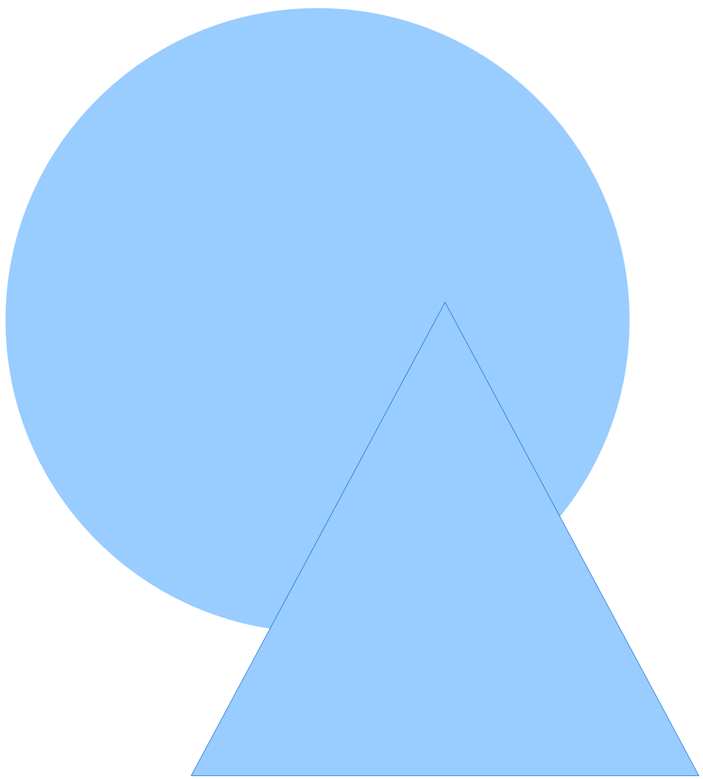
Geometry Formulae



Basic Geometry

Basic Geometry

- If two or more angles form a straight angle, the sum of their measures is 180º

  – The sum of all the measures of all the angles around a point is 360º

Parallel Lines

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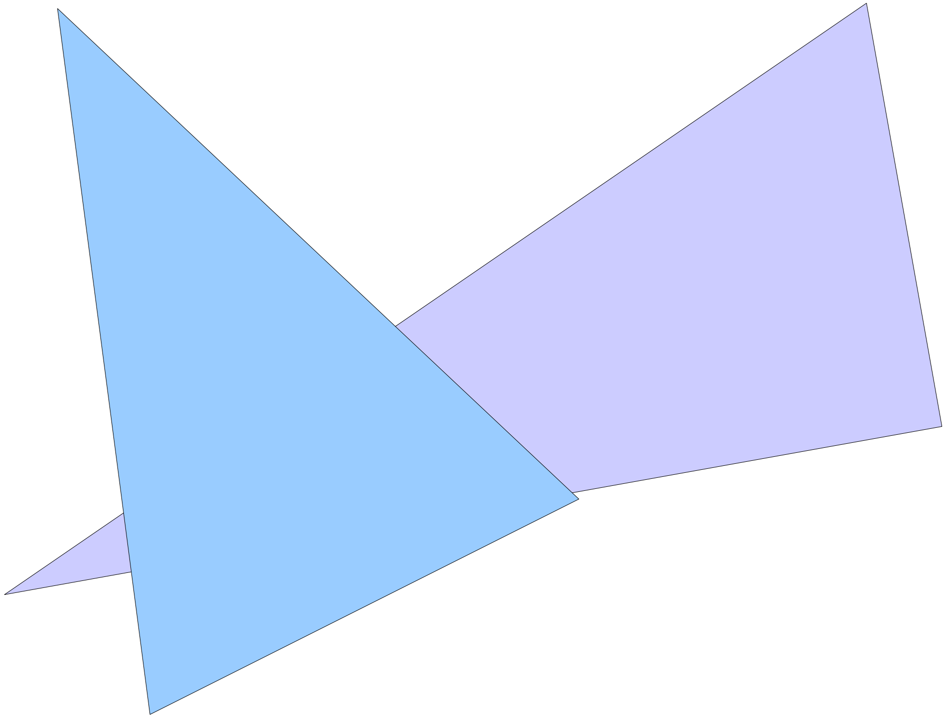
- If a pair of straight lines is cut by a transversal that is not perpendicular to the parallel lines, then
- Vertically opposite angles are a=b, c=d, e= f, g=h
- Corresponding angles are a=e, c= g, d=h, b=f
- Alternate interior angles are c=h, e=b
- Alternate exterior angles are a=f, d=g
- Supplementary angle pairs are c+e = b+h = 180

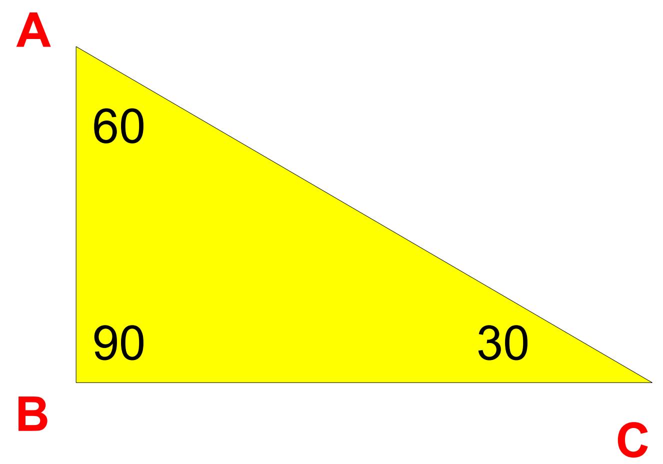


Triangles

Triangle

- In any triangle, the sum of the measures of the three angles is 180º
- The measure of the exterior angle of the triangle is equal to the sum of the measure of the two opposite interior angles
- In any right triangle, the sum of the measures of the two acute angles is 90º

30-60-90 Triangle



In most GRE geometry problems, you need not know Trigonometry.
A few equivalent concepts can help you solve them.

