SYMBOLS

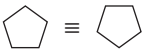
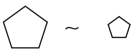
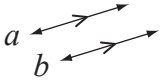
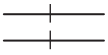
Number

$+$	plus or add
$-$	minus or subtract
$\times$	multiplied by, times, lots of
$\div$	divided by, into groups of
$=$	equals, is equal to
$\neq$	is not equal to
$\approx$	is approximately equal to
$<$	is less than, $4 < 6$
$>$	is greater than, $8 > 5$
$\leq$	is less than or equal to
$\geq$	is greater than or equal to
$( )$	brackets, a grouping symbol
$\%$	percent, $12\% = \frac{12}{100}$
$\cdot$	decimal point as in 7.9
-3	negative 3
6^3	6 raised to the 3rd power, $6 \times 6 \times 6$
$\sqrt{9}$	square root of 9
$\frac{4}{7}$	fraction, $4 \div 7$, four sevenths
$a:b$ or $\frac{a}{b}$	ratio of a to b
$2.\dot{4}$	recurring decimal
$2.\dot{1}\dot{3}$	recurring decimal

Algebra

$3x$	3 times x, 3 lots of x, $3 \times x$, $3(x)$
x^2	x raised to the 2nd power, $x \times x$
$-x$	opposite of x
$\frac{1}{x}$	reciprocal of x
(x,y)	coordinates in a Cartesian plane
m	gradient of a linear graph
c	y-intercept of a linear graph

Geometry

π (pi)	≈ 3.14 or $\frac{22}{7}$ ratio of the circumference to the diameter of a circle
$^\circ$	degree (a right angle measures 90°)
$\equiv$	is congruent to, 
$\sim$	is similar to, 
$\parallel$	is parallel to
$\perp$	is perpendicular to
ΔABC	triangle with vertices A, B and C
	right angle
$\overleftrightarrow{AD}$	line AD
$\overline{BC}$	segment BC
	parallel lines (line a is parallel to line b)
	congruent segments
	equal angles
	equal side lengths

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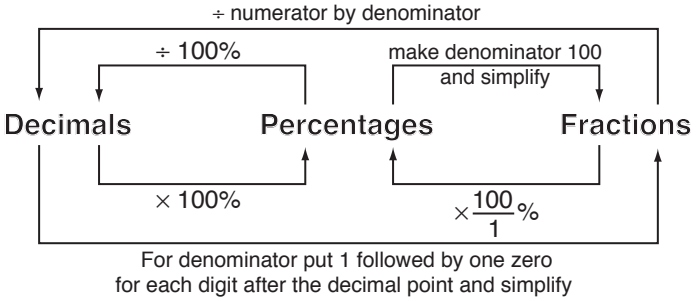
NUMBER FACTS (1)

Place value

millions	*hundreds of thousands*	*tens of thousands*	*thousands*	*hundreds*	*tens*	*units*	*decimal point*	*tenths*	*hundredths*	*thousandths*
1 000 000	*100 000*	*10 000*	*1000*	*100*	*10*	*1*		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Decimals / Fractions / Percentages



Fraction	Decimal	Percentage
$\frac{1}{1}$	1	100%
$\frac{1}{2}$	0.5	50%
$\frac{1}{3}$	$0.\dot{3}$	33.33%
$\frac{2}{3}$	$0.\dot{6}$	66.66%
$\frac{1}{4}$	0.25	25%
$\frac{3}{4}$	0.75	75%
$\frac{1}{5}$	0.2	20%
$\frac{2}{5}$	0.4	40%
$\frac{3}{5}$	0.6	60%
$\frac{4}{5}$	0.8	80%
$\frac{1}{8}$	0.125	12.5%
$\frac{1}{9}$	$0.\dot{1}$	11.11%

0

Subtraction $a - 0 = a$

Multiplication $a \times 0 = 0$ and $0 \times a = 0$

Division $0 \div a = 0$

1

Multiplication $a \times 1 = a$ and $1 \times a = a$

Division $a \div 1 = a$

Prime numbers < 100

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97

Perfect squares of numbers 0 to 30

0, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400, 441, 484, 529, 576, 625, 676, 729, 784, 841 and 900

NUMBER FACTS (2)

Real Numbers $\mathbb{R}$

IRRATIONAL
π, φ, e, $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$,
2.6293045632....
cos 30°

$\mathbb{Q}$
RATIONAL
$-2\frac{3}{7}$, 3.010101..., $\frac{4}{10}$, 0.56, $\sqrt{\frac{4}{9}}$

$\mathbb{Z}$
Integers
..., –3, –2, –1, 0, 1, 2, 3, ...

