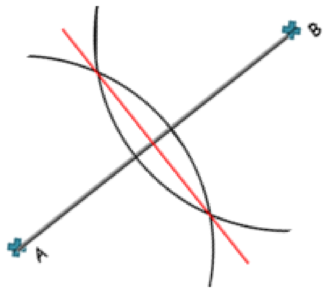
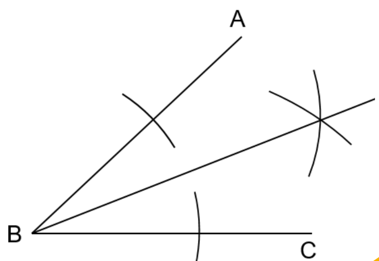
Year 9
CONSTRUCTIONS

Key Concept

Line Bisector



Angle Bisector



Key Words

Construction: To draw a shape, line or angle accurately using a compass and ruler.
Loci: Set of points with the same rule.
Parallel: Two lines which never intersect.
Perpendicular: Two lines that intersect at 90°.
Bisect: Divide into two parts.
Equidistant: Equal distance.

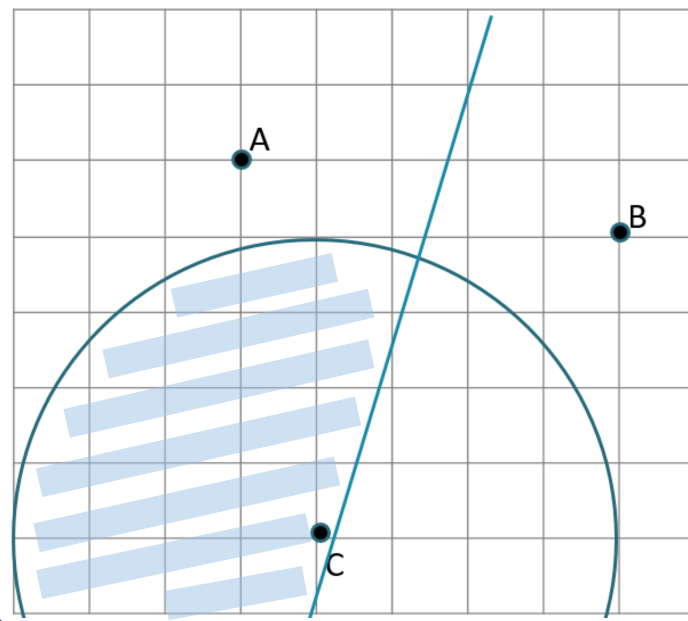
Examples

Shade the region that is:

- closer to A than B
- less than 4 cm from C

Line bisector of A and B

Circle with radius 4cm



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Clip Numbers

660-662, 674-677

Tip

Watch for scales.

For a scale of:
1 cm = 4 km.

20 km = 5 cm
6 cm = 24 km

Questions

1) Draw these angles then bisect them using constructions:
   a) 46° b) 18° c) 124°
2) Draw these lines and bisect them: a) 6cm b) 12cm

Year 9
SEQUENCES

Key Concepts

Arithmetic or linear sequences increase or decrease by a common amount each time.
Geometric series has a common multiple between each term.
Quadratic sequences include an n^2. It has a common second difference.
Fibonacci sequences are where you add the two previous terms to find the next term.

Linear/arithmetic sequence:

$$\overset{+1}{}\ \xrightarrow{-3}\ 4 \xrightarrow{+3} 7 \xrightarrow{+3} 10 \xrightarrow{+3} 13 \xrightarrow{+3} 16.....$$

a) State the nth term

$3n + 1$

Difference — The 0th term

b) What is the 100th term in the sequence?

$3n + 1$

$3 \times 100 + 1 = 301$

c) Is 100 in this sequence?

