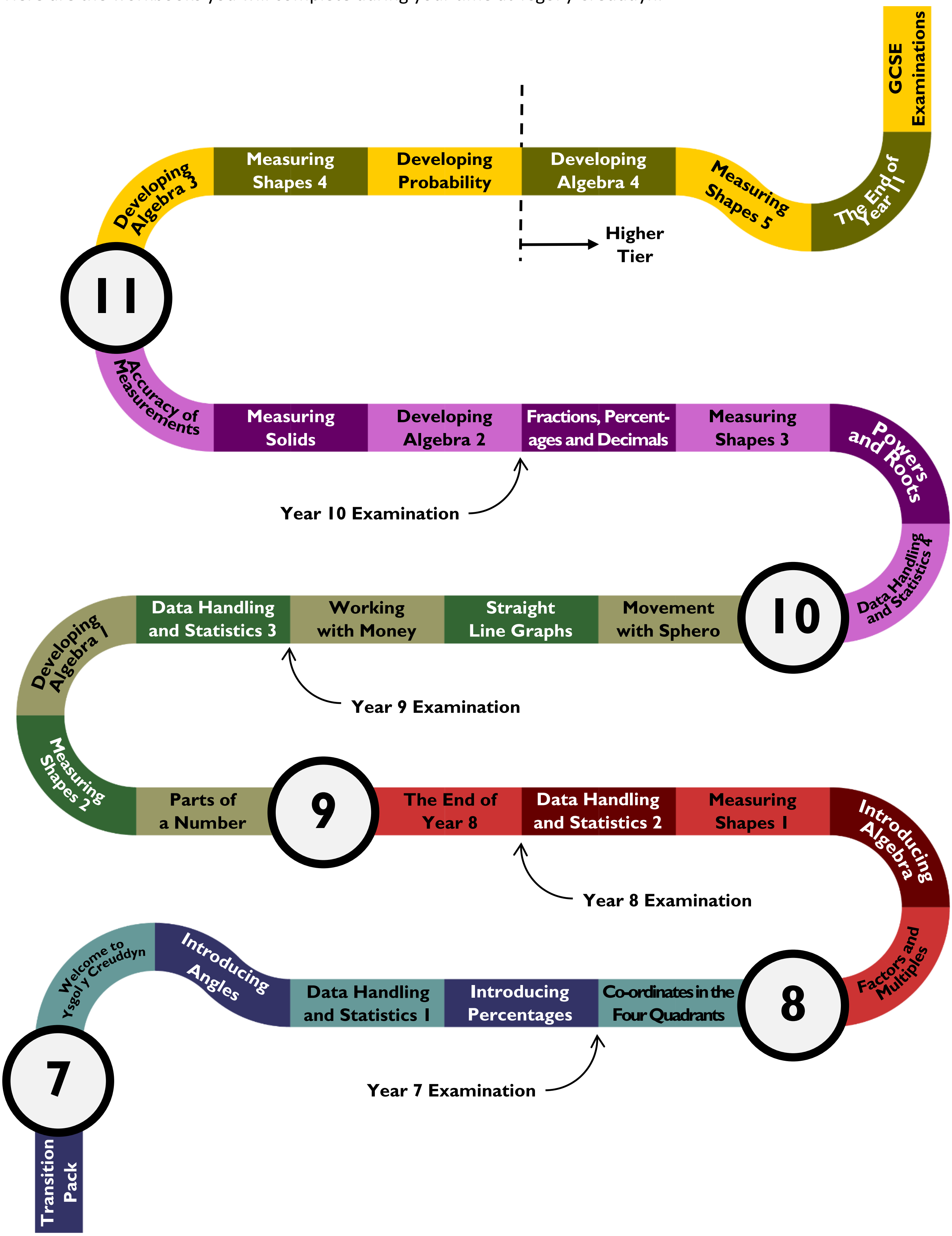

Fluency

Supporting Materials:

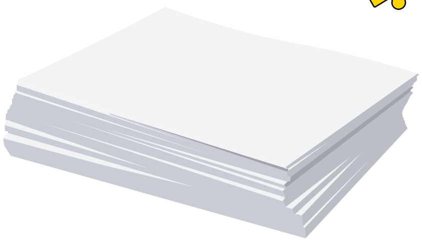
- Diagnostic Questions
  - A quiz for each workbook on the website www.diagnosticquestions.com.
- Reflection Sheet
  - An opportunity to assess your understanding of a workbook, and to see the test question order.
- Old WJEC examination questions; worksheets; investigations; puzzles.
  - Available for some topics.

Mathematics Learning Journey for Ysgol y Creuddyn

Here are the workbooks you will complete during your time at Ysgol y Creuddyn.



Proportion



Two measures are in **proportion to each other** if there is a **connection** between the measures. For example, the more pieces of paper there are in a pile of paper, the higher the pile will be. We say that the height of the pile of paper and the number of pages in the pile are in proportion to each other.

The **type** of proportion depends on the type of connection between the measures.

Direct Proportion	Inverse Proportion
As one measure increases, the other measure also increases.	As one measure increases, the other measure decreases.

Example

(a) The distance a car travels is in direct proportion to the amount of petrol it uses.

(b) The average speed of a car on a specific journey is in inverse proportion to the time the car takes to make the journey.

Exercise 1

Skill I

Note which type of proportion (direct proportion or inverse proportion) the following questions describe.

(a) The height of a pile of paper and the number of pages in the pile.

(b) The length of a piece of string and the mass of the string.

(c) The time taken to build a wall and the number of workers used to build the wall.

(d) The number of tins of soup bought and the total cost of the tins.

(e) The time taken to empty a water tank and the number of water pumps used to empty the tank.

(f) The number of pages in a book and the time taken to read the book.

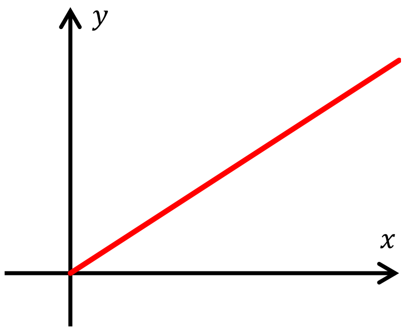
(g) The distance a car travels in half an hour and the average speed of the car.

(h) The age of a car and the monetary value of the car (during the first decade after the initial purchase).

(i) The mass of a bar of gold and the monetary value of the bar.

Direct Proportion

With direct proportion, when one measure increases (e.g. miles travelled, x), another measure must also increase (e.g. amount of petrol used, y). We can write this relationship as $y \propto x$. The symbol $\propto$ means "in proportion to". The graph on the right illustrates direct proportion. The gradient of the line (the multiplier of the proportion, k) can be any positive value.



Example

A digger can dig a 560 m long ditch in 21 days. How much time would it take to dig a 240 m long ditch?

Answer: To begin, we set out the information in a table, ensuring that the quantity we want to find appears in the bottom-right of the table.

Length of ditch	Time
560 m	21 days
240 m	?

By multiplying or dividing, we need to find a sum (or a series of sums) that changes 560 m to be 240 m.

Unitary Method (always works)

Starting with 560, divide by 560 to reach 1, then multiply by 240 to reach 240. Use the **same** sums with the time.

	Length of ditch	Time	
÷ 560	560 m	21 days	÷ 560
	1 m	$\frac{21}{560}$ days	
× 240	240 m	9 days	× 240

Inspection Method

Starting with 560, divide by 7 to reach 80, then multiply by 3 to reach 240. Use the **same** sums with the time.

	Length of ditch	Time	
÷ 7	560 m	21 days	÷ 7
	80 m	3 days	
× 3	240 m	9 days	× 3

Exercise 2

(a) A train travels 165 metres in 3 seconds.
How far would it travel in 8 seconds?

(b) An aeroplane travels 216 miles in 27 minutes.
How far would it travel in 12 minutes?

(c) £50 is worth $90. How much is £175 worth?

(d) A 7-metre ladder has 28 steps.
How many steps would a similar 5-metre ladder have?

(e) The mass of a 27 metre long piece of string is 351 grams.
What would be the mass of 15 metres of the same type of string?

(f) A rabbit can burrow a 4 metre long tunnel in 26 hours. How long would the rabbit take to burrow a 7 metre long tunnel?

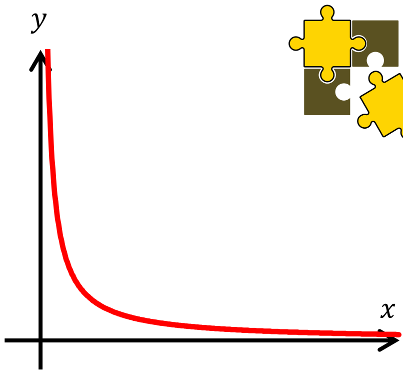
(g) A landscape gardener can paint 15 fence panels in 6 hours.
How long would it take to paint 40 fence panels?

(h) The cost of 12 printer cartridges is £90.
What is the cost of five of these printer cartridges?

(i) The height of 500 pieces of paper is 4.9 cm.
What would be the height of 800 pieces of the same type of paper?

Inverse Proportion

With inverse proportion, when one measure increases (e.g. average speed of a car, x), another measure decreases (e.g. the time taken to complete the journey, y). We can write this relationship as $y \propto \frac{1}{x}$. We read this as "y is inversely proportional to x". The graph on the right illustrates inverse proportion.



Example

If three diggers can dig a hole in 8 hours, how long would four diggers take to dig the same hole?

Answer: To begin, we set out the information in a table, ensuring that the quantity we want to find appears in the bottom-right of the table.

Number of machines	Time
3	8 hours
4	?

By multiplying or dividing, we need to find a sum (or a series of sums) that changes 3 to be 4.

Unitary Method (always works)

Starting with 3, we divide by 3 to reach 1, then multiply by 4 to reach 4. We use the **inverse** sums with the time.

	Number of machines	Time	
$\div 3$	3	8 hours	$\times 3$
	1	24 hours	
$\times 4$	4	6 hours	$\div 4$

Inspection Method

Starting with 3, we multiply by 4 to reach 12, then divide by 3 to reach 4. We use the **inverse** sums with the time.

	Number of machines	Time	
$\times 4$	3	8 hours	$\div 4$
	12	2 hours	
$\div 3$	4	6 hours	$\times 3$

Exercise 3

I

(a) Travelling at a constant speed of 32 kilometres per hour, a journey takes 18 minutes. How long would the same journey take travelling at a constant speed of 48 kilometres per hour?

(b) It takes a team of 8 people 6 weeks to paint a bridge. How long would the painting take if 12 people were employed?

(c) Usually, a swimming pool is filled using 4 water valves, over a period of 18 hours. Today however, one of the valves cannot be used. How long will it take to fill the pool using only 3 water valves?

(d) A journey can be completed in 44 minutes if we travel at an average speed of 50 miles per hour. How long would the same journey take if we travelled at an average speed of 40 miles per hour?

(e) A supply of hay is sufficient to feed 12 horses for 15 days.
How long would the same supply of hay feed 20 horses?

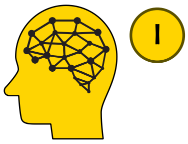
(f) It takes 3 combine harvesters 6 hours to harvest a crop of wheat. How long would it take to harvest the same crop using only 2 combine harvesters?

(g) It takes a team of 18 people 21 weeks to dig a canal. How long would it take to dig the canal using only 14 people?

(h) A tank can be emptied using 6 pumps in 18 hours. How long would it take to empty the tank using 8 pumps?

(i) A gang of 9 bricklayers can build a wall in 20 days. How long would a gang of 15 bricklayers take to build the same wall?

Exercise 4



In this exercise, you will need to decide what type of proportion each question describes, before using an appropriate method to find the answer.