$\mathbb{N}$
Natural (Whole Numbers)
0, 1, 2, 3, 4, 5, 6, ...

Operation terminology

Addition: sum, altogether, in total, more than
Subtraction: difference, less than, change
Multiplication: product, times, lots of
Division: a fraction (half, third, quarter) of, quotient

Order of Operations

The order of doing operations is:
1) Simplify inside all brackets.
2) Evaluate powers and square roots.
3) Calculate × and ÷ from left to right.
4) Calculate + and – from left to right.

Sign Rules

$+ + = +$
$- - = +$
$+ - = -$
$- + = -$

Rates and Proportions

$$a : b = \frac{a}{b}$$
$$a : b = c : d$$
$$\frac{a}{b} \times \frac{c}{d}$$
$$a \times d = b \times c$$
$$ad = bc$$

Applied number - money

$$\text{Percentage} = \text{Fraction} \times \frac{100}{1}\,\%$$
$$\frac{P}{100} = P\%$$

$$\text{Commission} = \% \times \text{Selling price}$$

$$\text{Simple Interest} = \text{Principal} \times \text{rate} \times \text{time}$$
$$SI = PRT$$

$$\text{Percentage change} = \frac{\text{amount of change}}{\text{original amount}} \times \frac{100}{1}\,\%$$

Applied number - distance

Distance (d) = average speed (v) × time taken (t)

$$d = vt$$
$$v = \frac{d}{t}$$
$$t = \frac{d}{v}$$

Applied number - rates

$$\text{Rate } (r) = \frac{\text{amount } (a)}{\text{time } (t)}$$
$$r = \frac{a}{t}$$
$$a = rt$$
$$t = \frac{a}{r}$$

ALGEBRA FACTS

Identity Properties

Addition	$a + 0 = a$	and	$0 + a = a$
Multiplication	$a \times 1 = a$	and	$1 \times a = a$

Associative Properties

Addition	$(a + b) + c = a + (b + c)$
Multiplication	$(a \times b) \times c = a \times (b \times c)$

Commutative Properties

Addition	$a + b = b + a$
Multiplication	$a \times b = b \times a$

Distributive Properties

$a(b + c) = ab + ac$

$a(b - c) = ab - ac$

Perfect square rules

$(a + b)^2 = a^2 + 2ab + b^2$

$(a - b)^2 = a^2 - 2ab + b^2$

Difference of two squares rule

$a^2 - b^2 = (a + b)(a - b)$

Inverse number rules

Addition	$a + -a = 0$	and	$-a + a = 0$
Multiplication	$a \times \frac{1}{a} = 1$	and	$\frac{1}{a} \times a = 1$

Index Laws

$a^0 = 1$	Zero exponent
$a^{-n} = \frac{1}{a^n}$	Negative exponent
$a^m \times a^n = a^{m+n}$	Product of powers
$\frac{a^m}{a^n} = a^{m-n}$	Quotient of powers
$(a^m)^n = a^{mn}$	Power to power
$(ab)^n = a^n b^n$	Product to power
$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	Quotient to power

Square root rules

$\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$

$\sqrt{a} \times \sqrt{a} = \sqrt{a \times a} = a$

$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

$\frac{\sqrt{a}}{\sqrt{a}} = \sqrt{\frac{a}{a}} = 1$

Properties of Equality

Addition	$a = b$ $a + c = b + c$
Subtraction	$a = b$ $a - c = b - c$
Multiplication	$a = b$ $ac = bc$
Division	$a = b$ $\frac{a}{c} = \frac{b}{c}$, $c \neq 0$

