

Geometry

Facts

Contents

Lines

Identifying Lines 2
Types of lines 3

Angles

Identifying Angles 4
Types of angles 6

Lines and Angles

Angles of a straight line 8
Angles around a point 9
Angles and intersecting lines 10
Angles and parallel lines 11

Polygons

Defining polygons 13
Triangles 14
Angles of a triangle 17
Quadrilaterals 18
Angles of a quadrilateral 20
Other polygons 21
Angles of polygons 22

Circles

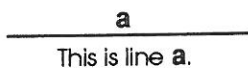
Lines in circles 23
Angles in Circles 25
Circles and tangents 27

Index inside back cover

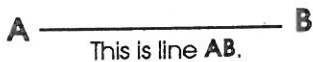
Identifying Lines

A line can be identified

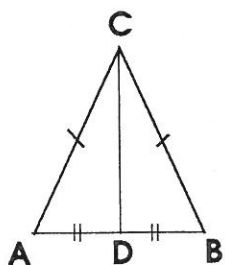
by a letter. . .



or by two letters.



Lines of equal length can be identified by marking them with the same symbol.



AC is of equal length to CB.

$$AC = CB$$

AD is of equal length to DB.

$$AD = DB$$

Types of Lines

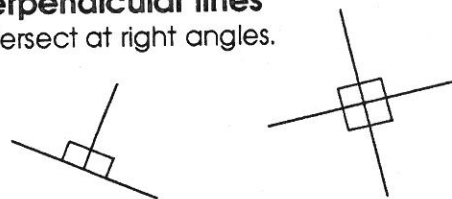
Horizontal and vertical lines

Horizontal line

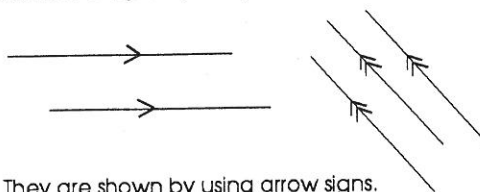
Vertical line

Perpendicular lines

intersect at right angles.



Parallel lines are always the same distance apart, they never meet.

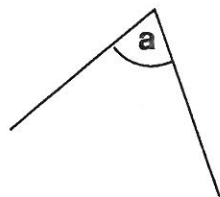


They are shown by using arrow signs.

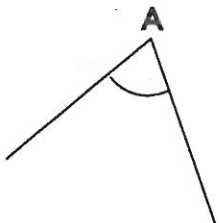
Identifying Angles

Angles can be identified in different ways...

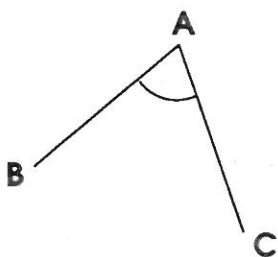
this is angle **a**
 $\angle a$



this is angle **A**
 $\angle A$



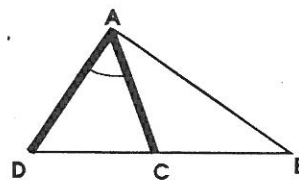
this is angle **BAC**
 $\angle BAC$
 or angle **CAB**
 $\angle CAB$



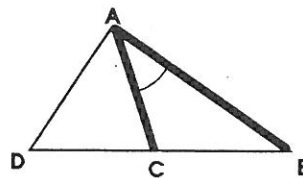
4

In this diagram...

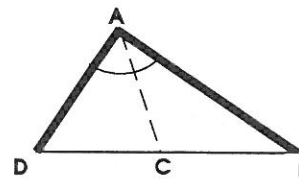
this is $\angle DAC$
 or $\angle CAD$.



this is $\angle CAB$
 or $\angle BAC$.



this is $\angle DAB$
 or $\angle BAD$.