(a) The height of a stack of 150 pieces of paper is 9 mm. What would be the heght of a stack of 350 pieces of similar paper?

(b) A small swimming pool can be filled in 9 minutes using 8 identical water pumps. How many pumps would be needed to fill the pool in 6 minutes?

(c) A car uses 24 litres of petrol to travel 216 km. How many litres of petrol are required to travel 162 km?

(d) A shop sells 8 apples for £1.40. What would be the price of 12 apples?

(e) A ship takes 12 days to complete a journey, travelling at a speed of 20 knots (1 knot = 1 nautical mile per hour). What speed is required to complete the journey in 10 days?

(f) For a Christmas party, a school arranges that 2 Christmas puddings are available for every 5 children. How many Christmas puddings must be purchased if there are 108 children?

(g) A car travels 180 km in 95 minutes. Find the time taken to travel 72 km at the same speed.

(h) Travelling at a speed of 84 km/hour, a train takes 2 hours to complete a journey. How long would the same journey take at a speed of 96 km/hour?

(i) If 12 pumps, all identical and working together, can empty a water tank in 60 minutes, how long would the tank take to empty if only 10 of the pumps were working?

(j) When a bike travels 145 m, each wheel rotates 58 times. How many times will each wheel rotate when completing a 1,000 m journey?

(k) It costs £1,450 to repair an 87 m long pavement.
Find the cost of repairing a 72 m long pavement at the same rate.

(l) A man owning 2,400 shares in a company receives a final dividend of £128. A final dividend of £164, from the same company, was received by a woman. How many shares does she own?

(m) An electric fire uses 8 units of electricity in 3 hours. How long would the electric fire work when using 20 units of electricity?

(n) A ship takes 45 days to complete a journey travelling at a speed of 16 knots. How long would the same journey take travelling at 18 knots?

(o) It costs £10.20 to feed a cat for 14 days. Find, to the nearent penny, the cost of feeding the same cat for 30 days.

(p) A machine can fill 580 bottles in 3 minutes.
How many bottles can the same machine fill in 1 hour?

(q) If 14 men can dig a ditch in 11 days, how many days would 22 men take to dig the same ditch?

(r) A bricklayer can lay 245 bricks in 3 hours. How many bricks could the bricklayer lay in 7 hours, working at the same rate?

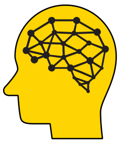
John Napier

John Napier was born in Edinburgh, Scotland in 1550. He was a mathematician, a physicist and an astronomer. Napier was the first person to use logarithms (A Level work) and was responsible for the popularisation of the decimal point in mathematics. In 1570 he published a document that contained the following rhyme.

Multiplication is vexation,
Division is as bad;
The Rule of Three doth puzzle me,
And practice drives me mad.

Challenge! ⚠

Use the internet to investigate the “Rule of Three” in a mathematical context.



More than one proportion

Example

A fruit grower knows that it will take 8 hours for 20 workers to pick 420 kg of strawberries. She needs to collect 360 kg of strawberries in 5 hours. What is the minimum number of workers she should employ?

Answer: In this question, there are three things that can vary, namely time, the number of workers, and the weight of the strawberries. We can, using the methods of proportion, change two of these at any one time, whilst keeping the third measure constant.

To start, let us keep the number of workers constant (20 workers), and consider how many strawberries they can pick in 5 hours. Because time and the weight of the strawberries are in direct proportion, we can form the following table.

	Time	Weight of the fruit	
÷ 8	8 hours	420 kg	÷ 8
	1 hour	420 ÷ 8 = 52.5 kg	
× 5	5 hours	52.5 × 5 = 262.5 kg	× 5

So, 20 workers can collect 262.5 kg of strawberries in 5 hours.

Next, let us keep the time constant (at 5 hours), and consider how many workers are required to collect 360 kg of strawberries. Because the weight of the fruit and the number of workers are in direct proportion, we can form the following table.

	Weight of the fruit	Number of workers	
÷ 262.5	262.5 kg	20	÷ 262.5
	1 kg	$20 \div 262.5 = \frac{8}{105}$	
× 360	360 kg	$\frac{8}{105} \times 360 = 27.\dot{4}2857\dot{1}$	× 360

So, we require $27.\dot{4}2857\dot{1}$ workers to collect 350 kg of strawberries in 5 hours. But we must have a whole number of workers, so we must **round up** to 28 workers to ensure that 360 kg of strawberries can be collected in 5 hours.

Exercise 5

I

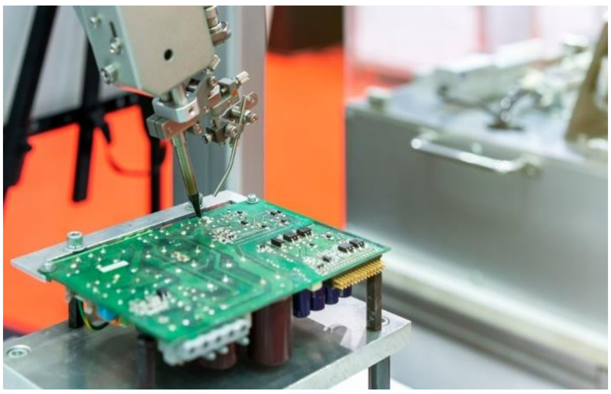
(a) 5 identical industrial water pumps can drain 600,000 litres of water in 8 hours. The local council wants to drain 450,000 litres of water from a flooded area. The work should not take more than 3 hours to complete. What is the minimum number of water pumps required for the task?

(b) Using their old printer, a printing company takes 12 hours to print 54,000 flyers. How long will it take to print another 72,000 flyers using a new printer that works twice as fast as the old one?

(c) A pump is used to fill empty tanks with oil. It takes 27 minutes to fill 6 identical tanks if the flow rate is 5 litres per second. Calculate how much time it would take to fill 8 of these tanks if the flow rate was 9 litres per second.

(d) A new school photocopier can photocopy 3 times as many pages as the old one in the same time. It used to take 20 minutes to copy 500 pages on the old photocopier. How much time would the new photocopier take to copy 600 pages?

(e) It takes 8 tractors 6 hours to plough 38 acres of land. What is the minimum number of tractors required to plough 76 acres of land in less than 9 hours? You may assume that each tractor works at the same rate and that all other conditions are similar.



(f) Machine A is three times as quick as Machine B at assembling identical circuit boards. Machine A is given two and a half times more circuit boards to assemble compared to Machine B. Machine B took 4 hours to complete all of its required assembly. How long did Machine A take to complete all of its required assembly? Give your answer in hours and minutes.

Proportion Graphs

You are required to recognise and interpret graphs that show direct proportion or inverse proportion.

Exercise 6

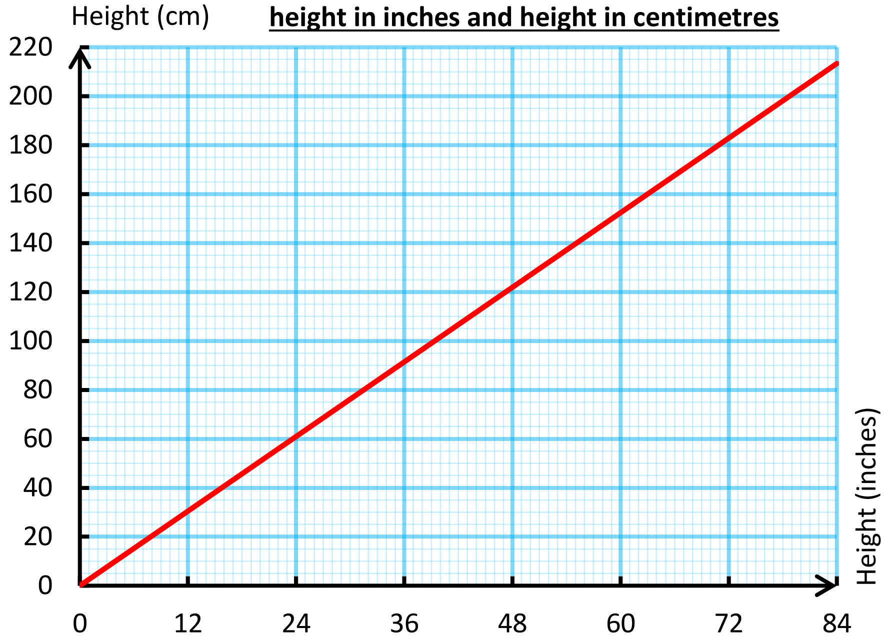
(a) What type of proportion (direct or inverse) is shown by the graph on the right?

(b) Siwan's height is 60 inches. What is Siwan's height in centimetres?

(c) Ben's height is 120 cm. What is Ben's height in inches?

(d) Huw's height is 170 cm. What is Huw's height in feet and inches?

Conversion graph for changing between height in inches and height in centimetres



Exercise 7

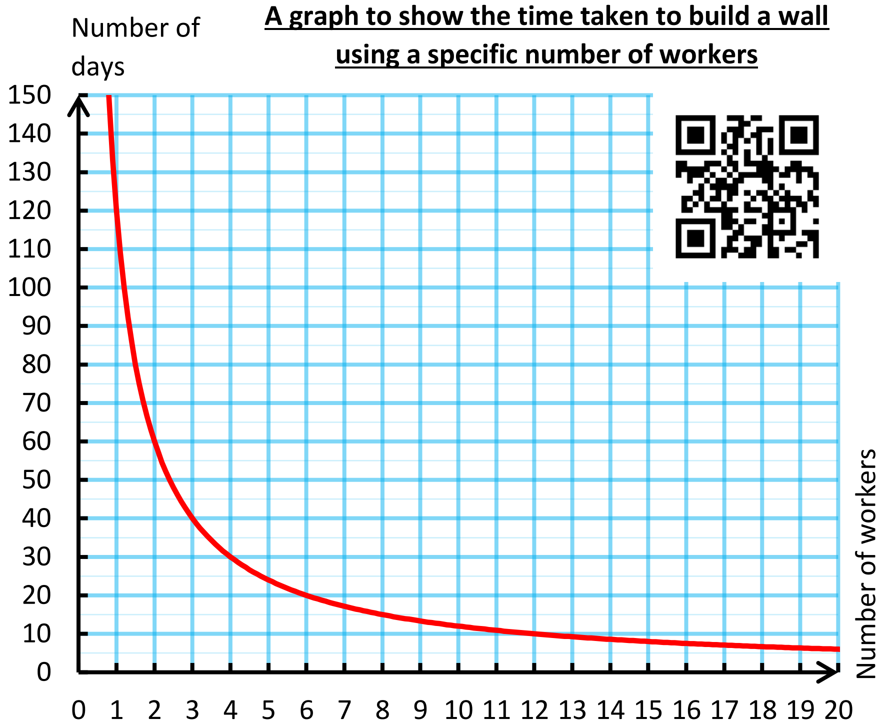
(a) What type of proportion (direct or inverse) is shown by the graph on the right?

(b) If 8 workers are available to build the wall, how many days will it take?

(c) Alan wishes to build the wall in less than 10 days. What is the minimum number of workers that Alan must employ?

(d) How long would it take for one person to build the wall?

A graph to show the time taken to build a wall using a specific number of workers



Evaluation

Key words	Corrections	I am happy with...	I need to revise...

Proportion Equations

Higher Tier

Direct Proportion

If two measures x and y are in **direct proportion** to each other, then it is possible to write the relationship between x and y as $y \propto x$. As an **equation,** we can write the relationship as $y = kx$, where k represents the multiplier of the proportion. Given the value of y for a specific value of x, we can solve the equation to find k, and therefore write the equation that connects x to y.

Example

y is in direct proportion to x. Given that $y = 8$ when $x = 2$, find the equation that connects x to y.