Inverse operation rules

Operation +	Inverse Operation −	Operation −	Inverse Operation +	Operation ×	Inverse Operation ÷	Operation ÷	Inverse Operation ×
$x + 3 = 6$		$x - 3 = 6$		$3x = 6$		$\frac{x}{3} = 6$	
$x + 3 - 3 = 6 - 3$		$x - 3 + 3 = 6 + 3$		$\frac{3x}{3} = \frac{6}{3}$		$\frac{x}{3} \times 3 = 6 \times 3$	
$x = 3$		$x = 9$		$x = 2$		$x = 18$	

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MEASUREMENT FACTS (1)

CONVERSIONS

Length

10 millimetres (mm) = 1 centimetre (cm)

100 cm = 1000 mm = 1 metre (m)

1000 m = 1 kilometre (km)

Area

100 square mm (mm^2) = 1 square cm (cm^2)

10 000 cm^2 = 1 square metre (m^2)

10 000 m^2 = 1 hectare (ha)

1 000 000 m^2 = 1 square km (km^2)

Liquid Capacity

1000 millilitres (mL) = 1 litre (L)

1000 000 L = 1 megalitre (ML)

1000 cubic cm (cm^3) = 1 L

1000 L = 1 cubic metre (m^3)

Volume

1000 cubic mm (mm^3) = 1 cubic cm (cm^3)

1 000 000 cm^3 = 1 cubic metre (m^3)

Time

60 seconds (s) = 1 minute (min)

60 minutes (min) = 1 hour (h)

24 hours (h) = 1 day

7 days = 1 week

2 weeks = 1 fortnight

4 weeks (approx.) = 1 month

365 = 52 weeks (approx.) = 12 months = 1 year

366 days = 1 leap year

10 years = 1 decade

100 years = 1 century

Temperature - degrees Celsius (°C)

0°C = freezing point of water

100°C = boiling point of water

37°C = human body temperature

Mass

1000 milligrams (mg) = 1 gram (g)

1000 g = 1 kilogram (kg)

1000 kg = 1 tonne (t)

METRIC PREFIXES

giga (G) = 1 billion = 1 000 000 000

mega (M) = 1 million = 1 000 000

kilo (k) = 1 thousand = 1000

hecto (h) = 1 hundred = 100

deca (da) = 1 ten = 10

micro (μ) = 1 millionth = $\frac{1}{1\,000\,000}$

milli (m) = 1 thousandth = $\frac{1}{1000}$

centi (c) = 1 hundredth = $\frac{1}{100}$

deci (d) = 1 tenth = $\frac{1}{10}$

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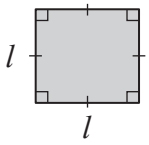
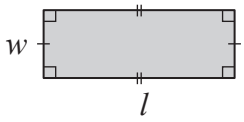
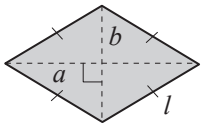
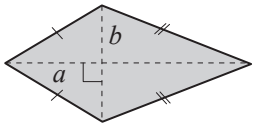
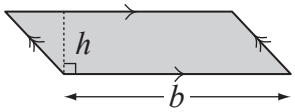
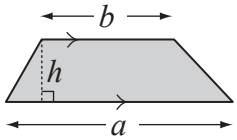
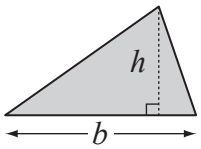
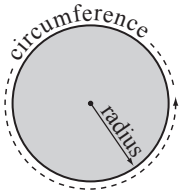
MEASUREMENT FACTS (2)

2D shapes - Formulae

Name	Shape	Perimeter	Area
Square		$P = 4 \times l$ $= 4l$	$A = l \times l$ $= l^2$
Rectangle		$P = 2l + 2w$ $= 2(l + w)$	$A = l \times w$ $= lw$
Rhombus		$P = 4 \times l$ $= 4l$	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$
Kite		$P =$ Sum of all sides	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$
Parallelogram		$P =$ Sum of all sides	$A = b \times h$ $= bh$
Trapezium		$P =$ Sum of all sides	$A = \frac{1}{2}(a + b)h$
Triangle		$P =$ Sum of all sides	$A = \frac{b \times h}{2}$ $= \frac{1}{2}bh$
Circle		$C = 2\pi r$	$A = \pi r^2$ where $\pi \approx 3.14$ or $\frac{22}{7}$

