GEOMETRY

NAMING ANGLES:

- any angle less than 90º is an **acute angle**
- any angle equal to 90º is a **right angle**
- any angle between 90º and 180º is an **obtuse angle**
- any angle between 180º and 360º is a **reflex angle**

NAMING TRIANGLES:

- any triangle which has three sides of equal length and three equal angles (60º) is an **equilateral triangle**
- any triangle which has two sides of equal length and two equal angles is an **isosceles triangle**
- any triangle which has no sides of equal length and no equal angles is a **scalene triangle**
- any triangle which has one right angle is a **right - angled triangle**

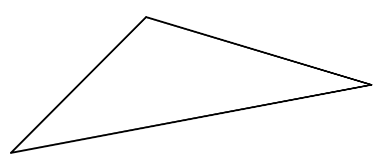
ANGLE SUMS:

- angles at a point on a straight line add up to 180º

  $a + b = 180º$
- angles round a point add up to 360º

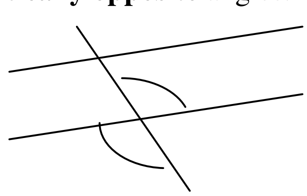
  $c + d + e = 360º$
- vertically opposite angles are equal
- angles in a triangle add up to 180º

$x + y + z = 180º$

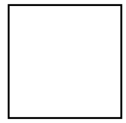
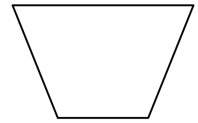


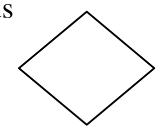
PARALLEL LINES:

At each point where a straight line crosses a set of parallel lines there are two pairs of **vertically opposite** angles:



QUADRILATERALS:

rectangle  square  trapezium 

parallelogram  rhombus 

POLYGONS:

The sum of interior angles of a polygon with n – sides is: (n – 2) . 180º. So for ABCDE the sum of interior angles is (5 – 2) . 180º = 540º.

- **regular** polygons have all the sides equal and the interior angles are equal as well
- **irregular** polygons have all the sides equal, but the interior angles are not.

Polygon	**Number of sides**	**Sum of interior angles**		**Interior angle of a regular polygon**
Triangle	3	180º	: 3	60º
Quadrilateral	4	360º	: 4	90º
Pentagon	5	540º	: 5	108º
Hexagon	6	720º	: 6	120º

The external angle of a triangle is equal to the sum of the two opposite interior angles:

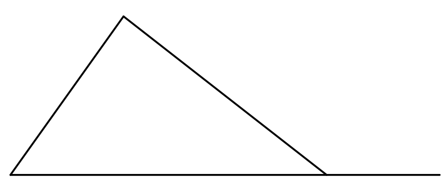
d is the external angle at c

Now c + d = 180º [angles on a straight line]

i.e. c = 180º - d

and a + b+ c = 180º [angles sum of a triangle]

c = 180º - (a + b)



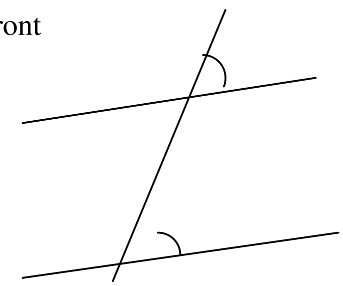
So 180º - d = 180º - (a + b)

d = a + b

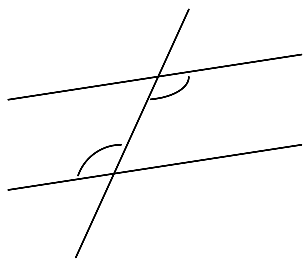
ANGLES:

In each of the following diagrams a straight line crosses two parallel lines:

Corresponding angles are equal – we look for an F shape which may be upside down and/or back to front



Alternate angles are equal – we look for a Z shape which may be back to front.



SOME MATHEMATICAL TERMS ABOUT A TRIANGLE:

- For the sides a, b, and c of a triangle *a triangle inequality* is valid: $a + b > c > a - b$.

It is also true that opposite a bigger side there is a bigger angle; opposite the smaller side there's a smaller angle.

- **Axis of an abscissa** AB is a line which passes through the centre of the abscissa and is perpendicular to it.
- **Axis of an angle** ABC is a half-line BX whose each point X is of equal distance to the arms BA, BC
- **Transversal line** of a triangle is an abscissa, whose marginal points are the centres of two sides of a triangle; it is parallel to that side, through centre of which it doesn't cross. Its size is equal to ½ of the side to which it is parallel.
- **Median** of a triangle is an abscissa, whose marginal points are a vertex of a triangle and the centre of the opposite side. The all three medians pass through one common point T, called the **centre of gravity**.
- **Altitude** (**height**) of a triangle is the distance between a vertex of a triangle and the line on which the opposite side of a triangle lies. The altitudes pass through one point O, called the **orthocentre**.

- in a right-angled triangle the Pythagoras' formula (rule) is valid: $\mathbf{a^2 + b^2 = c^2}$**,** where a and b are sides, either the opposite or adjacent, and c is a **hypotenuse,** i.e. the side opposite the right angle.

SOLIDS, THEIR SURFACE AREAS AND VOLUMES

A = surface area

V = volume

BLOCK

$A = 2\,(ab + bc + ac)$

$V = abc$

diagonal of a block = $\sqrt{a^2 + b^2 + c^2}$

CUBE

$A = 6\,a^2$

$V = aaa = a^3$

diagonal of a cube = $a\sqrt{3}$

CYLINDER

$A = 2\pi r^2 + 2\pi rv$

$V = \pi r^2 v$

SPHERE

$A = 4\pi r^2$

$V = \frac{4}{3}\pi r^3$

PRISM

If the base of a perpendicular prism is a triangle or a quadrilateral, we speak about a triangular or quadrangular prism. If the base is a regular polygon, we speak about a regular prism.

Generally:

$A = 2 \,.\, A_b + Q$

$V = A_b \,.\, h$

where A_b is the area of a base, Q is the surface area of casing, h is a height of the solid

PYRAMID may have as its base a triangle, quadrilateral or another polygon.

- triangle as a base = *tetrahedron*: $A = A_b + Q$

  $V = \frac{1}{3} A_b \,.\, v$

- rectangle as a base = quadrangular pyramid: $A = A_b + Q$

  $V = \frac{1}{3} a \,.\, b.\, v$

CONE

$A = \pi r^2 + \pi rs$

$V = \frac{1}{3} \pi r^2 v$

$s = \sqrt{r^2 + v^2}$