In many problems, the triangles turn out to be a right triangle with one of the angles as 30 or 60.
You have to immediately register that this is a 30-60-90 Triangle and check if there is an opportunity for you to apply the following rule.
This rule helps you to determine length of 2 sides of the Triangle, if you know just one

The rule says that: In a 30-60-90 triangle (one shown above),
The ratio of the

The length of side opposite to 30° **:** The length of side opposite to 60° **:**
The length of side opposite to 90°

= 1 **:** √3 **:** 2 = AB : BC : AC

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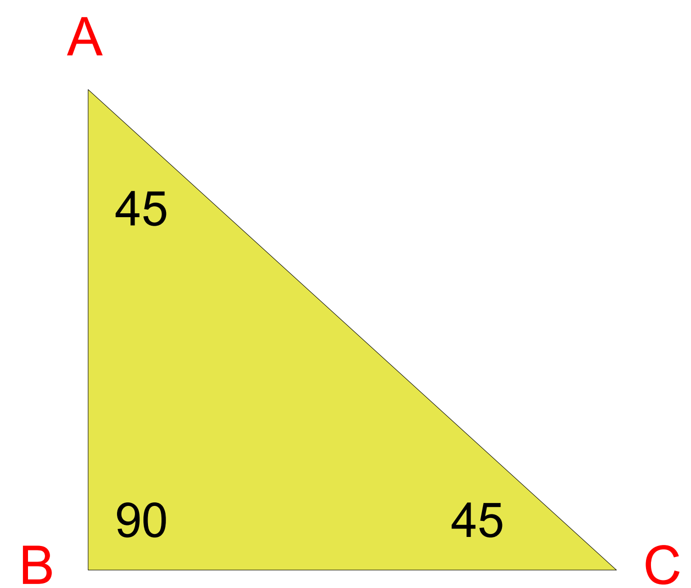
45-45-90 Triangle

Sometimes, the triangles turn out to be a isosceles right triangle with one of the angles as 45.
You have to immediately register that this is a 45-45-90 Triangle
and check if there is an opportunity for you to apply the following rule.
This rule helps you to determine length of the sides of the Triangle, if you know just one



The rule says that: In a 45-45-90 triangle (shown triangle),
The ratio of the

The length of side opposite to 45° **:** The length of side opposite to 45° **:** The length of side opposite to 90°

= **1 : 1:**$\sqrt{\mathbf{2}}$ = AB : BC : AC

Triangle

•An altitude divides an equilateral triangle into two 30-60-90 triangles

•The sum of the lengths of any two sides of a triangle is greater than the length of the third side

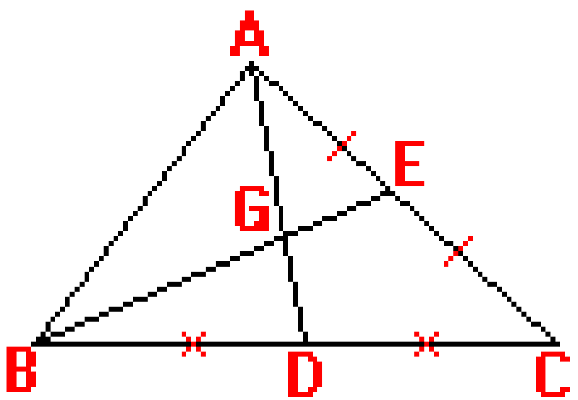
•The difference of the lengths of any two sides of a triangle is less than the length of the third side

•The area of the triangle is given by $\boldsymbol{A = \frac{1}{2}\, b.h}$, where b is the base of the triangle and h is the height of the triangle

•The area of an equilateral triangle with side s is given by

$$A = s^2\sqrt{3}/4$$

Centroid



•Centroid is the meeting point of the medians drawn from the vertex to the mid-point of the opposite side of the triangle

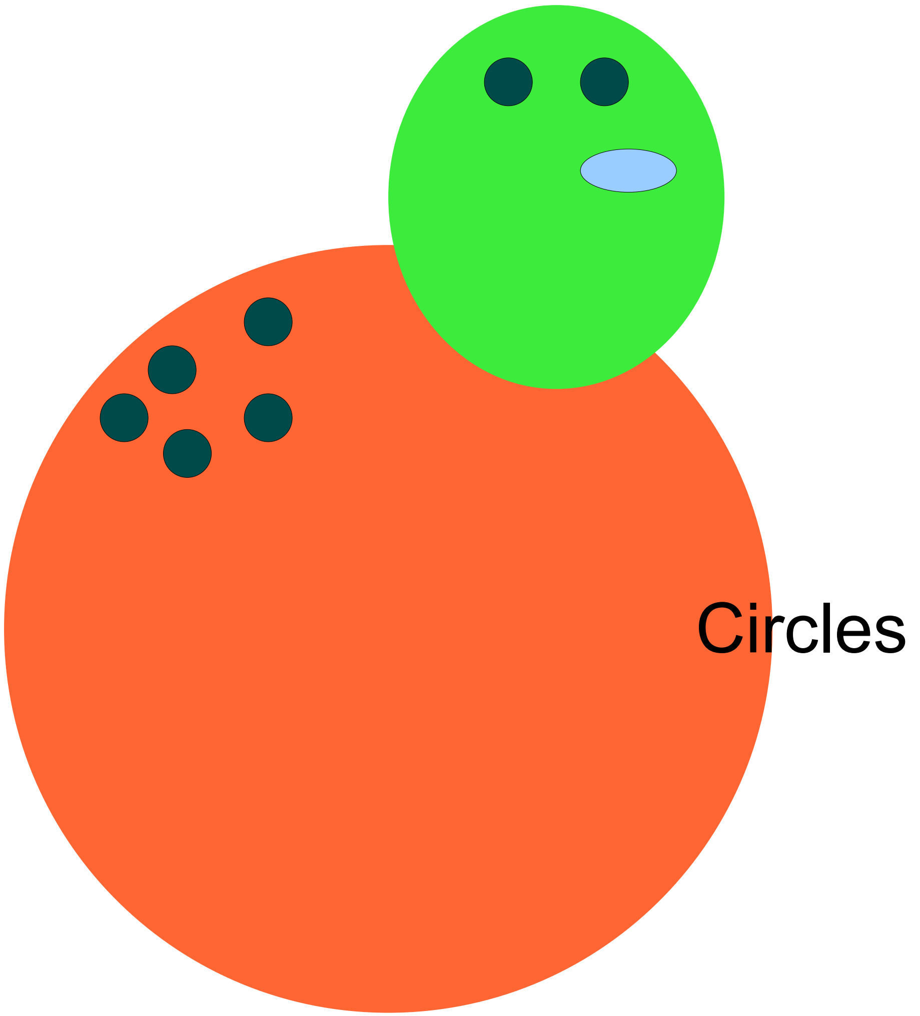
•Centroid divides the median in the ratio 1 : 2