Prefixes

poly - many
equi - equal
hedra - face
gon - angle
lateral - side

mono - one
bi or **di** - two
tri - three
quad or **tetra** - four
penta - five
hexa - six
hepta - seven
octa - eight
nona - nine
deca - ten

Abbreviations

l	length
w	width
h	height
b	base length
P	perimeter
r	radius
C	circumference
A	area

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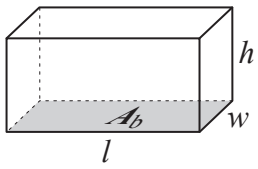
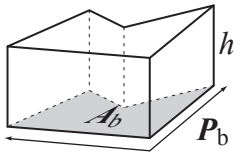
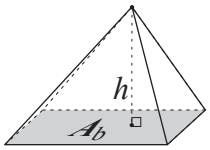
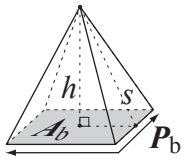
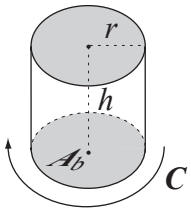
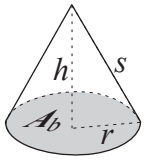
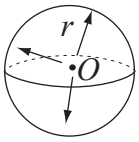
MEASUREMENT FACTS (3)

3D shapes - Formulae

Name	Shape	Surface Area	Volume
Rectangular Prism		$TSA = 2lw + 2wh + 2lh$ $= 2(lw + wh + lh)$	$V = lwh$ or $= A_b h$
Prism - (All)		$TSA = P_b \times h + 2A_b$ $= P_b h + 2A_b$	$V = A_b h$
Pyramid		$TSA =$ Sum of all areas of faces	$V = \frac{1}{3} A_b h$
Regular Pyramid		$TSA = \frac{P_b \times s}{2} + A_b$ $= \frac{P_b s}{2} + A_b$	$V = \frac{1}{3} A_b h$
Cylinder		$TSA = 2\pi r^2 + 2\pi rh$ $= 2\pi r(r + h)$	$V = A_b \times h$ $= \pi r^2 h$
Cone		$TSA = \pi r^2 + \pi rs$ $= \pi r(r + s)$	$V = \frac{1}{3} A_b \times h$ $= \frac{1}{3} \pi r^2 h$
Sphere		$TSA = 4\pi r^2$	$V = \frac{4}{3} \pi r^3$

Abbreviations

l	length
w	width
h	height
b	base length
P	perimeter
r	radius
C	circumference
A	area
TSA	total surface area
V	volume
A_b	base area
P_b	perimeter of base
s	slant height

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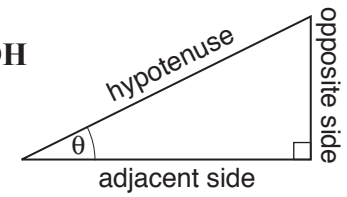
TRIGONOMETRY FACTS

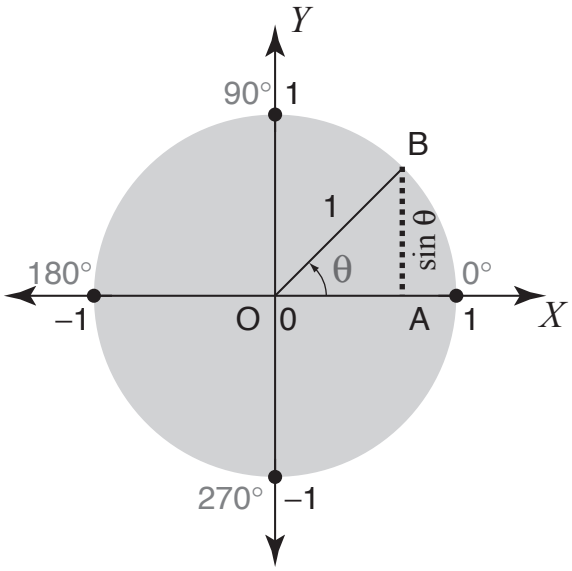
Sine

$\sin\theta = \dfrac{\text{Opposite}}{\text{Hypotenuse}}$ **SOH**



$\sin\theta = \dfrac{AB}{OB} = \dfrac{AB}{1} = AB$

Degree	0°	30°	45°	60°	90°	180°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0