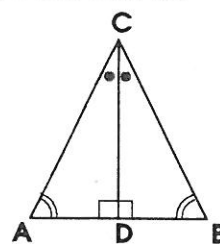


Angles of equal size can be identified by marking them with the same symbol.

$$\angle DAC = \angle DBC$$

$$\angle ACD = \angle BCD$$

$$\angle CDA = \angle CDB$$



5

Types of Angle

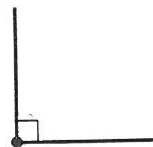
Acute angle

A turn of more than 0° but less than 90° .



Right-angle

A turn of 90° .



Obtuse angle

A turn of more than 90° but less than 180° .



6

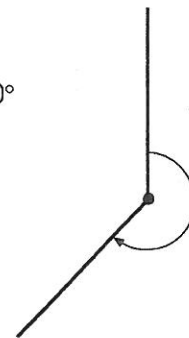
Straight line

A turn of 180° .



Reflex angle

A turn of more than 180° but less than 360° .



Complete turn

A turn of 360° .

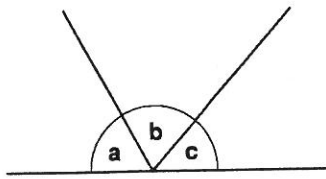


7

Angles on a straight line

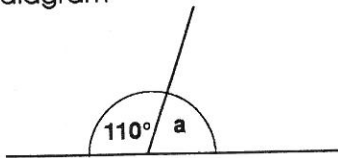
Angles on a straight line

add up to 180° .



Angles $a + b + c = 180^\circ$

In this diagram



$$110^\circ + a = 180^\circ$$

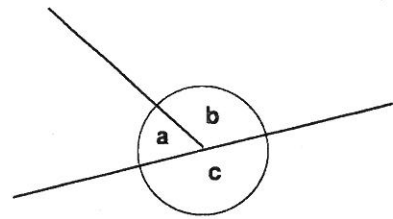
$$a = 70^\circ$$

because $110^\circ + 70^\circ = 180^\circ$.

Angles around a point

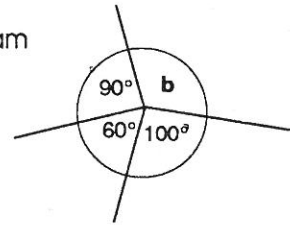
Angles around a point

add up to 360° .



Angles $a + b + c = 360^\circ$

In this diagram



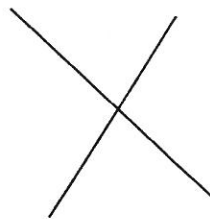
$$90^\circ + 60^\circ + 100^\circ + b = 360^\circ$$

$$b = 110^\circ$$

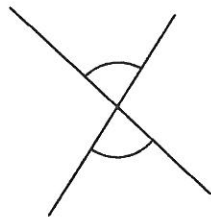
because $90^\circ + 60^\circ + 100^\circ + 110^\circ = 360^\circ$.

Angles and intersecting lines

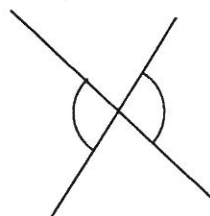
When two lines intersect **vertically opposite angles** are equal.



These angles are equal ...

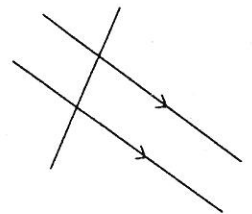


and so are these.

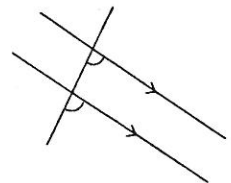


Angles and parallel lines

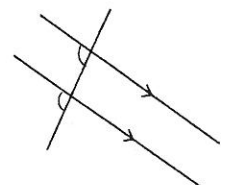
When a line intersects parallel lines **corresponding angles** are equal.



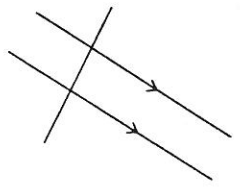
These angles are equal ...



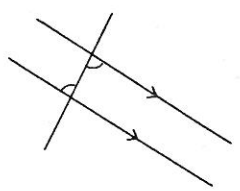
and so are these.