$3n + 1 = 100$

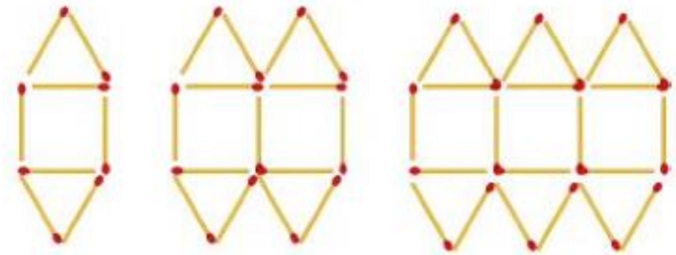
$3n = 99$

$n = 33$

Yes as 33 is an integer.

Examples

Pattern 1 Pattern 2 Pattern 3



Linear sequences with a picture:

State the nth term.

Hint: Firstly write down the number of matchsticks in each image:

$7n + 1$

Pattern 1	Pattern 2	Pattern 3
8	15	22

+1, -7, +7, +7

Geometric sequence e.g.

$$4 \xrightarrow{\times 3} 12 \xrightarrow{\times 3} 36 \xrightarrow{\times 3} 108...$$

Quadratic sequence e.g. $n^2 + 4$ Find the first 3 numbers in the sequence

First term: $1^2 + 4 = 5$

Second term: $2^2 + 4 = 8$

Third term: $3^2 + 4 = 13$

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198, 247-250, 264

Key Words

Linear
Arithmetic
Geometric
Sequence
Nth term

1) 1, 8, 15, 22, ...

a) Find the nth term b) Calculate the 50th term c) Is 120 in the sequence?

2) $n^2 - 5$ Find the first 4 terms in this sequence

ANSWERS: 1a) 7n – 6 b) 344 c) 18 so yes as n is an integer 2) -4, -1, 4, 11

Year 9
INEQUALITIES

Key Concepts

Inequalities show the **range** of numbers that satisfy a rule.

$x < 2$ means x is less than 2
$x \leq 2$ means x is less than or equal to 2
$x > 2$ means x is greater than 2
$x \geq 2$ means x is greater than or equal to 2

On a **number line** we use circles to highlight the key values:

○ is used for less/greater than
● is used for less/greater than or equal to

Examples

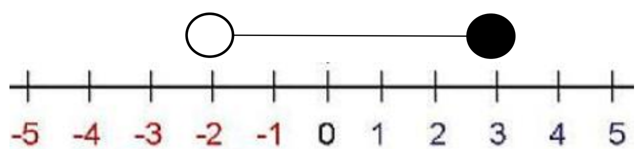
a) State the values of n that satisfy:

$$-2 < n \leq 3$$

Cannot be equal to 2   Can be equal to 3

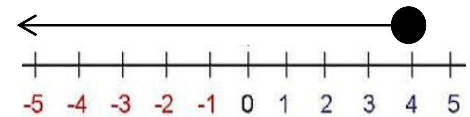
-1, 0, 1, 2, 3

b) Show this inequality on a number line:



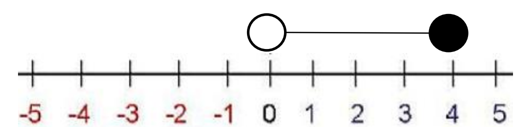
Solve this inequality and represent your answer on a **number line:**

$5x - 6 \leq 14$
$+6 \qquad +6$
$5x \leq 20$
$\div 5 \qquad \div 5$
$x \leq 4$



Solve this inequality and represent your answer on a **number line:**

$4 < 3x + 1 \leq 13$
$-1 \qquad -1$
$3 < 3x \leq 12$
$\div 3 \qquad \div 3$
$1 < x \leq 4$



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265-272

Key Words

Inequality
Greater than
Less than
Represent
Number line

1) State the values of n that satisfy: $-3 \leq n < 2$
2) Solve $4x - 2 \leq 6$ and represent your answer on a number line
3) Solve $5 < 2x + 3 \leq 9$ and represent your answer on a number line

ANSWERS: 1) -3, -2, -1, 0, 1   2) $x \leq 2$ 3) $1 < x \leq 3$

Year 9
REARRANGE AND SOLVE EQUATIONS

Key Concepts

Solving equations:
Working with inverse operations to find the value of a variable.