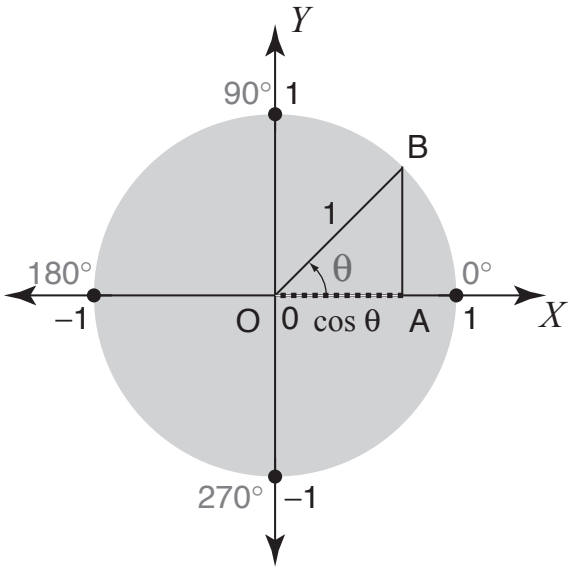


Cosine

$\cos\theta = \dfrac{\text{Adjacent}}{\text{Hypotenuse}}$ **CAH**

$\cos\theta = \dfrac{OA}{OB} = \dfrac{OA}{1} = OA$

Degree	0°	30°	45°	60°	90°	180°
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	–1

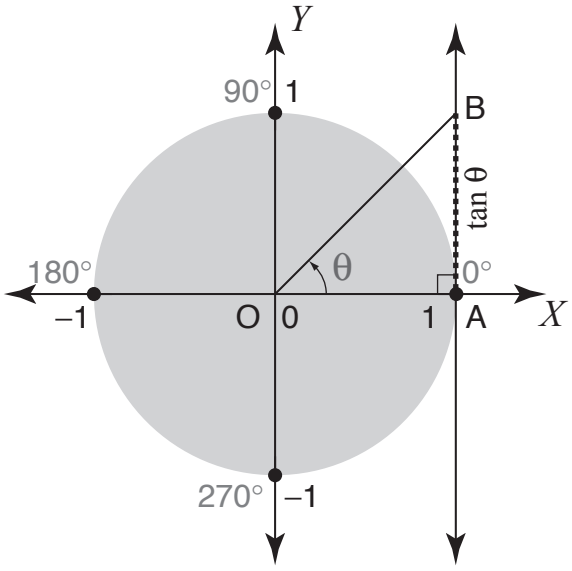


Tangent

$\tan\theta = \dfrac{\text{Opposite}}{\text{Adjacent}}$ **TOA**

$\tan\theta = \dfrac{AB}{OA} = \dfrac{AB}{1} = AB$

Degree	0°	30°	45°	60°	90°	180°
tan	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$		0



Trigonometry hint: SOH - CAH - TOA

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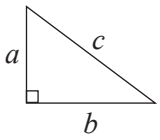
GEOMETRY FACTS (1)

Euler's formula

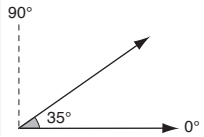
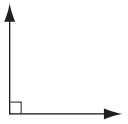
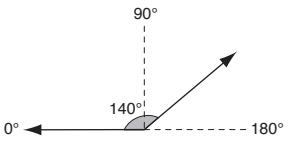
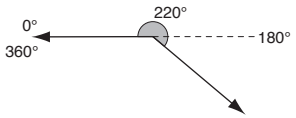
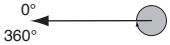
For any polyhedra:
Edges = Vertices + Faces – 2
E = **V** + **F** – 2