Answer: If y is in direct proportion to x, then $y \propto x$, or $y = kx$ for some multiplier k.
Substituting the values of x and y from the question, we see that $8 = k \times 2$, so that $k = \frac{8}{2}$, which gives $k = 4$.
Therefore the equation that connects x to y is $y = 4x$.

Exercise 8

Skill

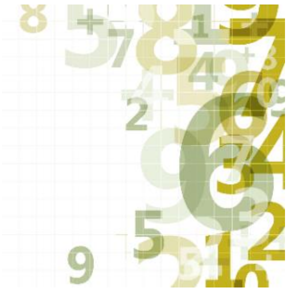
H

(a) y is in direct proportion to x. Given that $y = 12$ when $x = 3$, find the equation that connects x to y.

(b) y is in direct proportion to x. Given that $y = 35$ when $x = 5$, find the equation that connects x to y.

(c) y is in direct proportion to x. Given that $y = 2$ when $x = 8$, find the equation that connects x to y.

(d) y is in direct proportion to x. Given that $y = \frac{1}{3}$ when $x = 7$, find the equation that connects x to y.



Example

y is in direct proportion to x^2. Given that $y = 45$ when $x = 3$, find the equation that connects x to y.

Answer: If y is in direct proportion to x^2, then $y \propto x^2$, or $y = kx^2$ for some multiplier k.
Substituting the values of x and y from the question, we see that $45 = k \times 3^2$, so that $k = \frac{45}{3^2}$, which gives $k = 5$.
Therefore the equation that connects x to y is $y = 5x^2$.

Exercise 9

H

(a) y is in direct proportion to x^2. Given that $y = 80$ when $x = 4$, find the equation that connects x to y.

(b) y is in direct proportion to x^3. Given that $y = 500$ when $x = 5$, find the equation that connects x to y.

(c) y is in direct proportion to x^2. Given that $y = 16$ when $x = 8$, find the equation that connects x to y.

(d) y is in direct proportion to $\sqrt{x}$. Given that $y = 30$ when $x = 25$, find the equation that connects x to y.

Inverse Proportion

If two measures x and y are in **inverse proportion** to each other, then it is possible to write the relationship between x and y as $y \propto \frac{1}{x}$. As an **equation,** we can write the relationship as $y = \frac{k}{x}$, where k represents the multiplier of the proportion. Given the value of y for a specific value of x, we can solve the equation to find k, and therefore write the equation that connects x to y.

Example

y is in inverse proportion to x. Given that $y = 4$ when $x = 5$, find the equation that connects x to y.

Answer: If y is in inverse proportion to x, then $y \propto \frac{1}{x}$, or $y = \frac{k}{x}$ for some multiplier k.
Substituting the values of x and y from the question, we see that $4 = \frac{k}{5}$, so that $k = 4 \times 5$, which gives $k = 20$.
Therefore the equation that connects x to y is $y = \frac{20}{x}$.

Exercise 10

H

(a) y is in inverse proportion to x. Given that $y = 6$ when $x = 8$,
find the equation that connects x to y.

(b) y is in inverse proportion to x. Given that $y = 2$ when $x = 14$,
find the equation that connects x to y.

(c) y is in inverse proportion to x. Given that $y = \frac{2}{5}$ when $x = 8$,
find the equation that connects x to y.

Example

y is in inverse proportion to x^2. Given that $y = 3$ when $x = 6$, find the equation that connects x to y.

Answer: If y is in inverse proportion to x^2, then $y \propto \frac{1}{x^2}$, or $y = \frac{k}{x^2}$ for some multiplier k.
Substituting the values of x and y from the question, we see that $3 = \frac{k}{6^2}$, so that $k = 3 \times 6^2$, which gives $k = 108$.
Therefore the equation that connects x to y is $y = \frac{108}{x^2}$.

Exercise 11

H

(a) y is in inverse proportion to x^2. Given that $y = 4$ when $x = 5$,
find the equation that connects x to y.

(b) y is in inverse proportion to x^2. Given that $y = 15$ when $x = 10$,
find the equation that connects x to y.

(c) y is in inverse proportion to x^3. Given that $y = \frac{3}{4}$ when $x = 2$,
find the equation that connects x to y.

Exercise 12

Given that $y = 5$ when $x = 4$, write an equation to show each of the following relationships.

(a) $y \propto x$ (b) $y \propto x^2$ (c) $y \propto \sqrt{x}$ (d) $y \propto \frac{1}{x}$ (e) $y \propto \frac{1}{x^3}$ (f) $y \propto \frac{1}{\sqrt{x}}$

Exercise 13

H

(a) Given that y is in inverse proportion to x, and knowing that $y = 6$ when $x = 4$,
(i) find an expression for y in terms of x,
(ii) calculate y when $x = 2$,
(iii) calculate x when $y = 3$.

(b) Given that y is in proportion to x, and knowing that $y = 18$ when $x = 2$,
(i) find an expression for y in terms of x,
(ii) calculate y when $x = 7$,
(iii) calculate x when $y = 27$.

If the type of proportion is not stated, use direct proportion.

(c) Given that y is in direct proportion to x^2, and knowing that $y = 36$ when $x = 3$,
(i) find an expression for y in terms of x,
(ii) calculate y when $x = 4$,
(iii) calculate the two possible values for x when $y = 256$.

(d) Given that y is in inverse proportion to x^3, and knowing that $y = 5$ when $x = 4$,
(i) find an expression for y in terms of x,
(ii) calculate y when $x = 8$,
(iii) calculate x when $y = 40$.

Exercise 14

Applying

H

(a) In a science experiment, Susan takes measurements for t and m.
The following table shows her results.

t	2	6	8
m	4	108	256

Susan believes that either m is in proportion to t^2 or m is in proportion to t^3.
By considering both possibilities, find an expression for m in terms of t.
Show all of your calculations.

(b) In an experiment, a scientist saw that the force, F, between two particles was in inverse proportion to the square of the distance, d, between the particles. The unit of force was Netwons and the unit of distance was millimetres. When the particles were 5 mm apart, the force between them was 8 Newtons. How far apart were the particles when the force between them was 12.5 Newtons?

(c) Cerys takes people on hot air balloon trips. She knows that the pressure in the balloon, measured in atmospheres, is in inverse proportion to the square root of the height of the balloon above Earth. When the balloon is at a height of 36 metres above Earth, the pressure is 2 atmospheres.

(i) Write this information as an equation.

(ii) Cerys pilots her balloon up to a height of 400 m and then down to a height of 256 m. Calculate the change in pressure during the descent.

(d) Awel wants to paint the walls in her bedroom. The area of the walls is 75 m². The paint costs £6.80 per litre and 2 litres of paint covers 30 m². Write a formula that connects the area of the wall, A m², to the number of litres of paint required, L. Use the formula to calculate the cost of painting the walls in Awel's bedroom.

Finding Proportion Equations

Example

The following table shows two measures x and y.
Find the equation that shows the proportion that is between these measurements.

x	6	8
y	18	32

Answer: As x increases, so does y, so there is direct proportion between the measurements. Considering first whether the proportion is of the form $y \propto x$, or $y = kx$, let us substitute the data from the first column: $18 = k \times 6$, $k = \frac{18}{6}$, $k = 3$. To check whether we have a proportion of the form $y = 3x$, we must consider the data from the second column. The equation does not work for this data ($y = 3 \times 8 = 24$, not 32) so we must consider a different type of proportion. Considering whether we have a proportion of the form $y \propto x^2$, or $y = kx^2$, we must again substitute the data from the first column to find the multiplier of the proportion: $18 = k \times 6^2$, $k = \frac{18}{6^2}$, $k = \frac{1}{2}$. To check whether we have a proportion of the form $y = \frac{1}{2}x^2$, we must again consider the data from the second column. This time, the equation does work for the data ($y = \frac{1}{2} \times 8^2 = 32$), so the equation that shows the proportion that is between the measurements x and y is $y = \frac{1}{2}x^2$.

Exercise 15

Skill H

The following tables show measures x and y.
Find the equation that describes the proportion that is between the measurements.

(a)

x	4	6
y	12	18

(b)

x	4	6
y	3	2

(c)

x	10	6
y	15	9

(d)

x	20	15
y	3	4

(e)

x	2	3
y	20	45

(f)

x	2	3
y	18	8

(g)

x	2	3
y	32	108

(h)

x	4	9
y	14	21

Evaluation

Key words	Corrections	I am happy with...	I need to revise...

Quadratic Nth Term

Linear Nth Term

In the Developing Algbera 1 workbook, we learnt how to find the formula for the nth term of a linear sequence such as 9, 14, 19, 24, 29, ...

1. Consider what the rule is for finding the next number. Here, we must **add five** to find the next number.

+5 +5 +5 +5

9, 14, 19, 24, 29, ...

2. If another number was added at the start of the sequence, what would this number have to be? Here, the number would have to be 9 – 5 = 4.

–5 +5 +5 +5 +5

4, 9, 14, 19, 24, 29, ...

3. The $\boldsymbol{n}$**th term** for this sequence is $5n + 4$. (The 5 and the 4 come from the previous steps.)

–5 +5 +5 +5 +5

4, 9, 14, 19, 24, 29, ...

Nth Term = $5n + 4$

Exercise 16

Revision F

Find the nth term for the following linear sequences.

(a) 4, 6, 8, 10, 12, ...

(b) 13, 15, 17, 19, 21, ...

(c) 14, 17, 20, 23, 26, ...

(d) 20, 18, 16, 14, 12, ...

(e) 34, 31, 28, 25, 22, ...

(f) 10, 14, 18, 22, 26, ...

(g) 5, 5.5, 6, 6.5, 7, ...

(h) 8, 9, 10, 11, 12, ...

(i) 3, 6, 9, 12, 15, ...

(j) –12, –10, –8, –6, –4, ...

(k) –7, –9, –11, –13, –15, ...

(l) –3, –1, 1, 3, 5, ...

(m) –26, –30, –34, –38, –42, ...

(n) 2, 7, 12, 17, 22, ...

(o) 10, 9.75, 9.5, 9.25, 9, ...

The First Difference

The sequences in Exercise 16 were linear sequences as the difference between any two consecutive numbers was constant. For example, the common difference in question (a) was 2.

+2 +2 +2 +2

4, 6, 8, 10, 12, ...

In a quadratic sequence, the difference between any two consecutive numbers is not constant. For example, in the quadratic sequence 4, 15, 30, 49, 72, ... the difference between two consecutive numbers increases.

+11 +15 +19 +23

4, 15, 30, 49, 72, ...

We can use this **first difference** to decide whether or not a specific sequence is linear.

Exercise 17

Are the following sequences linear or not?

(a) 9, 11, 13, 15, 17, ...
(b) 1, 4, 9, 16, 25, ...
(c) 16, 14, 12, 10, 8, ...
(d) 3, 6, 11, 18, 27, ...
(e) 5, 7, 5, −1, −11, ...
(f) −20, −10, 0, 10, 20, ...
(g) 9, 8, 7, 6, 5, ...
(h) 11, 23, 43, 71, 107, ...
(i) 8, 7.5, 7, 6.5, 6, ...

Simple Quadratic Sequences

The simplest quadratic sequence is the sequence of square numbers

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, ...

The nth term for this sequence is n^2. We can form another quadratic sequence by adding or subtracting the same number from each of the square numbers. For example:

Sequence	Nth Term
4, 7, 12, 19, 28, ...	$n^2 + 3$
−1, 2, 7, 14, 23, ...	$n^2 - 2$

Quadratic sequences of this form have the nth term $n^2 + a$, where a is a specific number.

Exercise 18

Find the nth term for each of the following simple quadratic sequences.

