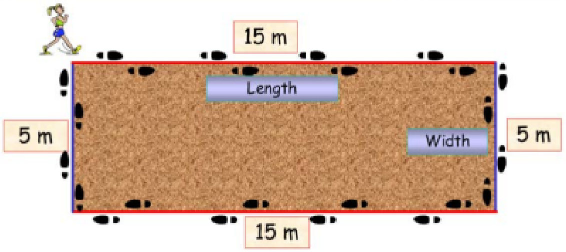
Year 10 – Maths Higher / Unit 7: Area and Volume – HT1

Corbett Maths video links: V312 V377 V358

Perimeter

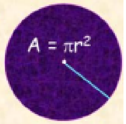
The perimeter of a shape is the distance around the outside.

Rectangles

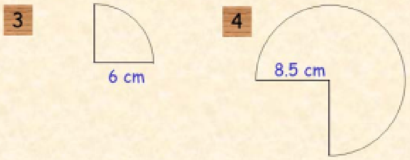


Perimeter = 15 m + 5 m + 15 m + 5 m = 40 m

The Area of a Circle



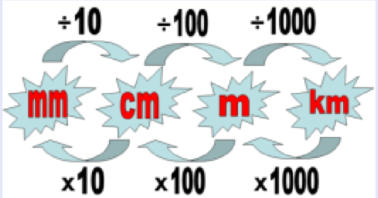
Find the area of the $\frac{1}{4}$ and $\frac{3}{4}$ circles.



$A = \frac{1}{4}\pi r^2$
$= \frac{1}{4} \times \pi \times 6^2$
$= 28.3\text{ cm}^2$ (1 dp)

$A = \frac{3}{4}\pi r^2$
$= \frac{3}{4} \times \pi \times 8.5^2$
$= 170.2\text{ cm}^2$ (1 dp)

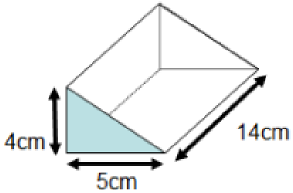
Metric conversions:

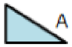


VOLUME is how many cubic units fit **inside** a shape.

For a prism* Volume = Area x length

*a shape that is the same all the way along its length

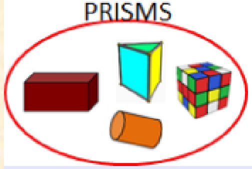




$A = ½ \times 4 \times 5 = 10\text{cm}^2$ $V = A \times L = 10 \times 14 = 140\text{cm}^3$

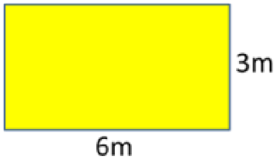
So, always start by working out the **area** on front of the shape – this has to be the same all the way along the length (i.e. it has to be a prism).

PRISMS



NOT PRISMS

Error bounds:



The lengths have been measured to the nearest metre

What the minimum and maximum values that the base and height could be?

$5.5 \le \text{base} < 6.5\text{m}$ $2.5 \le \text{height} < 3.5\text{m}$

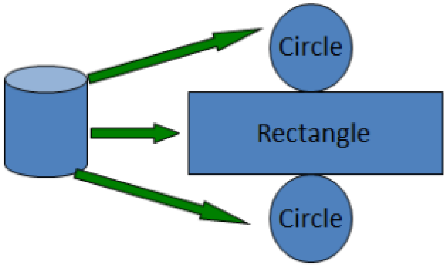
What the minimum and maximum values that the *perimeter* could be?

$16\text{m} \le \text{perimeter} < 20\text{m}$

What the minimum and maximum values that the *area* could be?

$13.75\text{m}^2 \le \text{area} < 22.75\text{m}^2$

SURFACE AREA is how many square units fit onto the **outside** of a shape.



