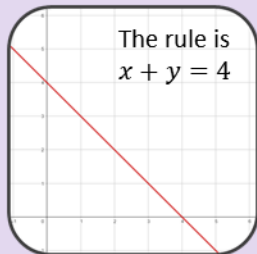
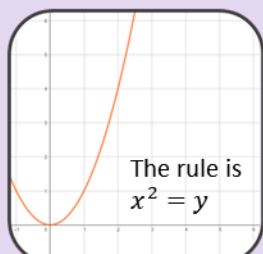


Unit 12: Solving Graphically

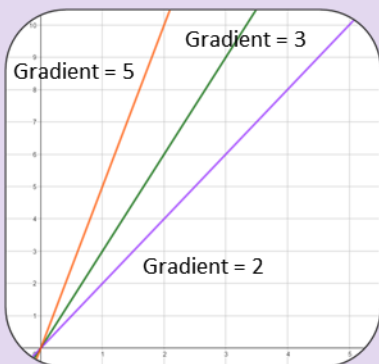
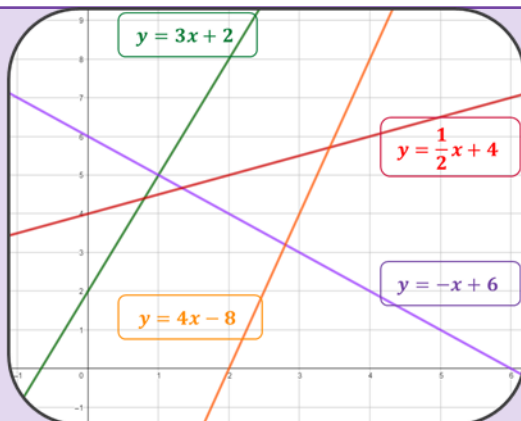
A graph is a representation of a rule.
All linear graphs are straight lines.



A linear graph



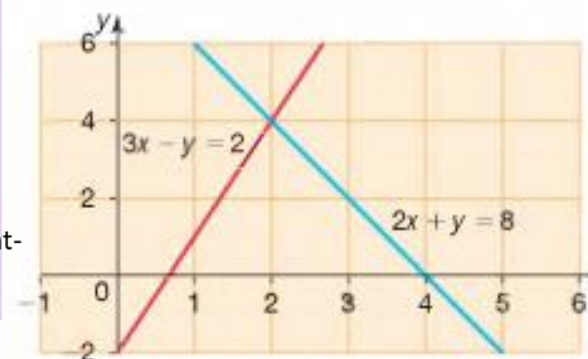
A non-linear graph



The steepness of a line is called the **gradient**.
The gradient is how much the line increases vertically for every 1 across.

The point where a graph crosses an axis is called an **intercept**. E.g. where the a line crosses the y-axis is called the **y-intercept**.

Straight lines can be described using gradient-intercept form, $y = mx + c$.



You can solve **simultaneous** equations graphically,
A solution is at a point of **intersection**.

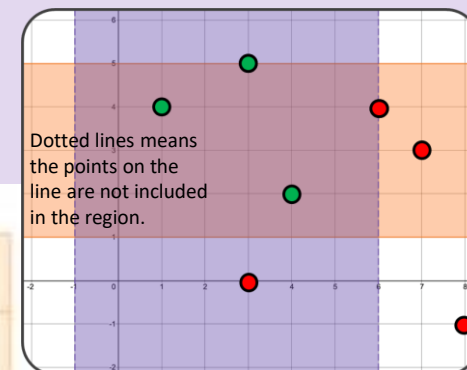
For example, for the equations $3x - y = 2$ and $2x + y = 8$,
the lines intersect at $(2, 4)$ so the solution is $x = 2$ and $y = 4$.