•Thus in the adjoining figure GE/BE = 1/3

•or GE/BG = 1/2

•Similarly, GD/AD = 1/3

•or GD/AG = 1/2


Circles

Circles

- Any triangle formed by connecting the endpoints of two radii, is isosceles. Here ∟OPQ = ∟OQP
- Circumference = 2Лr = Лd, where d is the diameter of the circle
- Area = Лr^2
- Circumference of a semi circle = Лr + d

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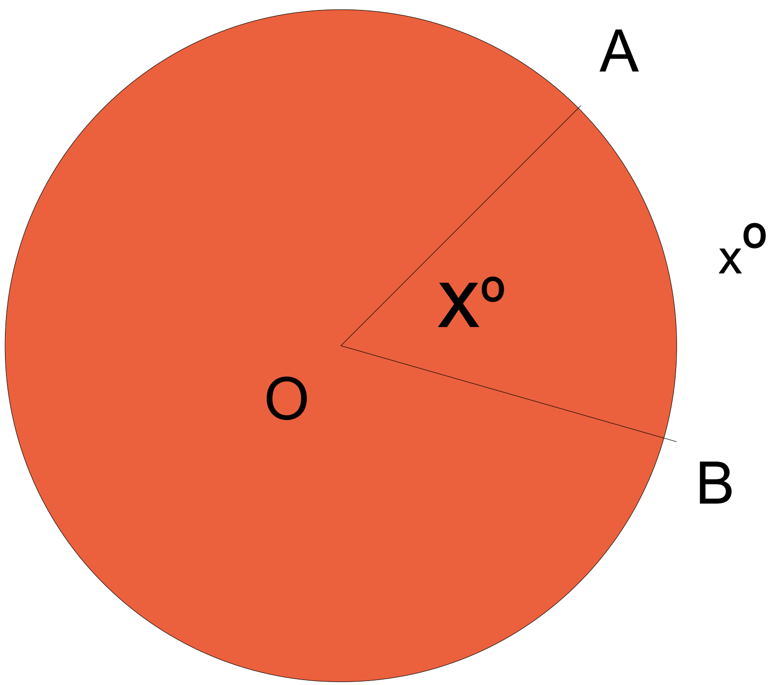
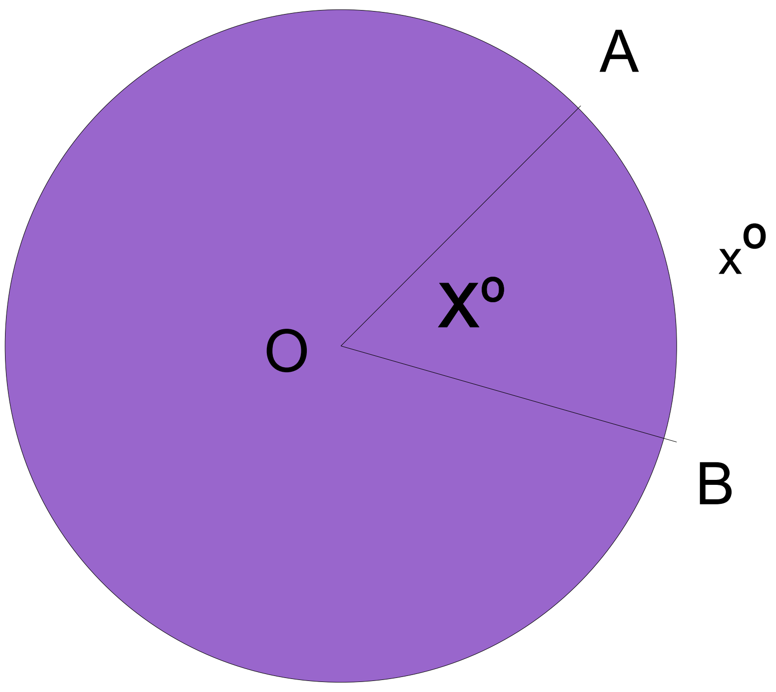
Arc of a circle

- Degree measure of a complete circle is 360º
- The degree measure of an arc AB = x^o