It's helpful to think of the net of the shape: the surface area is just the area of all the bits of the net added together.

e.g. A cube of side length 5cm:

Area of one face = 5 x 5 = 25cm²

Total surface area = 25 x 6 = 150cm²

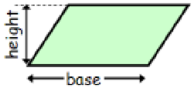
rectangle

Area = base x height

a triangle is half the area of a rectangle

Area = $\frac{\text{base x height}}{2}$

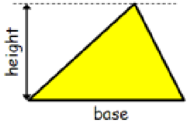
parallelogram



Area = base x height

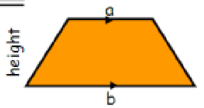
AREA

Always use the perpendicular height

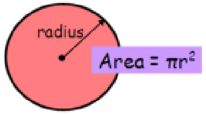


trapezium

Area = $\frac{(a + b) \times h}{2}$



circle

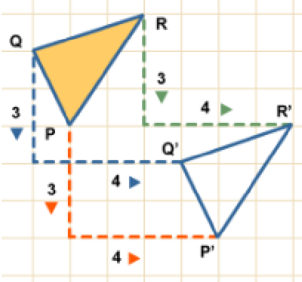


Area = πr²

Year 10 – Maths Higher / Unit 8: Transformations & Constructions– HT1

Translation: V325

To translate means to move a shape. The shape does not change size or orientation.



Column Vector:

In a column vector, the top number moves left (-) or right (+) and the bottom number moves up (+) or down (-)

$\begin{pmatrix}2\\3\end{pmatrix}$ means '2 right, 3 up'

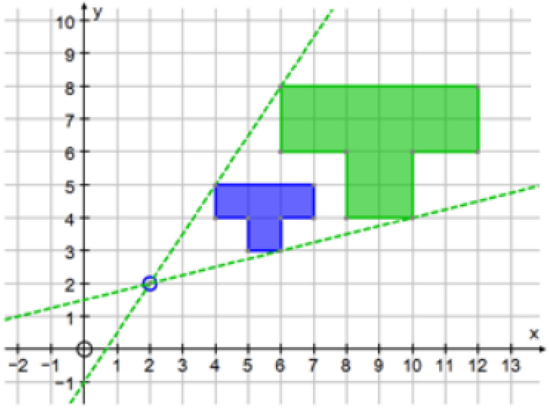
$\begin{pmatrix}-1\\-5\end{pmatrix}$ means '1 left, 5 down'

Enlargement:

The shape will get **bigger** or **smaller**. Multiply each side by the **scale factor**.

Scale Factor = 3 means '3 times larger = multiply by 3'

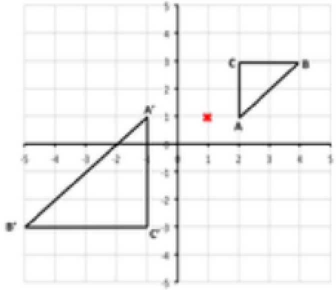
Scale Factor = ½ means 'half the size = divide by 2'



V104
V105
V106

V107 V108

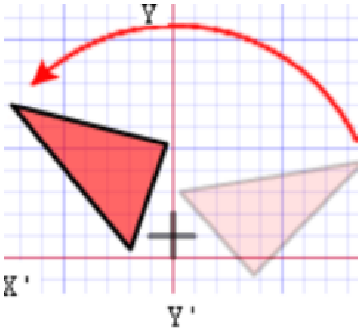
Negative Scale Factor Enlargements will look like they have been rotated. $SF = -2$ will be rotated, & also twice as big. Enlarge ABC by scale factor -2, centre (1,1)



Rotation: V275

The size does not change, but the shape is turned around a point. (Use tracing paper).

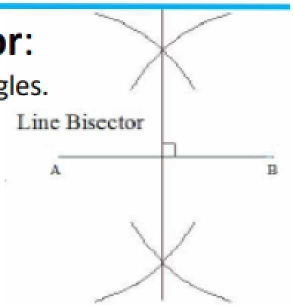
Rotate the triangle 90° anti-clockwise about (0,1).



Perpendicular Bisector:

Cuts a line in half and at right angles.

V78



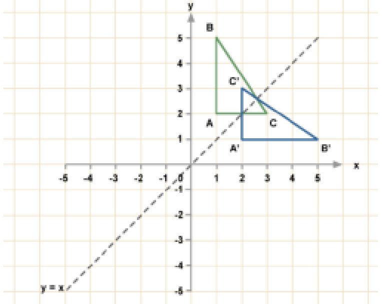
Reflection:

The size does not change, but the shape is '**flipped**' like in a **mirror**.