An **inequality** is a mathematical statement using one of these signs:

< less than ≤ less than or equal to
> greater than ≥ greater than or equal to

Language	Meaning	Example
----------	---------	---------

Inequality	A comparison of two quantities that are not equal.	$5x - 1 < 9$ $5x - 1$ is strictly less than 9.
------------	--	--



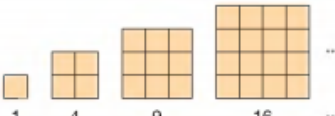
We can describe **regions** on a grid using **inequalities**.

Blue: $-1 < x < 6$

Orange: $1 \leq y \leq 5$

The green points are in both regions.

Unit 13: Solving Algebraically

Language	Meaning	Example
Sequence	An ordered set of numbers or other objects.	Square numbers  1 4 9 16 ... $T(1) = 1$ First term, position 1 $T(2) = 4$ Second term, position 2
Term	One of the separate items in a sequence.	
Position	A number that counts where a term appears in a sequence.	
Term-to-term rule	A rule that links a term in a sequence with the previous term.	Sequence: 3, 5, 7, 9, 11, 13 Term-to-term rule: 'add 2' $T(n + 1) = T(n) + 2$
Position-to-term rule / General term / nth term	A rule that links a term in a sequence with its position in the sequence.	Position-to-term rule: $T(n) = 2n + 1$

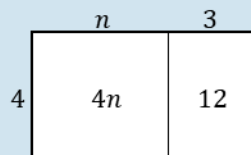
Equations and identities

- Two expressions are **equal** if they have the same **value**.
- We use the equals sign = to write an **equation**.
- Equations can be true or false.

The **value** of "2 + 3" is 5
So we can write $2 + 3 = 5$

$$1 + 2 = 6 - 3 \quad \text{True}$$

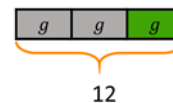
$$2 + 3 = 5 + 5 \quad \text{False}$$



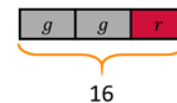
$$4(n + 3) \equiv 4n + 12$$

This symbol means 'identical to.' It means the expressions are **always** equal.

Bar models are good representations for **equations**. The bars represent **expressions**, and the numbers below show what the **expressions** have been **equated** to.



$$3g = 12$$



$$2g + r = 16$$

Language Meaning

Language	Meaning	Example
Simultaneous equations	Two or more equations that are true at the same time for the same values of the variables.	$(1) \quad 3x - y = 2$ $(2) \quad 2x + y = 8$ Both true when $x = 2$ and $y = 4$. On a graph the lines intersect at (2, 4).
Elimination	A method of solving simultaneous equations by removing one of the variables.	$(1) + (2) \quad 5x = 10 \Rightarrow x = 2$
Substitution	Replacing one of the variables in a simultaneous equation with an expression found by rearranging the other equation.	$(1) \Rightarrow y = 3x - 2$ into (2) $2x + (3x - 2) = 8 \Rightarrow 5x = 10 \Rightarrow x = 2$

Year 9 Summer 2 Knowledge Organiser

Week 1 – substitution (clip 189)

Quiz 1

1) Using $a = 3$, work out

a) $a + 5$

d) $2a + 1$

b) $7 - a$

e) $13 - \frac{a}{3}$

c) $6a$

f) $a^2 + 2a - 20$

Quiz 2

2) Using $x = 5$ and $y = 2$, work out

a) $x - y$

d) $5y - 5x$

b) $y - x$

e) $x^2 + 3y$

c) $3x + 2y$

f) $\frac{4x}{y} - xy$

Quiz 3

3) Using $a = 3$, $b = 1$ and $c = -2$, work out

a) $a + b + c$

d) $ab - c$

b) $2b + c$

e) $ac + 5b$

c) $c - a + b$

f) $c^2 - 2ab$

Quiz 4

4) Using $x = 3$, work out

a) $x^2 - 2x$

b) $2x^2 + x + 1$

c) $x^3 - 2x^2 - 5$

Year 9 Summer 2 Knowledge Organiser

Week 2 – rearranging (clip 280-287)