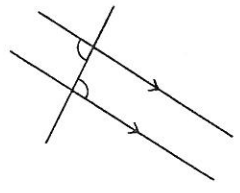
When a line intersects parallel lines **alternate angles** are equal.



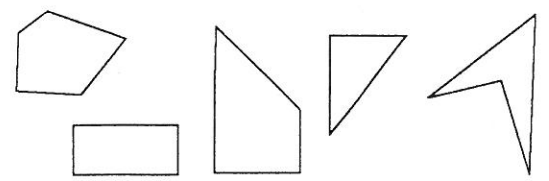
These angles are equal . . .



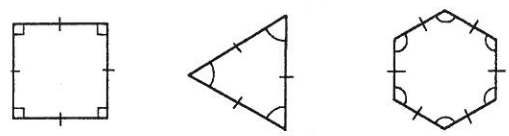
and so are these.



A **polygon** is a closed shape with three or more straight lines.



A **regular polygon** is a polygon with equal sides and equal angles.

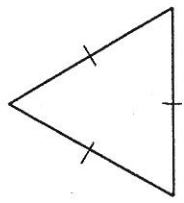


Triangles

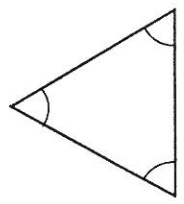
Triangles are polygons with three straight sides.

An **equilateral triangle** . . .

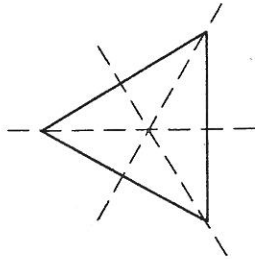
has three equal sides. . .



three equal angles. . .

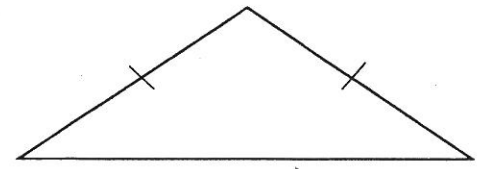


three lines of symmetry.

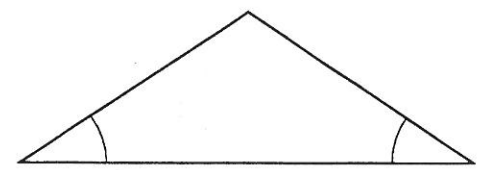


An **isosceles triangle** . . .

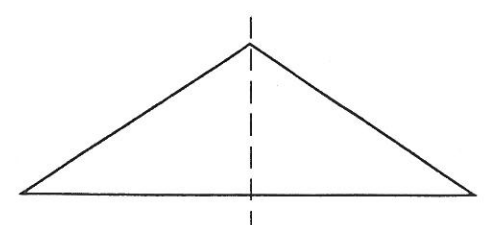
has two equal sides. . .



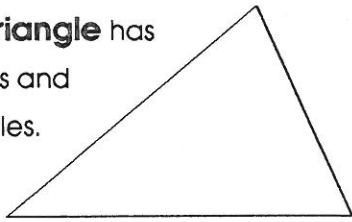
two equal angles. . .



one line of symmetry.

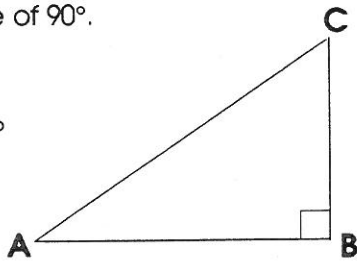


A **scalene triangle** has no equal sides and no equal angles.

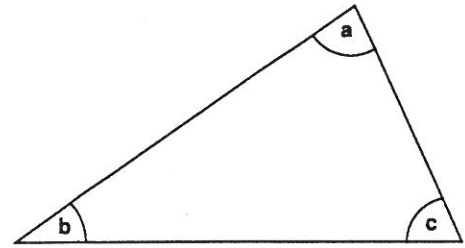


A **right-angled triangle** has one angle of 90° .