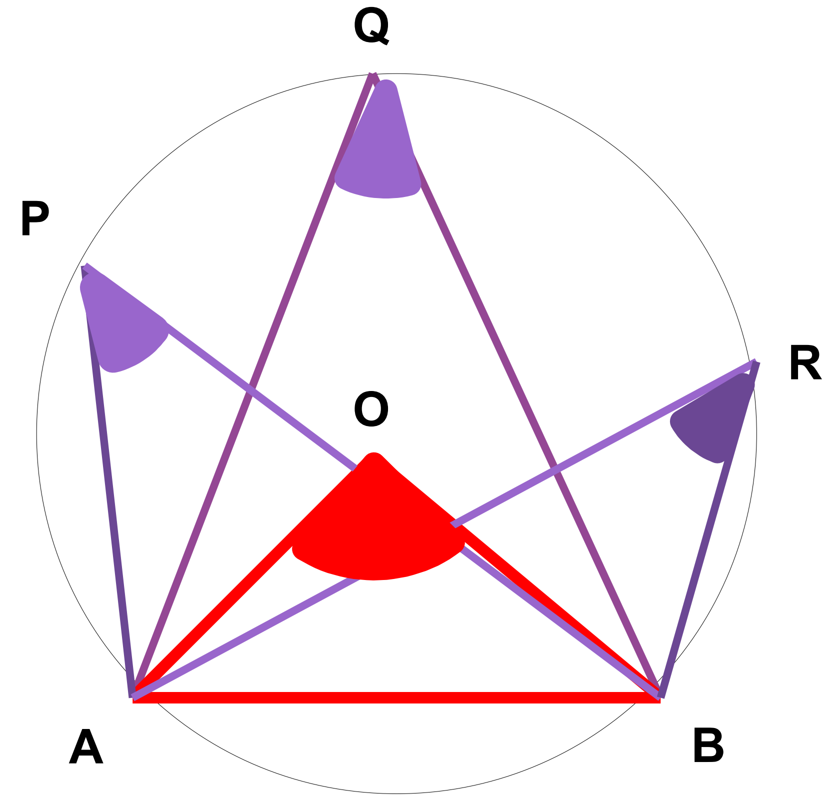
Arcs on a circle

- Length of a Arc AB / Circumference = $x^o/360^o$
- Area of a sector AOB / Area of the Circle = $x^o/360^o$



Angle Properties

- The angle subtended by a chord at the centre of the circle is twice the angle subtended by the Chord AB on the circle.
- Note that the angles (in violet) on the arc AQB are all equal angles
- If ∟AOB = 2x^o, then ∟APB = x^o; ∟AQB = x^o; ∟ARB = x^o



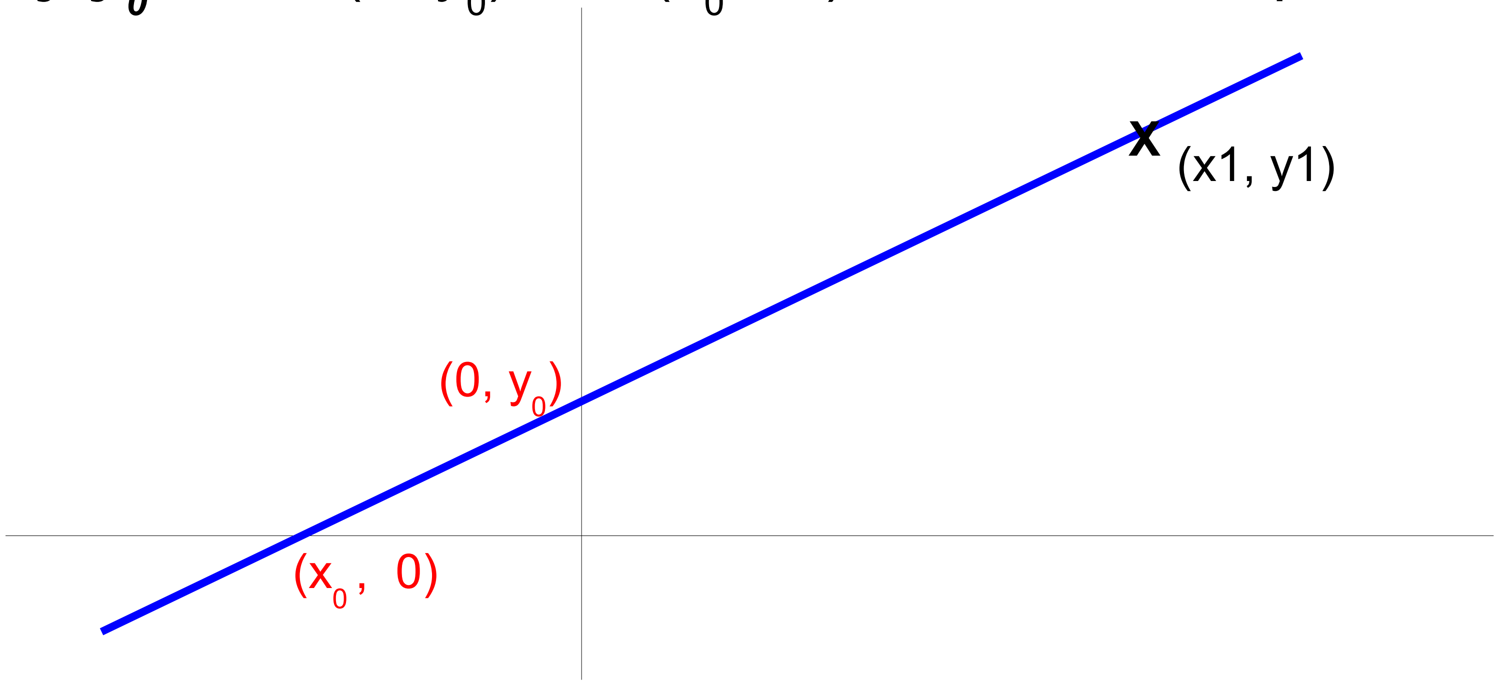
Coordinate Geometry

- The distance, d, between two given points, A(x1, y1) and B(x2, y2), can be calculated using the distance formula, $\boldsymbol{d = \sqrt{(x2-x1)^2 + (y2-y1)^2}}$
- Vertical lines do not have slopes
- Slope of any horizontal line is 0
- Slope of a line when two points are given is