(a) 2, 5, 10, 17, 26, ...
(b) 11, 14, 19, 26, 35, ...
(c) 7, 10, 15, 22, 31, ...
(d) −4, −1, 4, 11, 20, ...
(e) −9, −6, −1, 6, 15, ...
(f) 0, 3, 8, 15, 24, ...
(g) 1.5, 4.5, 9.5, 16.5, 25.5, ...
(h) 1, 4, 9, 16, 25, ...
(i) −25, −22, −17, −10, −1, ...

Exercise 19

Write the first five terms of the following quadratic sequences.

(a) $n^2 + 4$
(b) $n^2 - 6$
(c) $n^2 + 13$
(d) $n^2 - \frac{1}{4}$
(e) $n^2 + 27$
(f) $n^2 - 50$

More Complex Quadratic Sequences

Consider the quadratic sequence 2, 6, 16, 32, 54, ... It is not possible to form this sequence by adding or subtracting the same number from the list of square numbers, so a different method is needed to find the nth term.

Step 1: Find the **second difference** for the sequence.

Second Difference: +6, +6, +6

First Difference: +4, +10, +16, +22

2, 6, 16, 32, 54, ...

Step 2: Halve the second difference to find the coefficient[1] of n^2 in the formula for the nth term.

6 ÷ 2 = 3, so the nth term for the sequence contains the term $3n^2$.

[1] The coefficient of a term is the number that appears at the start of the term.

Step 3: Form a table to find the difference between $3n^2$ and the original sequence.

Original Sequence	2,	6,	16,	32,	54,	.....
n^2	1,	4,	9,	16,	25,	.....
$3n^2$	3,	12,	27,	48,	75,	.....
Original Sequence $- 3n^2$	−1,	−6,	−11,	−16,	−21,	.....

Step 4: Find the nth term of the linear sequence in the final row of the table.

$$-1, \xrightarrow{-5} -6, \xrightarrow{-5} -11, \xrightarrow{-5} -16, \xrightarrow{-5} -21, \quad .....$$

The nth term of the linear sequence is $-5n + 4$, so the nth term of the quadratic sequence is $3n^2 - 5n + 4$. (We can verify this by substituting into the formula, or by using *Table Mode* on a calculator.)

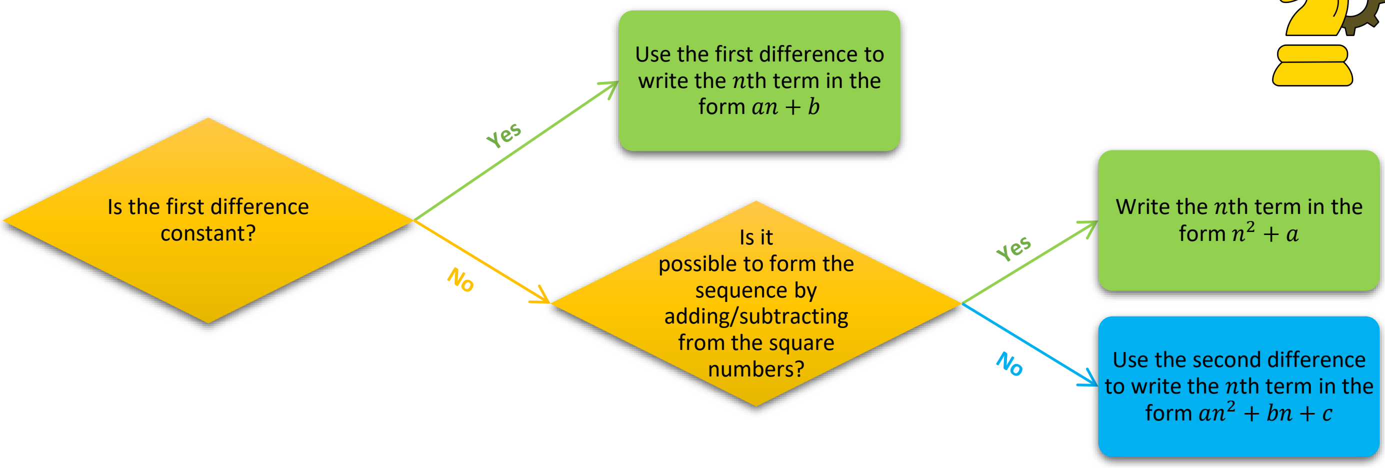
Exercise 20

I

Find the nth term of the following quadratic sequences.

(a) 6, 11, 18, 27, 38, ...
(b) 0, 5, 12, 21, 32, ...
(c) 2, 3, 6, 11, 18, ...
(d) −4, −3, 0, 5, 12, ...
(e) 11, 22, 37, 56, 79, ...
(f) 1, 2, 7, 16, 29
(g) 9, 18, 31, 48, 69, ...
(h) 6, 11, 20, 33, 50, ...
(i) 4, 18, 38, 64, 96, ...
(j) 6, 15, 32, 57, 90, ...
(k) −3, 8, 29, 60, 101, ...
(l) 10, 31, 64, 109, 166, ...
(m) 10, 40, 90, 160, 250, ...
(n) 8, 14, 24, 38, 56, ...
(o) 8, 22, 42, 68, 100, ...
(p) 9, 12, 13, 12, 9, ...
(q) 10, 9, 4, −5, −18, ...
(r) 3, −10, −29, −54, −85, ...
(s) 4, −8, −30, −62, −104, ...
(t) −15, −28, −49, −78, −115, ...
(u) 10.5, 17, 27.5, 42, 60.5, ...

Flow Chart: Finding the nth term of a linear or quadratic sequence



Exercise 21

I

Write the first 5 terms of the sequences with the following nth terms.

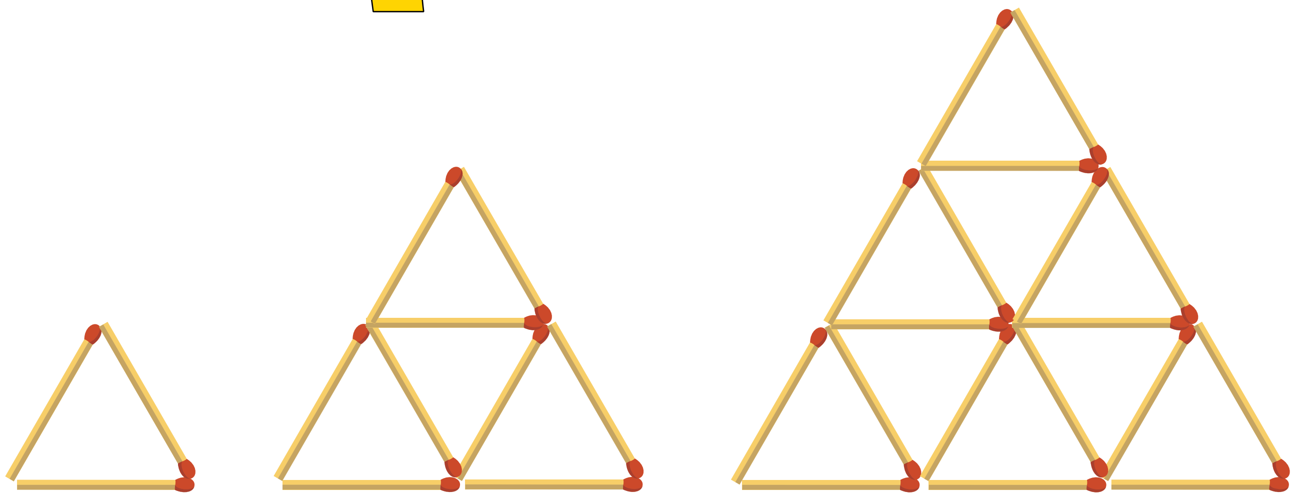
(a) $4n + 3$
(b) $n^2 + 9$
(c) $4n^2$
(d) $2n^2 + 6n + 5$
(e) $5n^2 - 3n + 7$
(f) $-3n^2 + 10n - 4$
(g) $n^3 + 2$
(h) n^4
(i) $\frac{1}{n}$

Exercise 22

Applying

I

Here is a matchstick pattern.



Pattern 1 | Pattern 2 | Pattern 3

(a) Draw Pattern 4 in your book.

(b) Copy and complete the following table.

Pattern number	1	2	3	4	5	6
Number of triangles	1	4				
Number of matches	3	9				

(c) Consider the sequence for the number of triangles. What is the nth term of this sequence?

(d) Consider the sequence for the number of matches. What is the nth term of this sequence?

(e) How many matches are required in order to make Pattern 20?

(f) What is the number of the pattern that contains 100 triangles?

(g) Steffan has 1,000 matches. What is the number of the biggest pattern that Steffan can create?

(h) Lisa creates a pattern that contains 225 triangles. How many matches are in Lisa's pattern?

Evaluation

Key words	Corrections	I am happy with...	I need to revise...

Inequalities

If you want to buy a bag of sweets that costs 79 pence, you require **at least** 79 pence.

Perhaps you have more than this amount in your pocket. The sum in your pocket must be greater than or equal to 79 pence.

If x represents the sum of money in your pocket, then we can write the **inequality** $x \geq 79$ to show when we would be able to buy the bag of sweets.

Inequality Symbols

- The meaning of the symbol $\geq$ is 'greater than or equal to'.
- The meaning of the symbol $>$ is 'greater than'.
- The meaning of the symbol $\leq$ is 'less than or equal to'.
- The meaning of the symbol $<$ is 'less than'.

In handwriting, we can write the symbols $\geq$ and $\leq$ as $\geqslant$ and $\leqslant$.

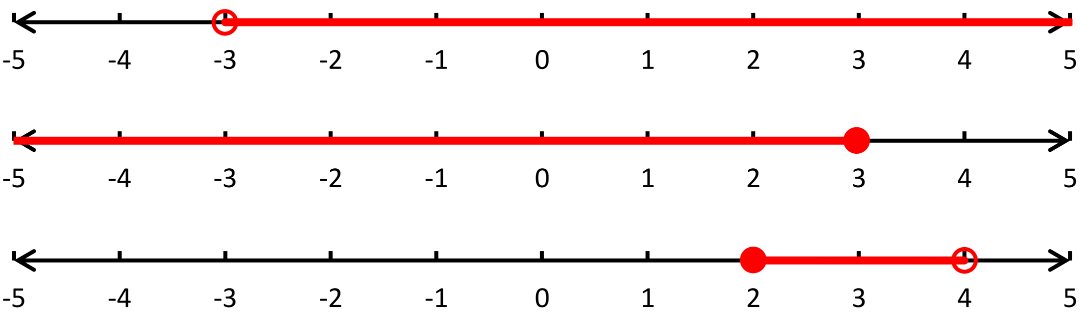
Inequalities on a Number Line

Example

Display the following inequalities on a number line.

(a) $x > -3$ (b) $y \leq 3$ (c) $2 \leq x < 4$

Answer: (a) (b) (c)

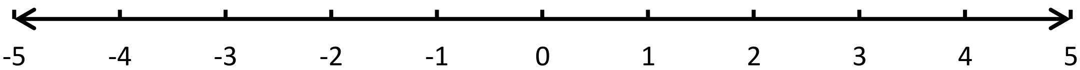


Exercise 23

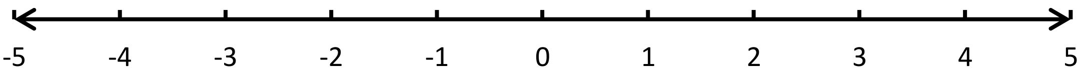
Skill I

Use the number lines below to display the following inequalities.