$\angle ABC = 90^\circ$

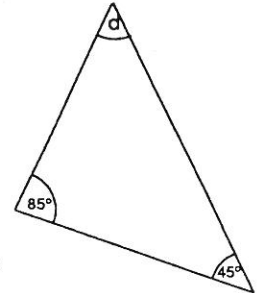


Interior angles of a triangle



Angles $a + b + c = 180^\circ$

In this diagram



$85^\circ + 45^\circ + d = 180^\circ$

$d = 50^\circ$

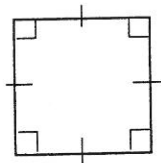
because $85^\circ + 45^\circ + 50^\circ = 180^\circ$

For *exterior angles of a triangle* see page 22.

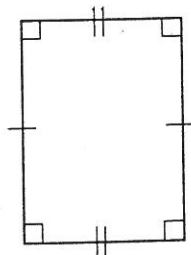
Quadrilaterals

Quadrilaterals are polygons with four straight sides.

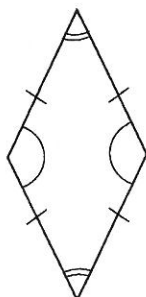
A **square** has ...
four equal sides
four equal angles
opposite sides parallel
four lines of symmetry.



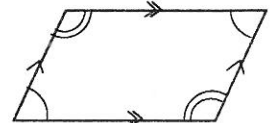
A **rectangle** has ...
opposite sides equal
four equal angles
opposite sides parallel
two lines of symmetry.



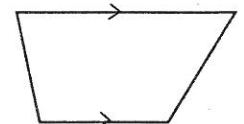
A **rhombus** has ...
four equal sides
opposite angles equal
opposite sides parallel
two lines of symmetry.



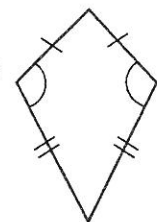
A **parallelogram** has ...
opposite sides equal
opposite angles equal
opposite sides parallel
no lines of symmetry.



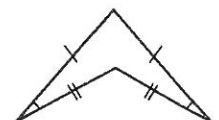
A **trapezium** has ...
one pair of parallel sides
no lines of symmetry.



A **kite** has ...
two pairs of adjacent equal sides
one pair of equal angles
one line of symmetry.

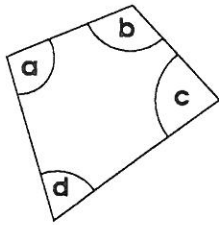


An **arrowhead** has ...
two pairs of adjacent equal sides
one reflex angle
two equal angles
one line of symmetry.



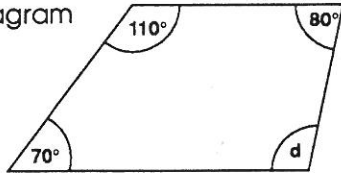
Angles of a quadrilateral

Interior angles of a quadrilateral add up to 360° .



Angles $a + b + c + d = 360^\circ$

In this diagram



$80^\circ + 110^\circ + 70^\circ + d = 360^\circ$
 $d = 100^\circ$

because $80^\circ + 110^\circ + 70^\circ + 100^\circ = 360^\circ$

For exterior angles of a quadrilateral see page 22.

Other polygons

A five sided polygon is a **pentagon**.



A six sided polygon is a **hexagon**.



A seven sided polygon is a **heptagon**.



An eight sided polygon is an **octagon**.



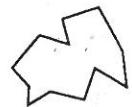
A nine sided polygon is a **nonagon**.



A ten sided polygon is a **decagon**.

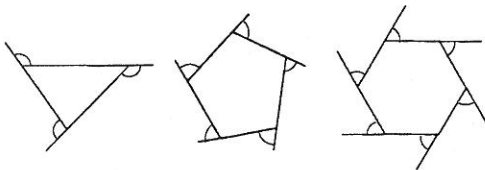


A twelve sided polygon is a **dodecagon**.