$\boldsymbol{m = (y2-y1)/(x2-x1)}$

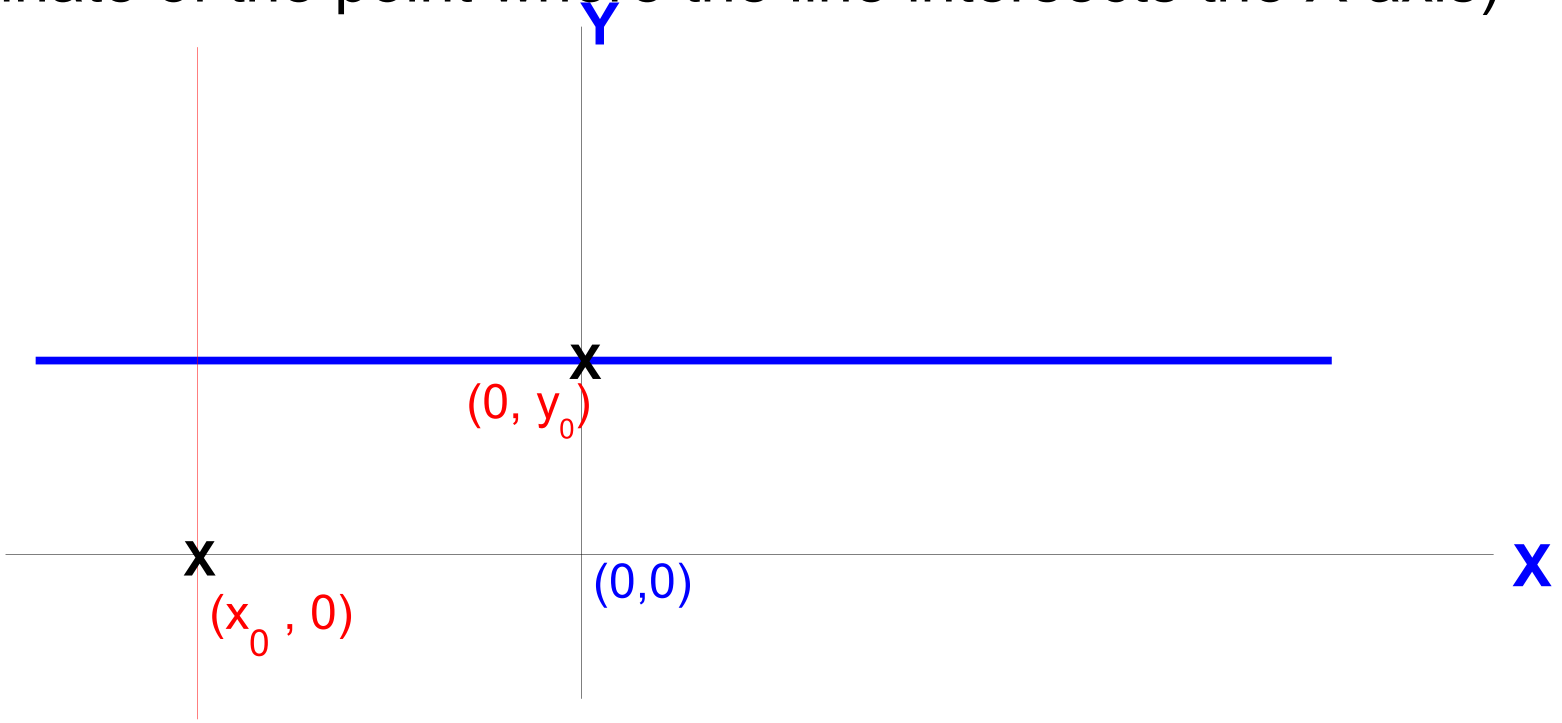
Equation of a line

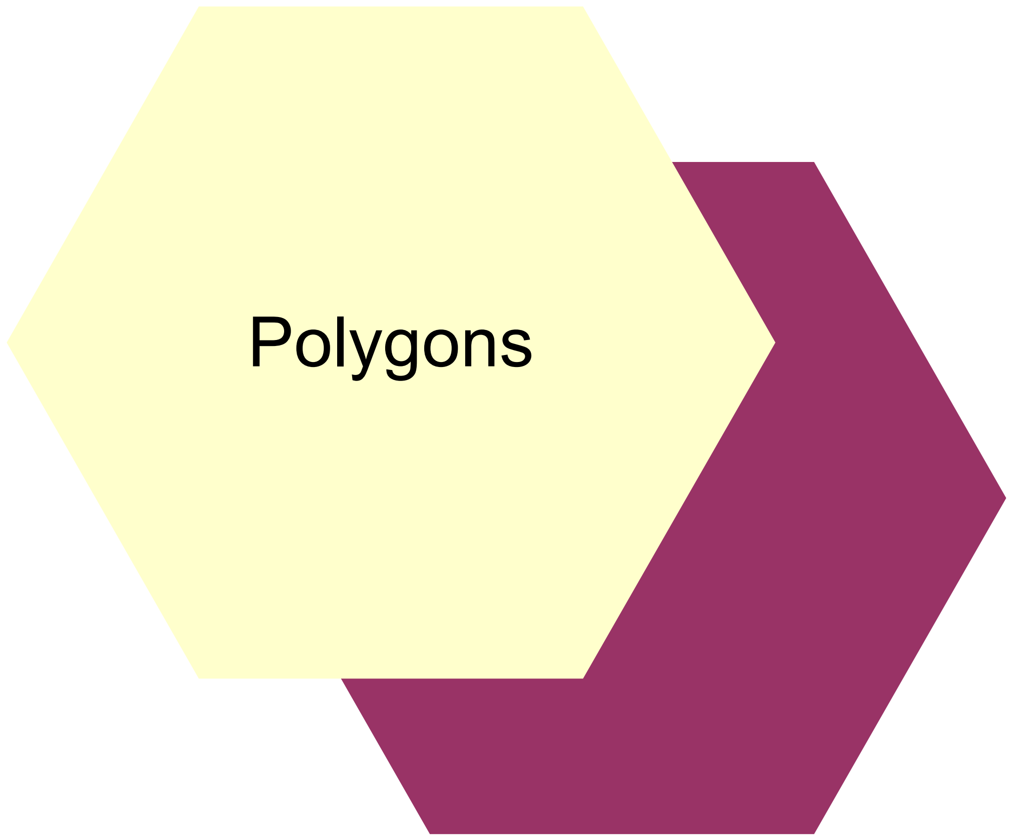
- Equation of line: $\boldsymbol{y = mx + b}$
- $\boldsymbol{(y - y1) / (x - x1) = m}$, if (x1,y1) is a point on the line
- $\boldsymbol{x/x_0 + y/y_0 = 1}$, if $(0, y_0)$ and $(x_0, 0)$ are the intercepts