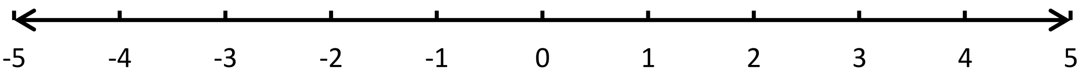
(a) $x < 4$



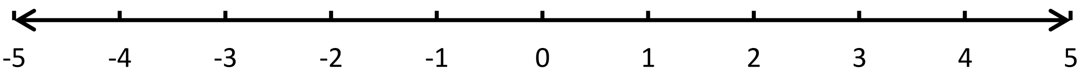
(b) $x \geq -2$



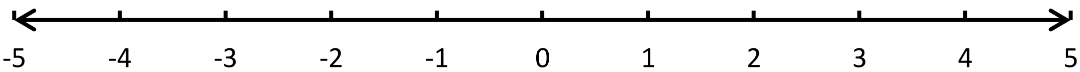
(c) $-4 < x \leq 1$



(d) $-2.5 \leq x < 3$



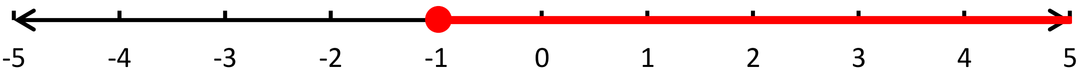
(e) $x > 0$



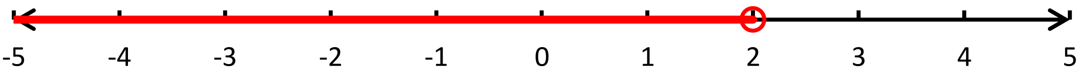
Exercise 24

Write the inequalities that are shown on the following number lines. (Use x as the variable.)

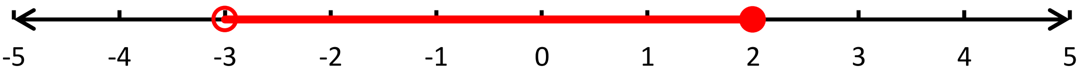
(a)



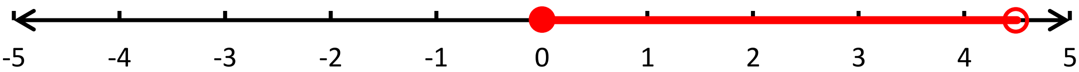
(b)



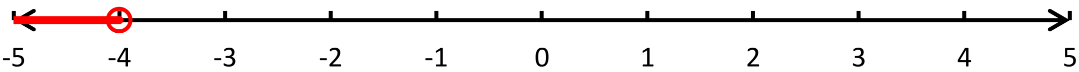
(c)



(d)



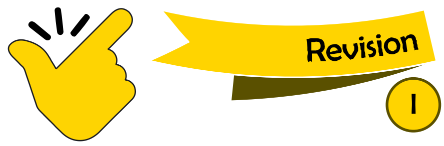
(e)



Solving Equations

Because solving inequalities is very similar to solving equations, it is appropriate now to revise some of the equation solving work from previous years.

Exercise 25



Solve the following equations.

One-step equations

(a) $x + 7 = 9$ (b) $3x = 15$ (c) $x - 4 = 14$

(d) $\frac{x}{2} = 10$ (e) $7y = 42$ (f) $\frac{12}{w} = -4$

Two-step equations

(g) $2x + 3 = 19$ (h) $3x - 1 = 17$ (i) $5y + 9 = 64$

Three-step equations

(j) $5x + 2 = 3x + 32$ (k) $4x - 5 = x + 16$ (l) $4x + 4 = 7x - 11$

Equations which require expansion first

(m) $2(x + 7) = 22$ (n) $3(y - 4) = 24$ (o) $20 = 4(x - 2)$

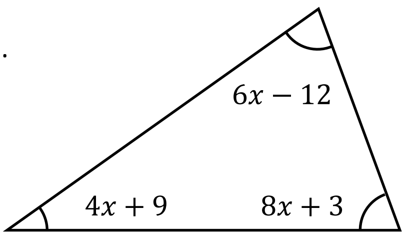
(p) $4(x + 2) = 2(x + 7)$ (q) $4(x - 12) + 2x = 0$ (r) $3(x - 4) = 2(x + 4) + 8$

Equations involving fractions

(s) $\frac{x}{2} + 5 = 9$ (t) $\frac{x+5}{2} = 4$ (u) $\frac{18}{x-2} = 3$

Equations in context

(v) Each angle in the triangle on the right is measured in degrees.
Calculate the size of the smallest angle.



Solving Inequalities

Solving inequalities is exactly the same as solving equations, but there is one important additional rule:

We must **change the symbol** in the middle of an inequality if we
(a) **swap sides**; (b) **multiply or divide by a negative number**.

If we need to change the symbol in the middle of an inequality, then the symbol $\geq$ changes to be $\leq$; the symbol $>$ changes to be $<$; the symbol $\leq$ changes to be $\geq$; and the symbol $<$ changes to be $>$.

Why do we need to change the symbol?

(a) Consider the inequality $5 > 2$, which shows something that is true.
If we swap the inequality's sides **without** changing the symbol in the middle, then we will finish with something that is false: $2 > 5$. We must therefore change the symbol in the middle of an inequality if we swap an inequality's sides. (In the example, the correct inequality after swapping sides would be $2 < 5$.)

(b) Consider again the inequality $5 > 2$. If we multiply both sides of the inequality by -2, we will finish with something that is false: $-10 > -4$. We must therefore change the symbol in the middle of an inequality if we multiply an inequality by a negative number. (In the example, the correct inequality after multiplying by -2 is $-10 < -4$.) The same is true if we divide an inequality by a negative number.

Example

Solve the following inequalities.

(a) $4x + 1 \geq 13$ (b) $7 - 3x < 1$ (c) $2(x + 4) \leq 5(x + 1)$ (d) $\frac{x}{2} > 6 + 2x$

Answer: (a) $4x + 1 \geq 13$

$4x \geq 12$	[Subtract 1]
$x \geq 3$	[Divide by 4]

(b) $7 - 3x < 1$

$-3x < -6$	[Subtract 7]
$x > 2$	[Divide by –3]

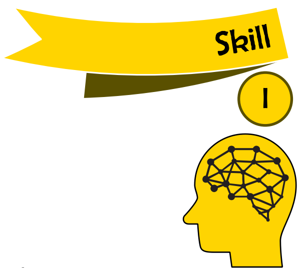
(c) $2(x + 4) \leq 5(x + 1)$

$2x + 8 \leq 5x + 5$	[Expand brackets]
$2x \leq 5x - 3$	[Subtract 8]
$-3x \leq -3$	[Subtract $5x$]
$x \geq 1$	[Divide by –3]

(d) $\frac{x}{2} > 6 + 2x$

$x > 2(6 + 2x)$	[Multiply by 2]
$x > 12 + 4x$	[Expand brackets]
$-3x > 12$	[Subtract $4x$]
$x < -4$	[Divide by –3]

Exercise 26



Solve the following inequalities.

(a) $x + 2 > 5$ (b) $5x \geq 20$ (c) $\frac{x}{3} < 6$

(d) $y - 4 \leq 10$ (e) $-2x < 8$ (f) $\frac{x}{-2} \leq 4$

(g) $2x + 5 > 37$ (h) $3y - 2 < 7$ (i) $4x - 4 \geq 4$

(j) $6 - 2x \geq 10$ (k) $10 - 3x < 22$ (l) $1 - x \leq 7$

(m) $4x + 6 > 2x + 18$ (n) $5x - 1 \geq 2x + 32$ (o) $3y + 4 < 2y - 10$

(p) $2x + 3 > 4x + 23$ (q) $3x - 8 \leq 5x + 20$ (r) $5y + 7 \geq y - 29$

Exercise 27

Solve the following inequalities.

(a) $3(x-1) < 9$

(b) $2(x+3) \leq 22$

(c) $5(3-y) > 10$

(d) $4(x+2) \geq 2(x+6)$

(e) $5(x-1) < 3(x+5)$

(f) $5(1-2x) > 4(2-3x)$

(g) $2x + 3(x-2) \geq 3x - 4$

(h) $z + 3(z-4) \leq 4$

(i) $7(3+x) < 7(3-x)$

(j) $3x - 2(x-1) > 4(x+2)$

(k) $2 - 2(3-y) \geq 6(2-y)$

(l) $5t - 3(2-t) < 2(3t+10)$

Exercise 28

Solve the following inequalities.

(a) $\frac{x}{2} + 3 > 8$

(b) $\frac{x}{3} - 2 \leq 4$

(c) $\frac{x}{-4} + 1 > 10$

(d) $\frac{x-12}{3} > 5$

(e) $\frac{x+4}{2} \leq -4$

(f) $\frac{y-4}{3} < 2$

(g) $\frac{x}{2} < 10 - 2x$

(h) $\frac{x}{3} \geq 4 + x$

(i) $\frac{2x}{5} < x - 9$

Example

Find the **least** whole number that satisfies the inequality $3x + 9 > x + 15$.

Answer: To begin, let us solve the inequality:

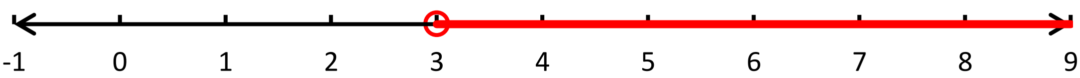
$3x + 9 > x + 15$

$3x > x + 6$ [Subtract 9]

$2x > 6$ [Subtract x]

$x > 3$ [Divide by 2]

We can show this solution on a number line:



The **least** whole number that is greater than 3 is 4, so 4 is the answer to the question.

Exercise 29

Find the **least** whole number that satisfies the following inequalities.

(a) $x > 8$

(b) $x \geq 4$

(c) $x - 4 > 9$

(d) $2x + 6 \geq 24$

(e) $6x + 5 > 4x + 13$

(f) $6x + 4 > 4x + 13$

(g) $3x + 9 \geq x + 3$

(h) $4x - 8 \leq 5x + 5$

(i) $\frac{x+1}{2} > 5$

Example

List the whole numbers that satisfy the inequality $5 < 2x - 1 \leq 17$.

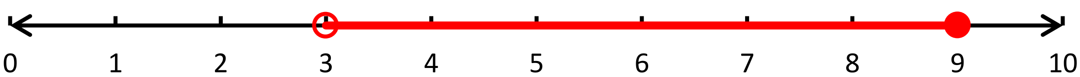
Answer: To begin, let us solve the inequality:

$5 < 2x - 1 \leq 17$

$6 < 2x \leq 18$ [Add 1]

$3 < x \leq 9$ [Divide by 2]

We can show this solution on a number line:



The whole numbers that satisfy the inequality are 4, 5, 6, 7, 8 and 9.

Exercise 30

I

List the whole numbers that satisfy the following inequalities.

(a) $5 \le x \le 8$ (b) $5 < x < 8$ (c) $5 < x \le 8$

(d) $-4 \le x \le 2$ (e) $-4 < x < 2$ (f) $-4 \le x < 2$

(g) $6 < 2x < 10$ (h) $6 \le 3x < 18$ (i) $4 < 4y \le 20$

(j) $3 \le 2x + 1 \le 13$ (k) $3 < 2x - 1 < 17$ (l) $5 \le 3x - 1 < 11$

(m) $3 < 2x \le 9$ (n) $5 \le 2x + 4 < 15$ (o) $7 < 5x + 1 \le 21$

Exercise 31

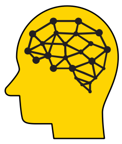
Applying

I

(a) Four times a number n take away 3 is less than twice the number n add 5.
Write an inequality satisfied by n and solve it to find the possible values for n.

(b) Vincent and Rowena start to rent television sets at the same time. Vincent pays £14 per month for his rental television. Rowena uses a different method; she pays an upfront payment of £50 then pays rent at £8 a month. Let x represent the number of months both Vincent and Rowena have been renting their televisions.
(i) Write an inequality that is satisfied by x for the number of months the total amount payed by Vincent is **less** than the total amount payed by Rowena.
(ii) Solve the inequality. Explain what your solution tells you about Vincent and Rowena.