Line **x=?** is a **vertical line.**
Line **y=?** is a **horizontal line.**
Line **y=x** is a **diagonal line.**

V272 V273 V274

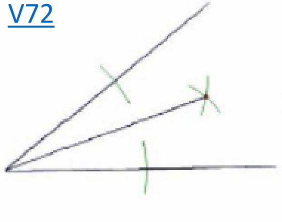
Reflect shape C in the line y=x



Angle Bisector:

Cuts the angle in half.

V72

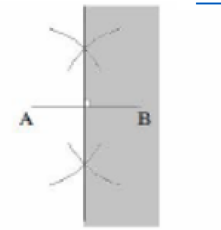


Angle Bisector

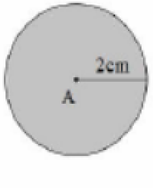
Loci:

A locus is a path of points that follow a rule.

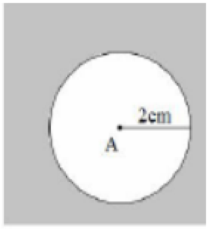
V75 V76 V77



Points Closer to B than A



Points less than 2cm from A



Points more than 2cm from A

Year 10 – Maths Higher / Unit 9: Equations & Inequalities – HT1

Quadratic: V325

A quadratic expression is of the form **$ax^2 + bx + c$**
where a, b and c are numbers, **$a \neq 0$**
Examples of quadratic expressions: **x^2 or $8x^2 - 3x + 7$**

Factorising Quadratics: V118 V119

When a quadratic expression is in the form $x^2 + bx + c$ find the 2 numbers that add to give b & multiply to give c.
e.g. $x^2 + 7x + 10 = (x+5)(x+2)$
(because 5 and 2 add to give 7 and multiply to give 10)

Difference of Two Squares V120

An expression of the form $a^2 - b^2$ can be factorised to give $(a+b)(a-b)$.
e.g. $x^2 – 25 = (x+5)(x-5)$ or $16x^2 – 81 = (4x+9)(4x-9)$

Solving Quadratics ($ax^2 = b$)

Isolate the x^2 term and square root both sides.

e.g. $2x^2 = 98$
$x^2 = 49$
$x = \pm 7$

Remember there will be a positive and a negative solution.

Solving Quadratics ($ax^2 + bx = 0$)

Factorise and then **solve = 0** V266

e.g. $x^2 - 3x = 0$
$x(x-3) = 0$
$x = 0$ or $x = 3$

e.g. Solve $x^2 + 3x – 10 = 0$
Factorise: $(x+5)(x-2) = 0$
$x=-5$ or $x=2$

Simultaneous Equations:

A set of two or more equations, each involving two or more variables (letters).
The solutions to simultaneous equations satisfy both/all of the equations.
V295 V296 V297

e.g. $2x + y = 7$
$3x – y = 8$
$x=3, \ y=1$

Factorising Quadratics when a ≠ 1 V266

When a quadratic is in the form **$ax^2 + bx + c$**

1. Multiply a by c = ac
2. Find two numbers that add to give b and multiply to give ac.
3. Re-write the quadratic, replacing bx with the two numbers you found.
4. Factorise in pairs – you should get the same bracket twice
5. Write your two brackets – one will be the repeated bracket, the other will be made of the factors outside each of the two brackets.

Completing the Square V267a V371

A quadratic in the form **$ax^2 + bx + c$** can be written in the form **$(x + p)^2 + q$**

1. Write a set of brackets with x in and half the value of b.
2. Square the bracket.
3. Subtract $(b/2)^2$ and add c.
4. Simplify the expression.

Solving Quadratics using the Quadratic Formula: V267

A quadratic in the form **$ax^2 + bx + c$** can be solved using the formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

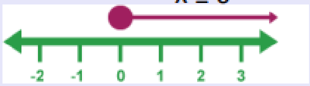
Use the formula if the quadratic does not factorise easily.