Equation of a line

- Equation of a line parallel to X axis is : $y = y_0$(where y_0 is the Y co-ordinate of the point where the line intersects the Y axis)
- Equation of a line parallel to Y axis is : $x = x_0$ (where x_0 is the X co-ordinate of the point where the line intersects the X axis)




Polygons

Polygon types

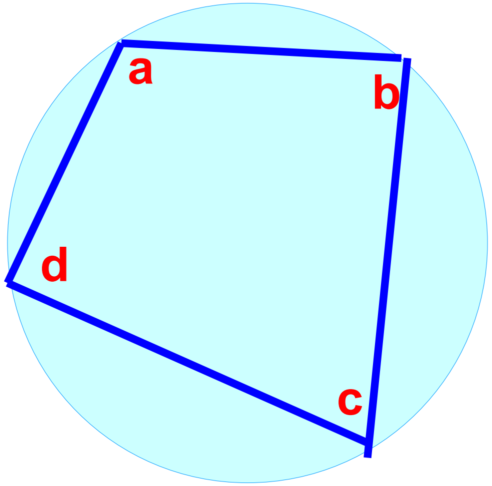
Name	Number of Sides
Triangle	٣
Quadrilateral	٤
Pentagon	٥
Hexagon	٦
Heptagon	٧
Octagon	٨
Nanogon	٩
Decagon	١٠

Cyclic Polygon

- A convex Polygon is called a Cyclic Polygon, if all the vertices lie on a single circle
- Sum of opposite angles of a *Cyclic Quadrilateral* is 180º

a + c = 180

b + d = 180



– A Regular polygon is a Cyclic Polygon whose sides are of Equal length

Formulae related to Polygons

- Sum of Interior Angles of a N sided Polygon =

  $$(N - 2) \times 180^o$$

- The interior angles of a Regular Polygon are equal to each other. The measure of an interior angle of a regular Polygon =

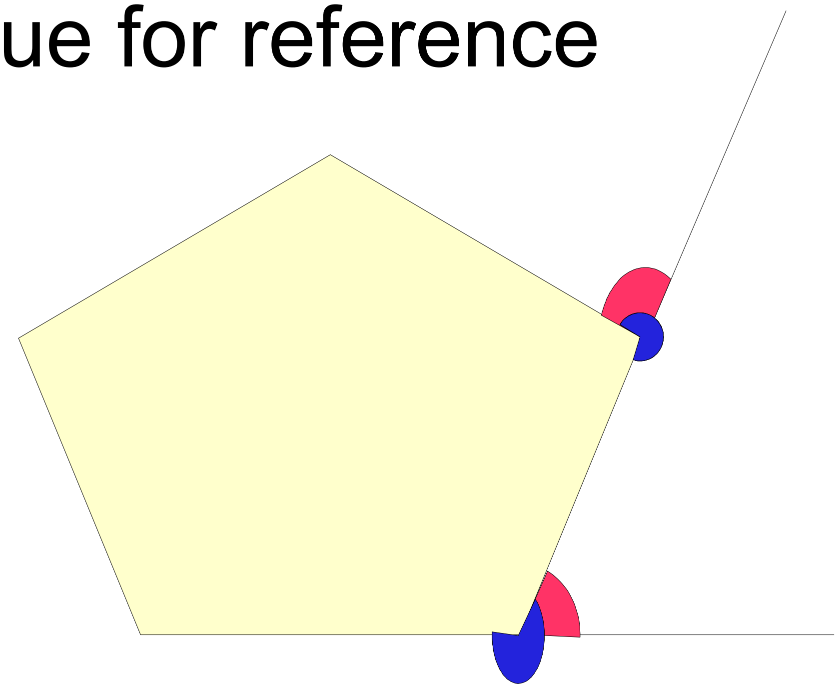
  $$(N - 2) \times 180^o \ / \ N$$

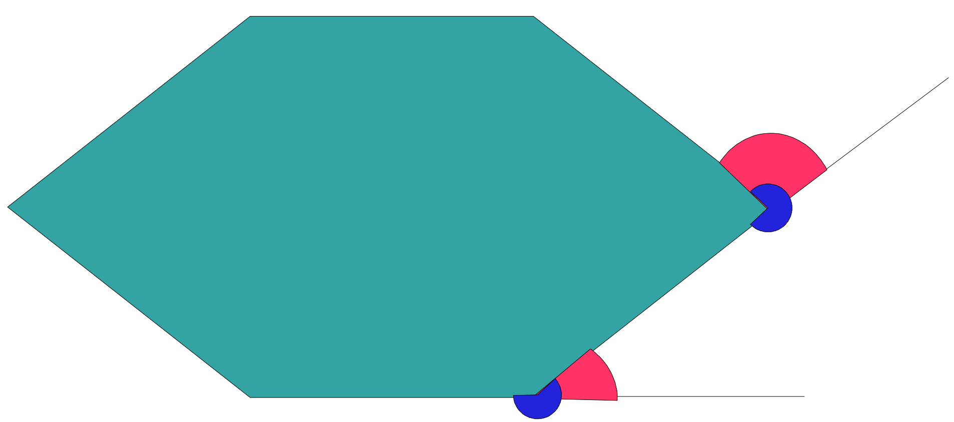
- Number of Diagonals of a N sides polygon =

  $$N \times (N-3) / 2$$

Angles

- Sum of External Angles of a N sided Polygon =
  (n+2) * 180º
- The measure of each Exterior Angle is ***360º / N***
- The External angle is different and marked in blue for reference