(c) Sali has mathematics and science homework. Let m and s represent the time that Sali intends to spend completing each of the homework tasks.



(i) Sali intends to spend less than 3 hours on her mathematics homework. Write this as an inequality.
(ii) What is the meaning of $1 < s < 2$?
(iii) What is the meaning of $m > s$?

(d) A bus can hold up to 46 people. A school intends to transport 5 adults and as many groups of 4 children as is possible to fit on the bus.
(i) Which of the following inequalities is true about the bus?

$4n + 5 > 46$ $4n + 5 \le 46$ $4n - 5 < 46$ $4n - 5 \ge 46$

(ii) Solve the correct inequality from part (i) to find the maximum number of groups of four children that can be transported on the bus.

Evaluation

Key words	Corrections	I am happy with...	I need to revise...

Regions of Graphs

Higher Tier

In this chapter, we will discuss how to shade a region of graph paper defined by a set of inequalities. In order to do this, we must revise how to plot graphs of the form $x = a$; $y = b$ and $y = mx + c$, and learn a new technique for plotting graphs of the form $ax + by + c = 0$.

Revising plotting graphs of the form $x = a$ and $y = b$

- The graph of $x = a$ is a vertical line passing through the point $(a, 0)$.
- The graph of $y = b$ is a horizontal line passing through the point $(0, b)$.

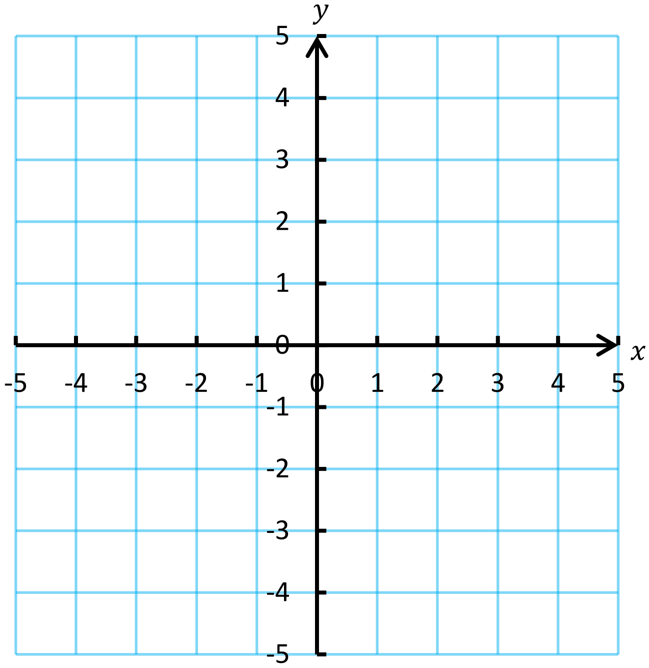
Exercise 32

Revision

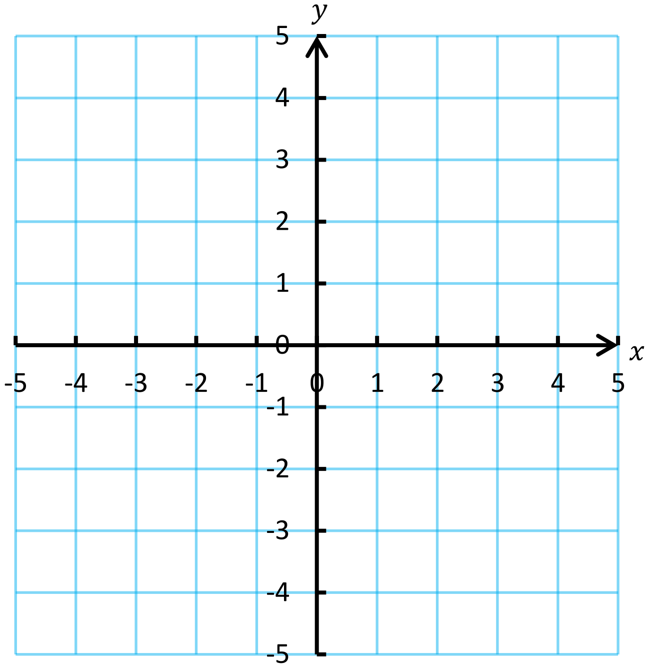
F

Use the graph paper below to plot the following lines.

(a) $x = 3, y = 4, x = -2, y = -3$



(b) $y = 2, x = -3, y = 1.5, x = -\frac{5}{2}$



Revising plotting graphs of the form $y = mx + c$

Given a straight line of the form $y = mx + c$, for example $y = 3x - 2$, here are two ways of plotting the line on graph paper.

Method 1: Using a table

(a) Substitute different values of x into the equation in order to create a table of values.

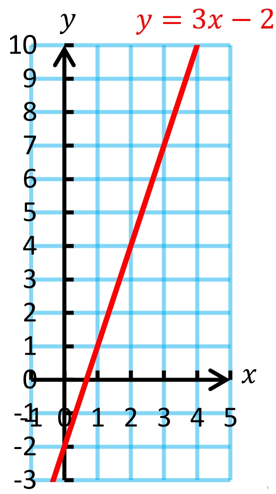
x	0	1	2	3
y	-2	1	4	7
	↑	↑	↑	↑
	$3 \times 0 - 2$	$3 \times 1 - 2$	$3 \times 2 - 2$	$3 \times 3 - 2$
	$= 0 - 2$	$= 3 - 2$	$= 6 - 2$	$= 9 - 2$
	$= -2$	$= 1$	$= 4$	$= 7$

(b) Plot the values from the table on graph paper before connecting the points with a straight line.

Method 2: Using the gradient and y–intercept

(a) For the line $y = 3x - 2$, the y–intercept is –2, so the line passes through the point (0, –2). Plot this point on the graph paper.

(b) The gradient is 3, so for each **one** unit we move to the right (starting from the point (0, –2)), we must move **three** units up. Plot some of these points before connecting the points with a straight line.

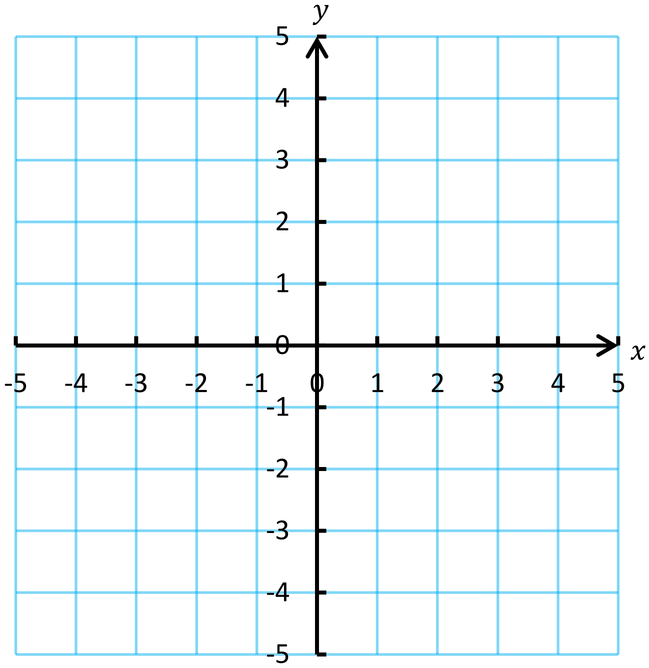


Exercise 33

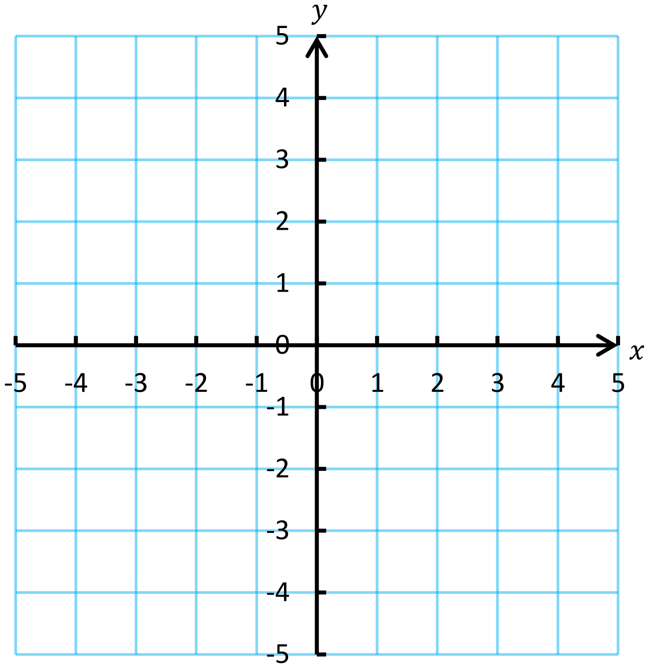
F

Use the graph paper below to plot the following lines.

(a) $y = 2x - 3$, $y = -\frac{1}{2}x + 1$



(b) $y = x$, $y = -x$



Plotting graphs of the form $ax + by + c = 0$

See the Developing Algebra 2 workbook to revise this topic.

Example

Plot a straight line for the equation $2x + 3y - 12 = 0$.

Method 1: The Hiding Method

To find the value of y when $x = 0$, **hide** the term in x using your finger, and solve the equation that remains.

$2x + 3y - 12 = 0 \rightarrow 3y - 12 = 0$

$3y = 12$ [Add 12]

$y = 4$ [Divide by 3]

So the line goes through the point $(0, 4)$.

To find the value of x when $y = 0$, **hide** the term in y using your finger, and solve the equation that remains.

$2x + 3y - 12 = 0 \rightarrow 2x - 12 = 0$

$2x = 12$ [Add 12]

$x = 6$ [Divide by 2]

So the line goes through the point $(6, 0)$.

To plot the line for the equation $2x + 3y - 12 = 0$, plot the two points $(0, 4)$ and $(6, 0)$ on graph paper before connecting them with a straight line.

We can "hide" the terms because they disappear when substituting in 0.

Method 2: The Rearranging Method

Re-arrange the equation in order to make y the subject of the equation.

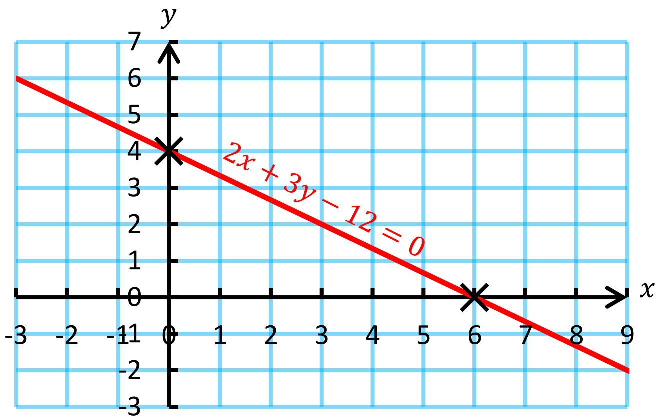
$2x + 3y - 12 = 0$

$3y - 12 = -2x$ [Subtract $2x$]

$3y = -2x + 12$ [Add 12]

$y = -\frac{2}{3}x + 4$ [Divide by 3]

We can now plot the equation, using the techniques for plotting an equation of the form $y = mx + c$.