Inequality symbols: V176 V177 V178 V179

$x>2$ means x is **greater than** 2
$x<3$ means x is **less than** 3
$x\geq1$ means x is **greater than or equal to** 1
$x\leq6$ means x is **less than or equal to** 6

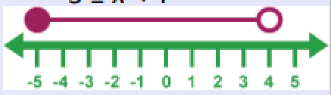
Inequalities can be shown on a number line.
Open circles are used for numbers that are **less than or greater than** (< or >)
Closed circles are used for numbers that are **less than or equal or greater than or equal** (≤ or ≥)

$x \geq 0$



$x < 2$

$-5 \leq x < 4$



Corbett Maths video links V244 V250 V247

TECHNICAL LANGUAGE:

P("something") means *probability of "something" happening*

"Mutually exclusive" means that if one thing happens, the other cannot. E.g. being alive and dead are mutually exclusive states!

"Bias" = unfairness. It would be biased to roll a die that has 2 sixes on it and no zeroes in a normal dice game.

If outcomes A and B are mutually exclusive,
P(A) + P(B) = 1 or 1-P(A) = P(B)

E.g. If there is no draw allowed,
and P(win) = 0.7, B(lose) must be 0.3

Sometimes bias is difficult to spot in experiments.
If you flip a coin 100 times, you expect 50 heads and 50 tails, but does that mean your coin is biased if you get 60:40? What about 90:10?? What about 99:1????

On fair dice, opposite faces *should* add up to 7.

COMBINING PROBABILITIES:

If you want to find the probability of 2 things happening, MULTIPLY the individual probabilities.

One of the reasons why fractions are convenient for probability is That they are so easy to multiply;
Multiply numerators, multiply denominators ½ x ⅝ = 5/16

Remember to simplify whenever possible

Example:
P(win) = 2/5 P(win) = 3/10 P(win both) = 2/5 x 3/10 = 6/50 = 3/25

The LANGUAGE of probability:

P("something") means *probability of "something" happening*

Eg. When tossing a coin P(heads) = 0.5 or ½
P(tails) = 0.5 or ½
P(heads or tails) = 1 (certain)
P(coin flying off into outer space) = 0 (impossible)

It's often easiest to write probabilities as **fractions***, especially if you want to combine probabilities in tree diagrams…

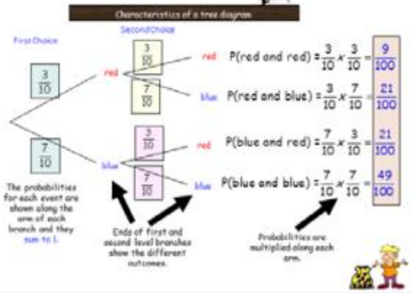
$$* \ \frac{\text{how many ways it can happen}}{\text{How many outcomes there are altogether}}$$

Sample Space Diagrams:
Often used to find all the possible combinations of 2 events being combined:

Roll a die

Roll a die	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

If we're adding, The value in the (6,6) box of the SSD would be 12



The probabilities for each event are shown along the arm of each branch and they sum to 1.

Ends of first and second level branches show the different outcomes.

Probabilities are multiplied along each arm.

You can use two-way tables to help solve probability problems:

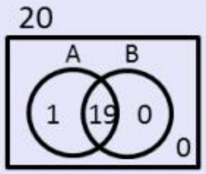
	France	Holland	Elsewhere	Total
June	6	18	5	29
July	10	19	2	31
August	15	15	10	40
Total	31	52	17	100

What is the probability that a person selected at random:

1. Went to Holland on holiday?	52/100
2. Went on holiday in July?	31/100
3. Went to France in August?	15/100
4. Did not visit either France or Holland?	17/100
5. Went on holiday in June?	29/100

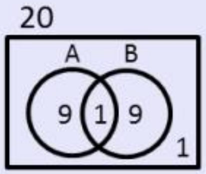
VENN DIAGRAMS

$$P(A\cap B) = \frac{19}{20}$$



20 people chose A, and 19 chose B.

$$P(AUB) = \frac{19}{20}$$



1 person opts out of choosing either A or B.