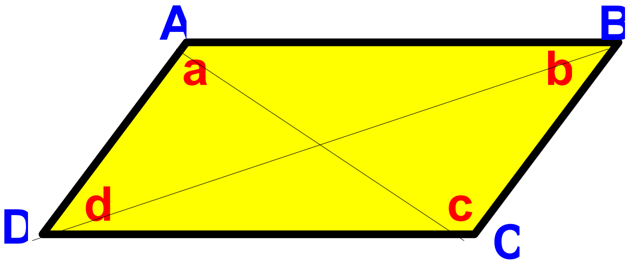
Parallelogram

- AB = DC   and AD = BC
- a = c , b = d
- a + b = 180º

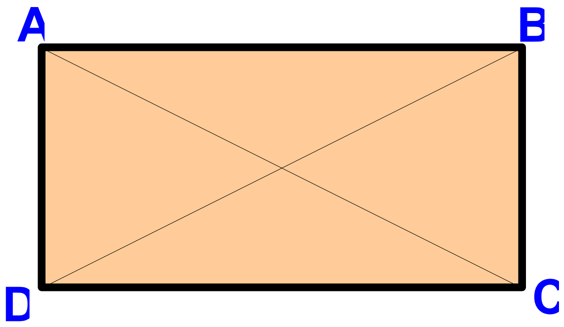
  c + d = 180º

  b+c = 180º & a+d = 180º

- Diagonals AC and BD bisect each other
- A diagonal divides the parallelogram into two Congruent triangles



Rectangle

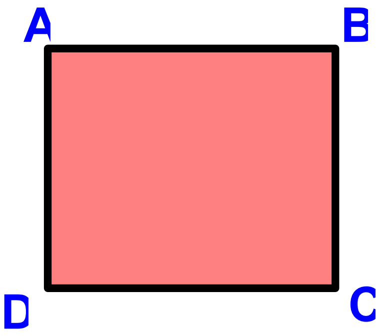


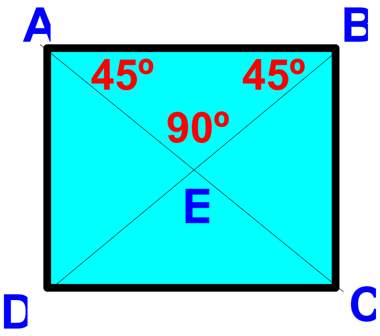
- AB = DC and AD = BC
- Angles a = c = b = d = 90º
- Diagonals AC and BD

  bisect each other
- The diagonals of a rectangle have the same length, AC = BD

Square

- AB = DC = AD = BC
- a = c = b = d = 90º
- Diagonals AC and BD bisect each other at right angles and are perpendicular to each other
- AEB, BEC, CED, DEA are 45º–45º–90º triangles

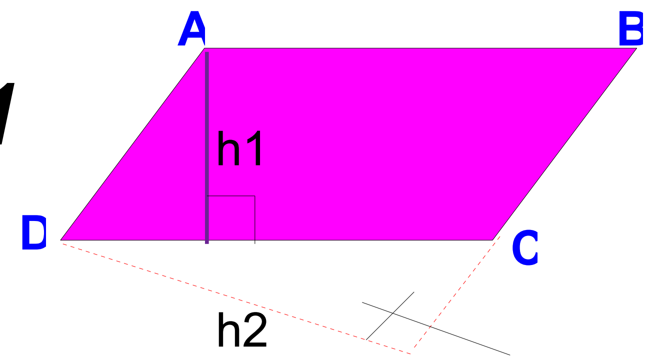




Area

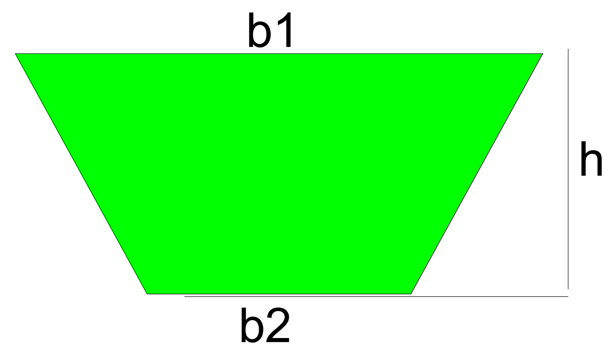
- Parallelogram : ***DC x h1***

  = BC x h2



- Rectangle : ***length x breadth***
- Square : $\boldsymbol{(side)^2 = (diagonal)^2 / 2}$
- Trapezium :