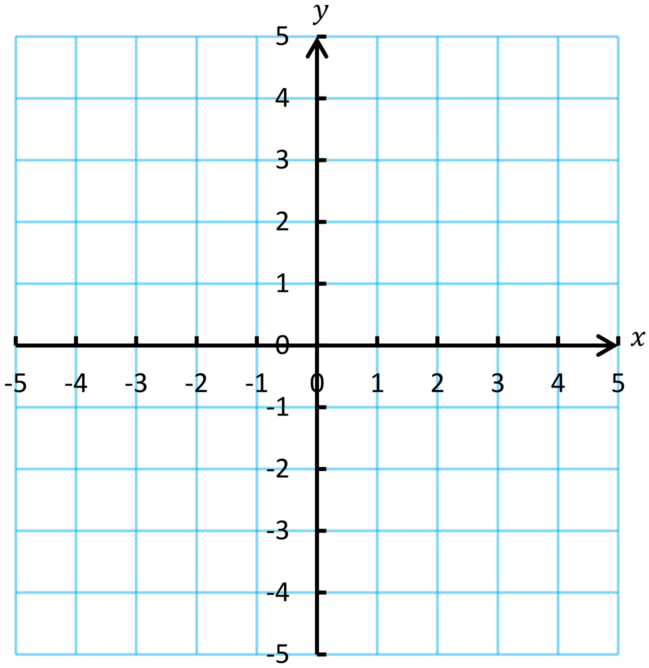


Exercise 34

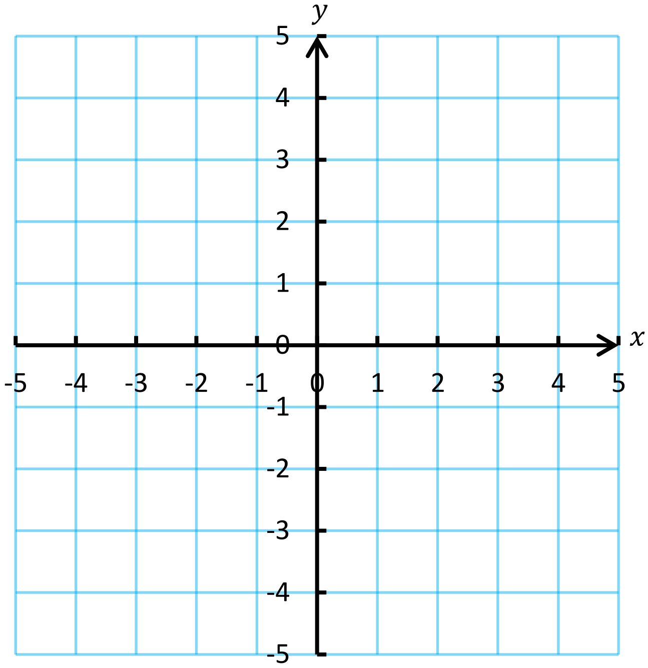
Skill I

Use the graph paper below to plot the following lines.

(a) $2x + 3y - 6 = 0$



(b) $4x - 2y - 8 = 0$



Shading Regions

We can now consider how to use a set of inequalities to shade a region on graph paper.

Example

Shade the region defined by the following inequalities.

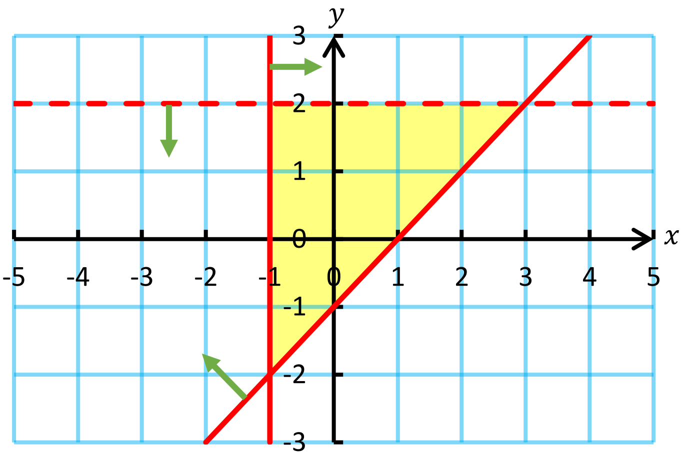
$$y < 2,\ x \geq -1,\ y \geq x - 1$$

Answer: **Step 1:** Plot the graphs of $y = 2,\ x = -1, y = x - 1$.

Rule: Use a solid line (——) for inequalities containing $\geq$ or $\leq$; and a dotted line (- - - -) for inequalities containing $>$ or $<$.

Step 2: Show, using an arrow, a region corresponding to each of the three lines.

Step 3: Shade the region that is satisfied by all of the arrows / inequalities.



For lines that aren't vertical or horizontal, **substitute a point that doesn't lie on the line** to decide **which way the arrow should point**. For example, considering $y \geq x - 1$, substitute the point $(0, 0)$:

$$0 \geq 0 - 1$$
$$0 \geq -1$$

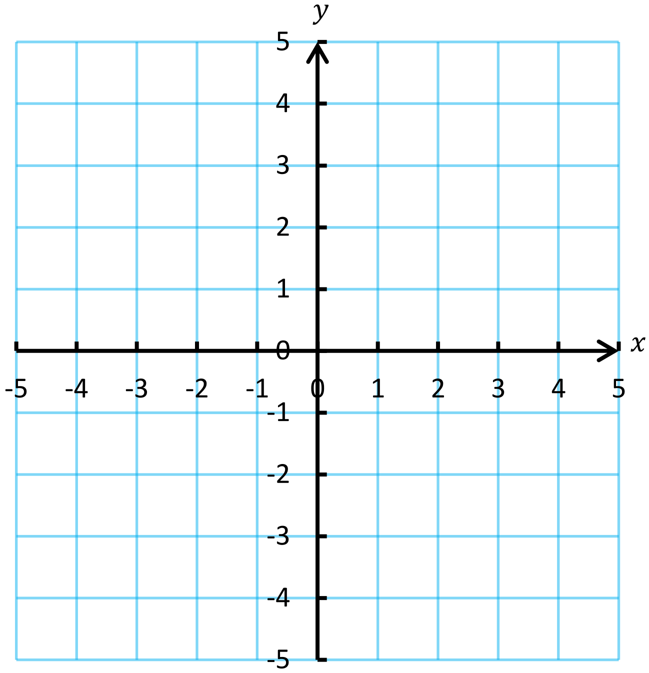
This inequality is **true**, so the arrow should point **towards** the point (0, 0).

Exercise 35

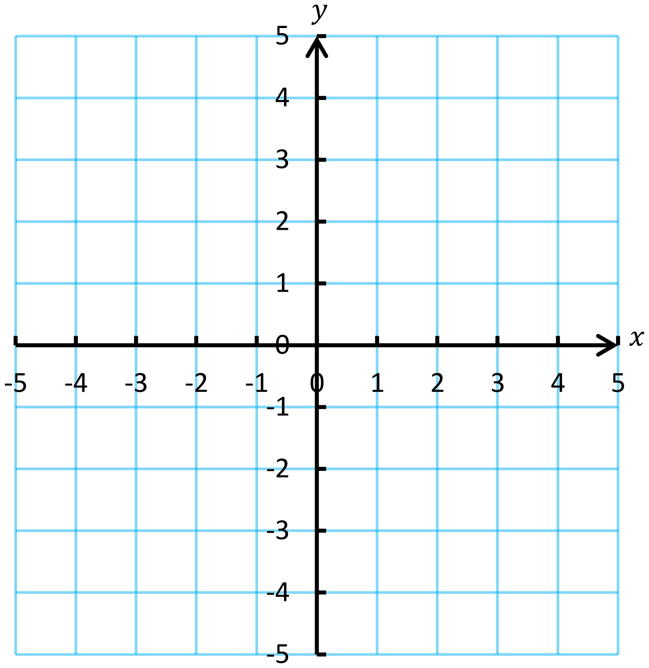
H

Shade the region that is defined by the following sets of inequalities.

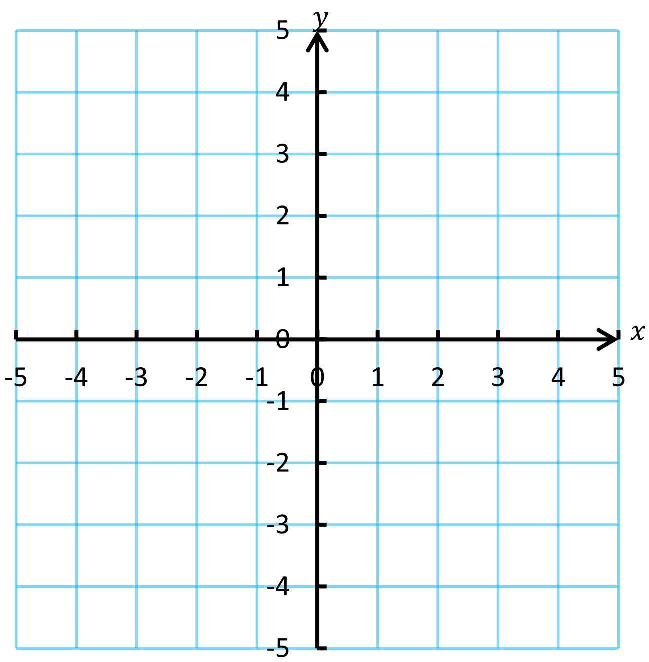
(a) $y < 4, x < 3, y \geq -2, x \geq -1$



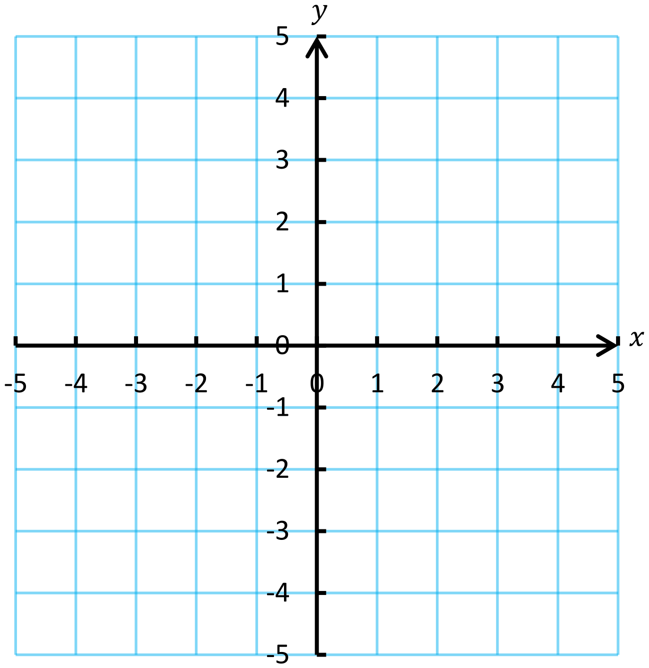
(b) $y \leq 3, x \geq 0, y \geq 2x - 3$



(c) $y > 1, x \geq 1, x + 2y - 4 \leq 0$



(d) $y > -2, y < x + 1, y < -2x + 3$



Exercise 36

H

Draw suitable axes in order to shade the regions that are defined by the following sets of inequalities.

(a) $x + y \leq 4, y \leq 2x + 4, y \geq 1$

(b) $y \geq 0, x < -1, y \leq x + 3$

(c) $x \geq -1, y < 4, y \geq 3x - 1$

(d) $y > -4, x < -1, y \leq 2x + 1$

(e) $y < 2, x \leq 1, y > -x + 2$

(f) $y > -3, x \geq -2, x \leq 1.5, y \leq -\frac{1}{2}x + 1$

Exercise 37

H

Draw suitable axes in order to shade the regions that are defined by the following sets of inequalities.