Rearranging an equation:
Working with inverse operations to isolate a highlighted variable.

In solving and rearranging we **undo the operations** starting from the last one.

Examples

For each step in solving an equation we must do the **inverse** operation

Solve:

$5(x-3) = 20$

Expand

$5x - 15 = 20$

$+15 \qquad\qquad +15$

$5x = 35$

$\div 5 \qquad\qquad \div 5$

$x = 7$

Solve:

$12 = 3x - 18$

$+18 \qquad\qquad +18$

$30 = 3x$

$\div 3 \qquad\qquad \div 3$

$x = 10$

Solve:

$7p - 5 = 3p + 3$

$-3p \qquad\qquad -3p$

$4p - 5 = 3$

$+5 \qquad\qquad +5$

$4p = 8$

$\div 2 \qquad\qquad \div 2$

$p = 2$

Rearrange to make r the subject of the formulae :

$$Q = \frac{2r-7}{3}$$

$\times 3 \qquad\qquad \times 3$

$$3Q = 2r - 7$$

$+7 \qquad\qquad +7$

$$3Q + 7 = 2r$$

$\div 2 \qquad\qquad \div 2$

$$\frac{3Q+7}{2} = r$$

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177-186, 280-284, 287

Key Words

Solve

Rearrange

Term

Inverse operation

1) Solve $7(x+2) = 35$

2) Solve $4x - 12 = 28$

3) Solve $4x - 12 = 2x + 20$

4) Rearrange to make x the subject:

$$y = \frac{3x+4}{2}$$

ANSWERS: 1) $x = 3$ 2) $x = 10$ 3) $x = 16$ 4) $x = \frac{2y-4}{3}$

Year 9

DIRECT AND INVERSE PROPORTION USING ALGEBRA

Key Concepts

Variables are **directly proportional** when the **ratio is constant** between the quantities.

Variables are **inversely proportional** when **one quantity increases in proportion to the other decreasing.**

α is the symbol we use to show that one variable is in proportion to another.

Direct proportion: $\boldsymbol{y \propto x}$

Inverse proportion: $\boldsymbol{y \propto \frac{1}{x}}$

Examples

Direct proportion:

g is directly proportional to the square root of h
When g = 18, h = 16
Find the possible values of h when g = 2

$$g \propto \sqrt{h}$$
$$g = k\sqrt{h}$$
$$18 = k\sqrt{16}$$
$$18 = 4k$$
$$4.5 = k$$
$$g = 4.5\sqrt{h}$$

$$g = 4.5\sqrt{h}$$
When $g = 2$
$$2 = 4.5\sqrt{h}$$
$$\frac{2}{4.5} = \sqrt{h}$$
$$\left(\frac{4}{9}\right)^2 = h$$
$$\frac{16}{81} = h$$

Inverse proportion:

The time taken, t, for passengers to be checked-in is inversely proportional to the square of the number of staff, s, working.
It takes 30 minutes passengers to be checked-in when 10 staff are working. How many staff are needed for 120 minutes?

$$t \propto \frac{1}{s^2}$$
$$t = \frac{k}{s^2}$$
$$30 = \frac{k}{10^2}$$
$$3000 = k$$
$$t = \frac{3000}{s^2}$$

$$t = \frac{3000}{s^2}$$
$$120 = \frac{3000}{s^2}$$
$$s^2 = \frac{3000}{120}$$
$$s^2 = 25$$
$$s = \sqrt{25}$$
$$s = 5$$

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343-345, 346-348

Key Words

Direct
Inverse
Proportion
Divide
Multiply
Constant

1) e is directly proportional to f
When e = 3, f = 36
Find the value of f when e = 4

2) x is inversely proportional to the square root of y.
When x = 12, y = 9
Find the value of x when y = 81

ANSWERS 1) $f = 48$ 2) $x = 4$