Angles of polygons

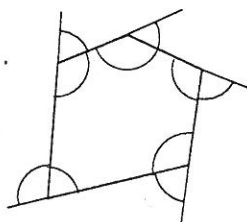
The **exterior angles** of all polygons add up to 360° .



The sum of the **interior angles** of a polygon is

$(\text{Number of sides} \times 180) - \text{sum of the exterior angles}$

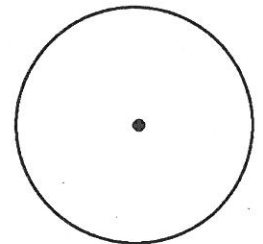
For a pentagon...



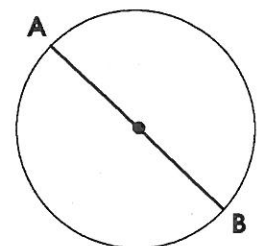
the sum of the interior angles is
 $(5 \times 180^\circ) - 360^\circ = 540^\circ$.

Lines in circles

The **circumference** is the perimeter of a circle.



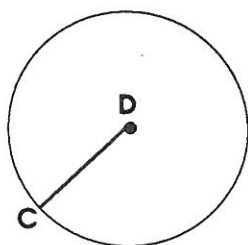
A **diameter** is any straight line that joins two points of the circle and passes through the centre.



AB is a diameter.

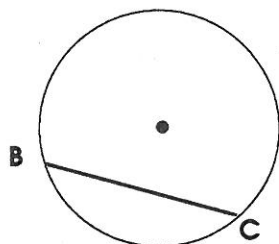
A **radius** is the distance from the centre to a point on the circle.

CD is a radius.



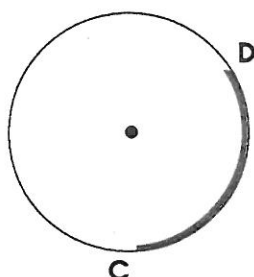
A **chord** is a line joining any 2 points on a circle.

BC is a chord.



An **arc** is part of the circumference of a circle.

CD is an arc.

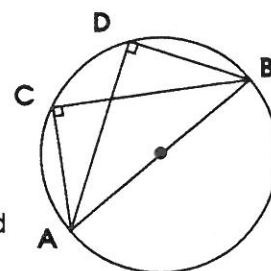


The angle at any point of the circumference standing on a diameter is 90° .

AB is the diameter.

$\angle ACB$ and $\angle ADB$ stand on the diameter.

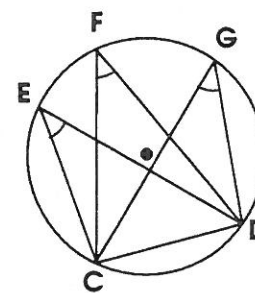
$\angle ACB = \angle ADB = 90^\circ$



The angles at any point of the circumference standing on the same arc are equal.

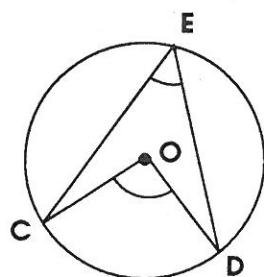
$\angle CED$, $\angle CFD$ and $\angle CGD$ stand on arc **CD**.

$\angle CED = \angle CFD = \angle CGD$



The angle at the centre is twice the angle at any point on the circumference standing on the same arc.

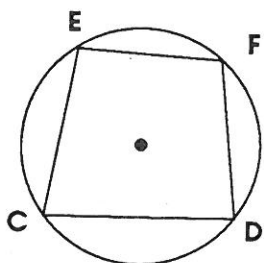
$\angle COD = 2\angle CED$



The sum of opposite angles of a cyclic quadrilateral is 180° .

$\angle ECD + \angle EFD = 180^\circ$

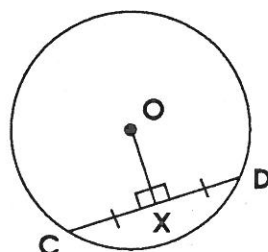
$\angle CEF + \angle CDF = 180^\circ$



The line drawn from the centre of a circle to the midpoint of a chord is perpendicular to the chord.