(a) $x \leq 2, y > -4, y \geq 2x - 2.5$

(b) $y < 2, x \geq -3, y \geq x - 1, y \geq -x - 4$

(c) $x + y < 1, x \geq -3$

(d) $y \geq x - 2, y < x + 4$

(e) $y < 2x, y \geq x + 1$

(f) $x + y > 2, y > x - 3$

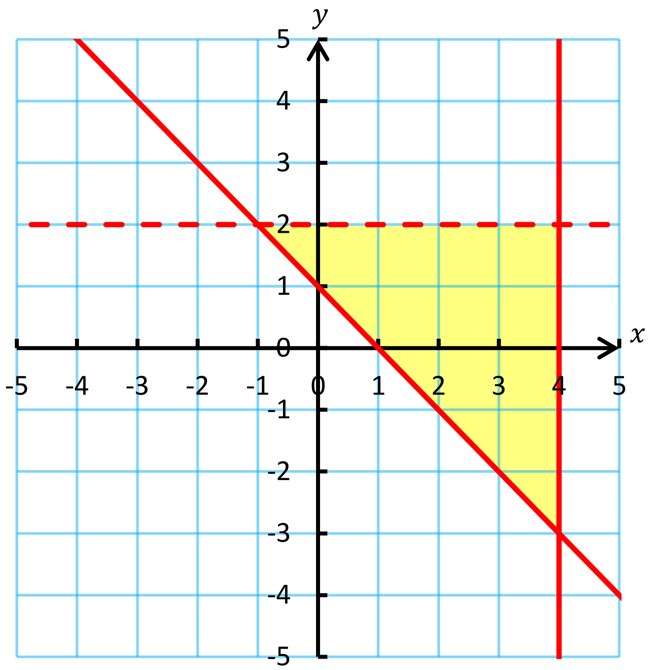
(g) $x - 2y < 4, y \leq x$

(h) $2x - 3y \leq 6, 2x + 2y < 0$

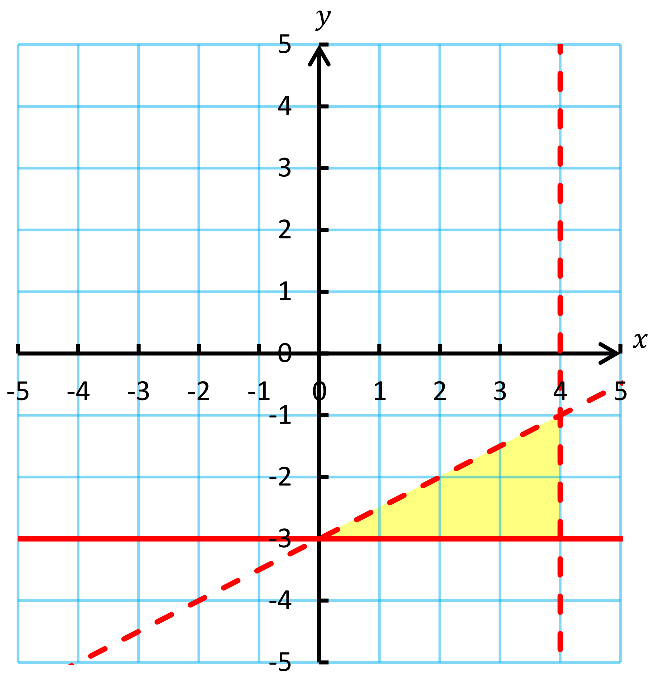
Exercise 38

What inequalities define the following shaded regions?

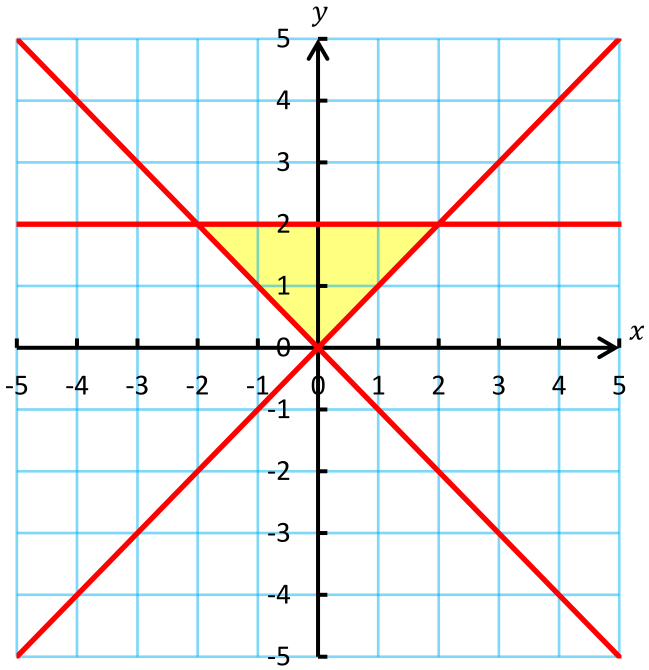
(a)



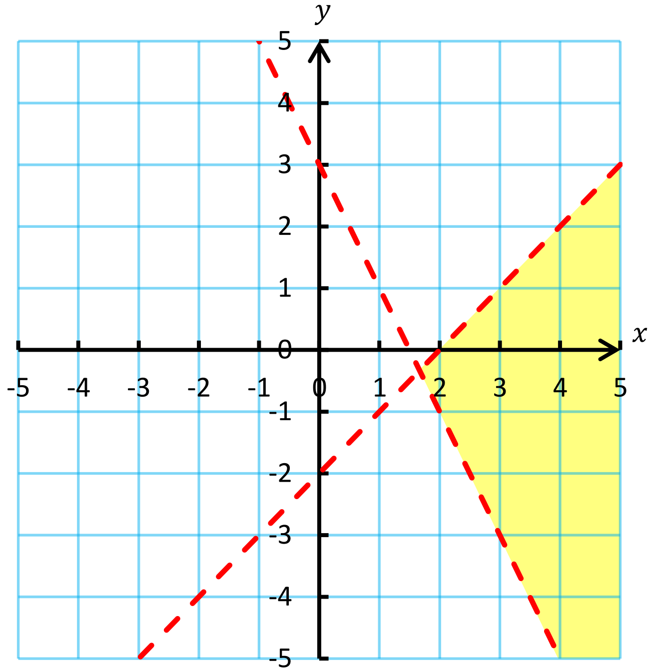
(b)



(c)



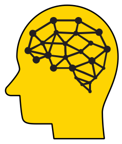
(d)



Exercise 39

Applying

H



A shop has asked a manufacturer to produce skirts and jackets.

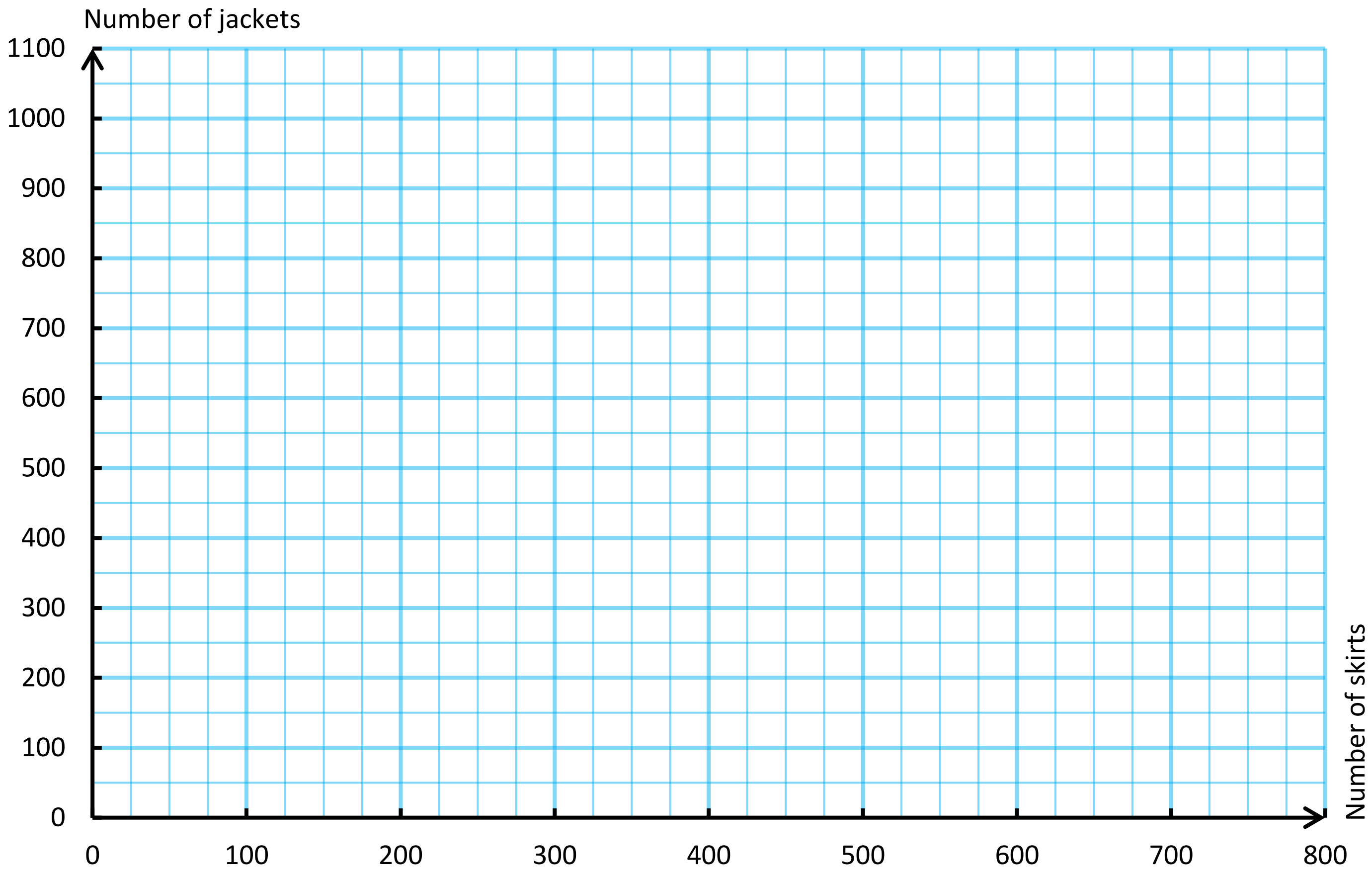
As raw materials, the manufacturer has 750 m² of cotton and 1,000 m² of polyester.

Each skirt requires 1 m² of cotton and 2 m² of polyester.

Each jacket requires 1.5 m² of cotton and 1 m² of polyester.

The price of a skirt is £50 and the price of a jacket is £40.

Assuming that everything is sold, how many skirts and jackets should the shop buy in order to maximise their profit?



Evaluation

Key words	Corrections	I am happy with...	I need to revise...

Developing

Algebra 3

Reflection

Name: ....

Percentage in the test: ....

	I know this.	I need to revise this.	Question in the test:	Correct in the test?
I know how to recognise whether the connection between two measures is a **direct proportion** or an **inverse proportion**.			1, 2, 3	
If two measures are in direct proportion, I can **calculate one of the missing measures**.			2	
If two measures are in inverse proportion, I **can calculate one of the missing measures**.			1, 3	
I can work with **more than one proportion**.			4	
I can **recognise and use the graphs** of direct proportion and inverse proportion.				
I can write and use **proportion equations**.			5	
Given a set of data for two measurements, I can **find the equation** that describes the connection between the measurements.				
I can **write the nth term** for **simple quadratic sequences**, e.g. $n^2 + 9$.			6	
I can **write the nth term** for **more complex quadratic sequences**, e.g. $4n^2 + 2n - 1$.			6	
I can **illustrate an inequality on a number line**.			7	
I can **solve inequalities**.			8	
I can **find the least whole number** (or the **greatest**) that satisfies an inequality.				
I can **list all the whole numbers** that satisfy an inequality.			9	
I can **plot lines of the form $ax + by + c = 0$**.				
Given a set of inequalities, I can **shade the region** that is defined by those inequalities.			10	
Given a region on graph paper, I can **find the set of inequalities** that define the region.				