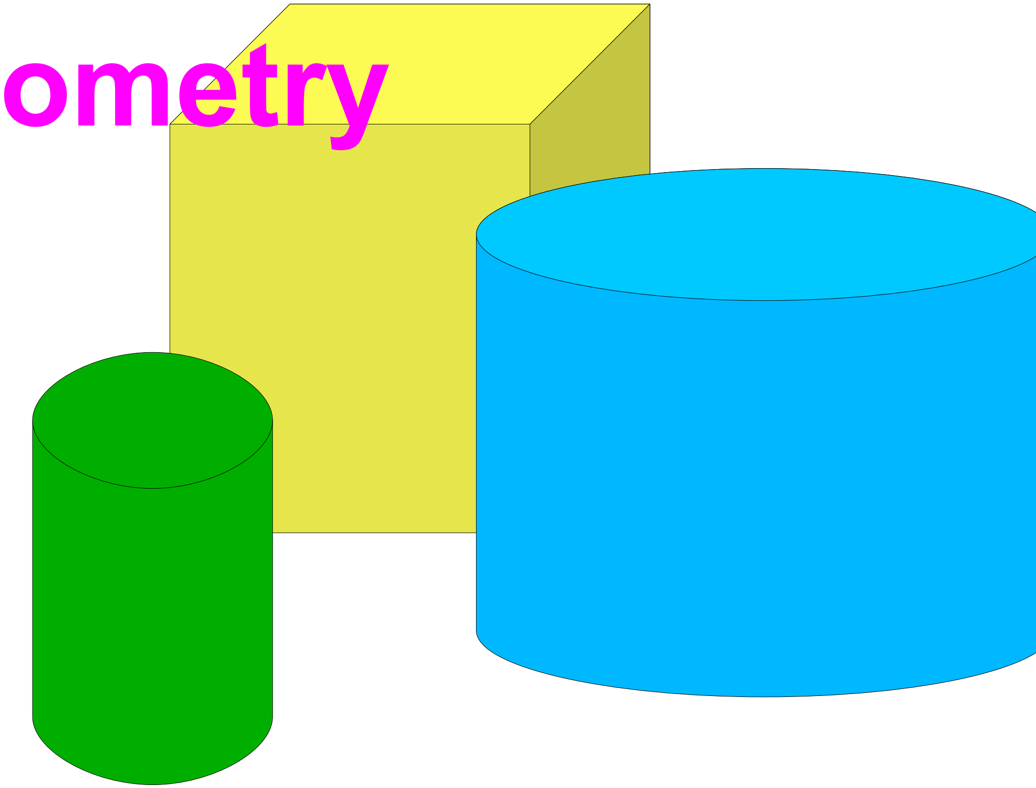
  (½) (b1 + b2) x h



Some points to remember

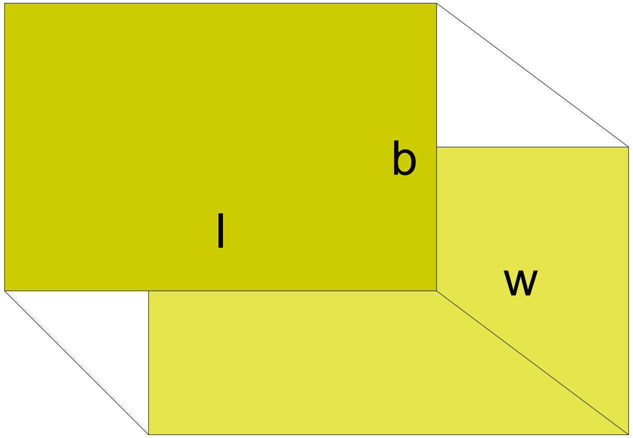
- For a given Perimeter, the rectangle with the largest area is a square.
- For a given area , the rectangle with the smallest perimeter is a square

Solid Geometry



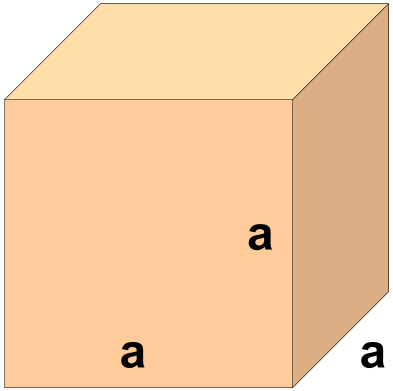
Cuboid

- The volume of a rectangular solid (cuboid), is ***V= l.w.h***
- The surface area of a cuboid is A = ***2(lw + lh + wh)***



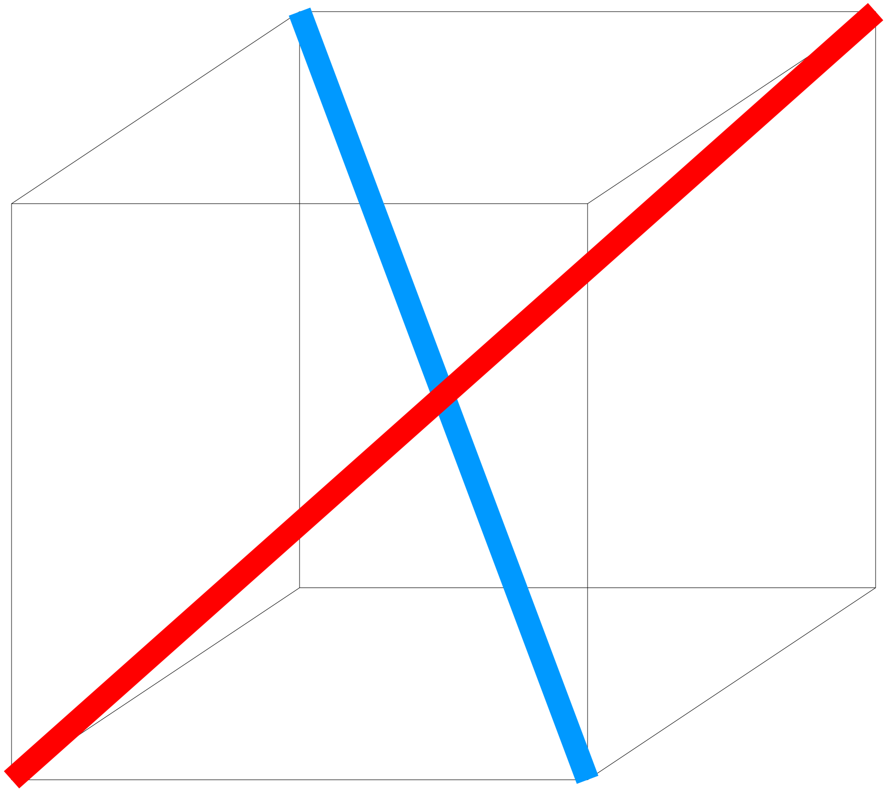
Cube

- The volume of the cube is $V = a.a.a = a^3$
- The surface area is $A = 6.a^2$



Diagonal

- A diagonal,*d*,of a box is the longest line segment that can be drawn between two points on the box, $d^2 = l^2 + w^2 + h^2$



Cylinder

- The Volume of a Cylinder, V whose circular base has radius r and height h is $\boldsymbol{V = \pi r^2 h}$
- The surface area, A, of the cylinder is $\boldsymbol{A = 2\pi rh}$