<p>1) Rearrange to make x the subject of the formula</p> <p>a) $y = x - 2$</p> <p>b) $y = x + 7$</p> <p>c) $y = x + t$</p> <p>d) $y = 5x + 3$</p> <p>e) $y = 2x - 4$</p>	<p>Quiz 1</p>	<p>2) Rearrange to make x the subject of the formula</p> <p>a) $3x + 2 = y$</p> <p>b) $4x - 1 = y$</p> <p>c) $ax - 3 = y$</p> <p>d) $ax + m = t$</p> <p>e) $x + y = t$</p>	<p>Quiz 2</p>
<p>3) Rearrange to make x the subject of the formula</p> <p>a) $y = x + t - v$</p> <p>b) $ax - c = y$</p> <p>c) $y = ax - tv + c$</p> <p>d) $y + x = ct$</p> <p>e) $c + ax + t = y + m$</p>	<p>Quiz 3</p>	<p>4) Rearrange to make x the subject of the formula</p> <p>a) $\frac{x - u}{4} = y$</p> <p>b) $\frac{x + a}{b} = c$</p> <p>c) $\frac{3(x + 2)}{c} = y$</p> <p>d) $\frac{a(x + b)}{c} = d$</p> <p>e) $\frac{t(x + c)}{d} = e + f$</p>	<p>Quiz 4</p>

Year 9 Summer 2 Knowledge Organiser

Week 3 – sequences (clip 196-198)

Quiz 1

- 1) Write the first five terms of each sequence
- a) Start at 1 and add 5
 - b) Start at 30 and subtract 4
 - c) Start at 11 and add 9

Quiz 2

- 2) For each sequence, describe the rule and find the next two terms
- a) 5, 7, 9, 11, ____, ____
 - b) 11, 16, 21, 26, ____, ____
 - c) 22, 19, 16, 13, ____, ____

Quiz 3

- 3) Write down the first four terms and the 10th term
- a) $n \longrightarrow 3n$
 - b) $n \longrightarrow 3n + 2$
 - c) $n \longrightarrow n - 3$
 - d) $n \longrightarrow 2n + 5$

Quiz 4

- Work out the n th term
- a) 2, 4, 6, 8,
 - b) 3, 5, 7, 9,
 - c) 5, 8, 11, 14,
 - d) 1, 5, 9, 13,

Year 9 Summer 2 Knowledge Organiser

Week 4 – solving equations (clip 176-188)

<p>Solve</p> <p>Quiz 1</p> <p>a) $x + 5 = 8$</p> <p>b) $x + 7 = 9$</p> <p>c) $x - 3 = 12$</p> <p>d) $x - 6 = 10$</p> <p>e) $2 + x = 5$</p>	<p>Quiz 2</p> <p>f) $2x = 14$</p> <p>g) $3x = 30$</p> <p>h) $\frac{x}{2} = 8$</p> <p>i) $\frac{x}{5} = 7$</p> <p>j) $\frac{4x}{3} = 8$</p>
<p>Solve</p> <p>Quiz 3</p> <p>a) $5x + 2 = 17$</p> <p>b) $3x - 1 = 17$</p> <p>c) $2x + 10 = 20$</p> <p>d) $4x - 7 = 29$</p> <p>e) $4 + 2x = 14$</p>	<p>Quiz 4</p> <p>f) $\frac{x}{2} + 3 = 7$</p> <p>g) $\frac{x}{5} - 2 = 4$</p> <p>h) $\frac{2x}{5} - 1 = 9$</p> <p>i) $\frac{3x}{2} + 5 = 11$</p> <p>j) $\frac{4x}{5} + 6 = 8$</p>

Year 9 Summer 2 Knowledge Organiser

Week 5 – simultaneous equations (clip 190-195)