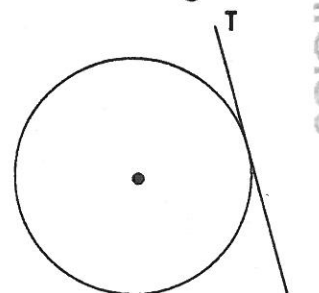
$CX = XD$

$\angle OXC = \angle OXD = 90^\circ$



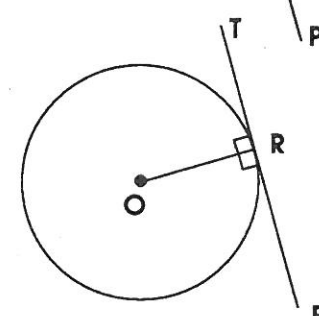
A **tangent** is a straight line which touches the circumference of a circle at one point only.

TP is a tangent.



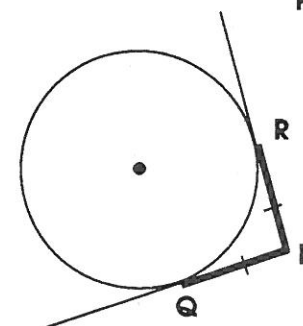
The radius to the point of contact is perpendicular to the tangent.

$\angle ORT = \angle ORP = 90^\circ$

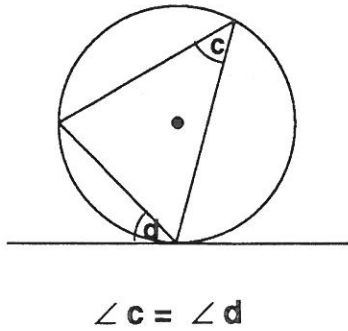
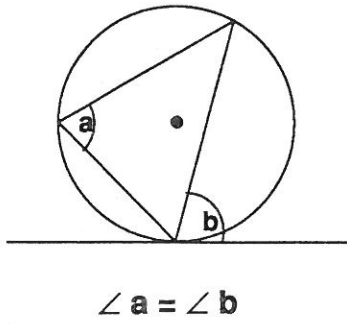


Two tangents are drawn from the same point outside a circle. **R** and **Q** are the points of contact.

$PR = PQ$



The angle between a tangent and a chord is equal to any angle made by that chord in the alternate segment of the circle.



Index

	Page		Page
Acute angle	6	Lines and angles	8
Alternate angles	12	intersecting lines	10
Angles	4	parallel lines	11, 12
alternate	12	straight lines	8
corresponding	11	Nonagon	21
equal angles	5	Obtuse angle	6
identifying	4	Octagon	21
in circles	25	Parallel lines	3, 11
interior	17	Parallelogram	19
intersecting lines	10	Pentagon	21
on a straight line	8	Perpendicular lines	3, 26
quadrilateral	20	Polygons	13-
round a point	9	identifying	21
triangles	17	interior angles	22
types of	6	exterior angles	22
vertically opposite	10-	regular	13
Arc	24	Quadrilaterals	18
Arrowhead	19	angles of	20
Chord	24	radius	24
Circles	23	Rectangle	18
angles of	25	Reflex angle	7
and tangents	27	Regular polygons	13
Circumference	23	Rhombus	18
Complete turn	7	Right angle	6
Corresponding angles	11	Scalene triangle	16
Cyclic quadrilateral	26	Square	18
Decagon	21	Straight line	7
Diameter	23	angles on	8
Dodecagon	21	Tangents	27
Equilateral triangle	14	Trapezium	19
Exterior angles	22	Triangles	14
Heptagon	21	angles of	17
Hexagon	21	equilateral	14
Horizontal	3	isosceles	15
Interior angles	17, 20, 22	right angled	16
Isosceles triangle	15	scalene	16
Kite	19	Vertical	3
Lines	2	Vertically opposite angles	10
equal length	2		
identifying	2		
types	3		