<p>Solve $3x + y = 11$ $4x - y = 3$</p> <p>Solve $2x - 5y = 3$ $4x + 5y = 21$</p>	<p>Quiz 1</p> <p>Solve $x + 3y = 10$ $x + y = 6$</p> <p>Solve $3x + 2y = 3$ $2x + 2y = 5$</p> <p>Quiz 2</p>
<p>Solve $2x + 3y = -7$ $7x - 2y = -12$</p> <p>Solve $3x - 2y = 5$ $9x + 5y = -7$</p>	<p>Quiz 3</p> <p>Quiz 4</p> <p>If nine rats and seven ferrets cost £116.75 and four rats and six ferrets cost £88, how much would five rats and four ferrets cost?</p>

Year 9 Summer 2 Knowledge Organiser

Week 6 – simultaneous equations (clip 218-219)

Quiz 1

Complete the table of values for $y = x + 2$

x	0	1	2	3	4
y					

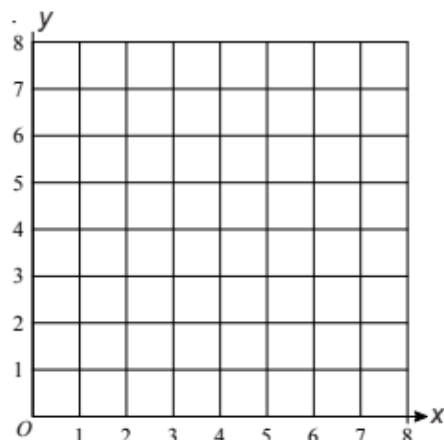
Quiz 2

Complete the table of values for $x + y = 7$

x	0	1	2	3	4
y					

Use your graph to solve the simultaneous equations $y = x + 2$ and $x + y = 7$

Quiz 3



Quiz 4

Solve the simultaneous equations

$$y = x + 6 \quad \text{and} \quad y = 3 - x$$

Year 9 Summer 2 Knowledge Organiser

Week 7 – inequalities (clip 273-276)

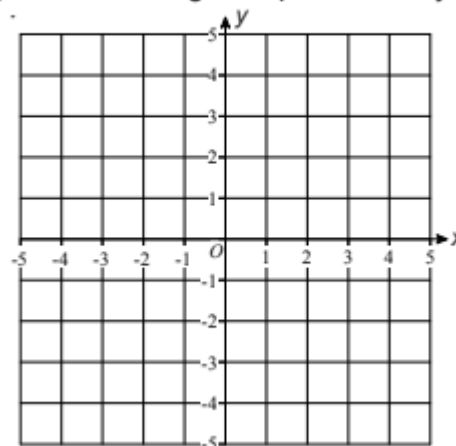
If x is an integer, what are the possible values of x ?

Quiz 1

- a) $-4 \leq x \leq 2$
- b) $-3 \leq x < 1$
- c) $1 < x \leq 5$
- d) $-3 < x \leq 4$
- e) $-7 \leq x \leq -4$

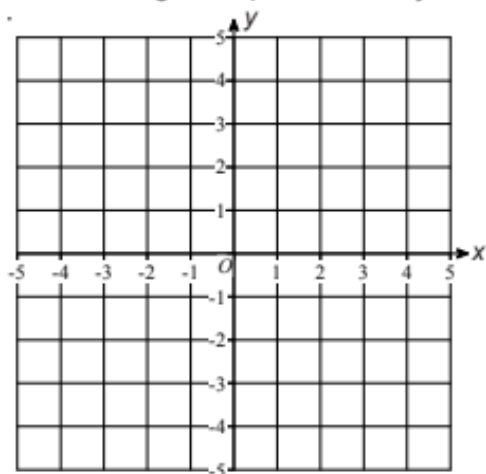
Quiz 2

- a) Shade the region represented by $x \leq -1$
- b) Shade the region represented by $x > 3$



Shade the region represented by $1 \leq y \leq 4$

Quiz 3



Shade the region where $-1 \leq x \leq 3$ and $-4 \leq y \leq -2$

Quiz 4