Pythagoras' theorem

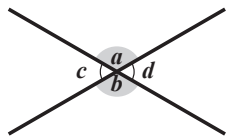
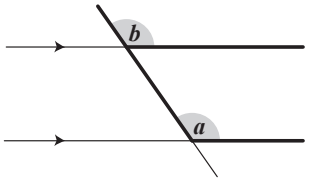
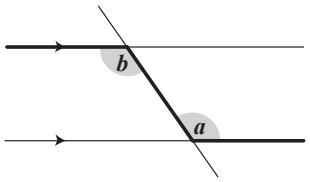
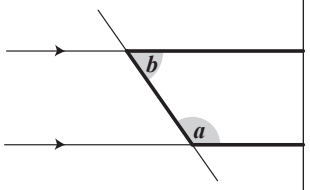
$a^2 + b^2 = c^2$



Angle types

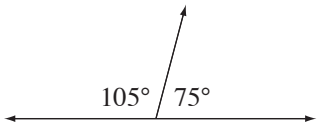
Acute	Right	Obtuse	Straight	Reflex	Revolution
< 90°	90°	more than 90° less than 180°	180°	more than 180° less than 360°	360°
					

Properties of angles

Vertically opposite	Corresponding	Alternate	Co-interior
			
$\angle a = \angle b$ and $\angle c = \angle d$	$\angle a = \angle b$	$\angle a = \angle b$	$\angle a + \angle b = 180°$

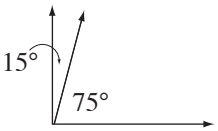
Supplementary Angles

Add to 180°



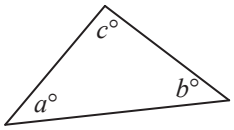
Complementary Angles

Add to 90°

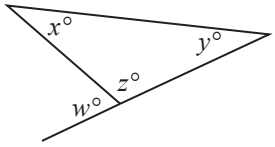


Properties of angles in a triangle

The sum of interior angles of a triangle is 180°.
$a° + b° + c° = 180°$



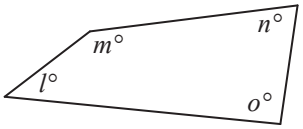
An exterior angle of a triangle is equal to the sum of the two opposite interior angles of the triangle.
$w° = x° + y°$



Sides and angles	Triangle type
no equal sides/angles	**scalene**
two equal sides/angles	**isosceles**
three equal sides/angles	**equilateral**
all acute angles	**acute-angled**
one right angle	**right-angled**
one obtuse angle	**obtuse-angled**

Properties of angles in a quadrilateral

The sum of interior angles of a quadrilateral is 360°.
$l° + m° + n° + o° = 360°$



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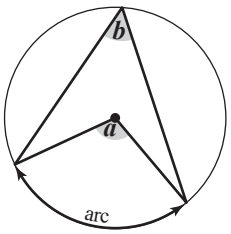
GEOMETRY FACTS (2)

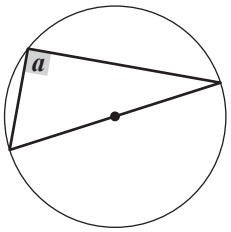
Properties of angles in a circle

Property 1
The angle that an arc forms at the centre of a circle is twice the size of the angle formed by the same arc on the circumference.



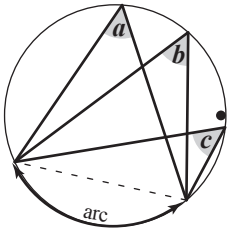
$\angle a = 2 \times \angle b$

Property 2
The angle formed on the circumference from a diameter of a circle is always a right angle.



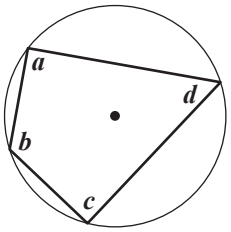
$\angle a = 90°$

Property 3
All angles at the circumference standing on the same arc, in the same segment, are equal.



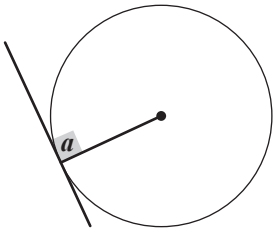
$\angle a = \angle b = \angle c$

Property 4
the opposite angles in a cyclic quadrilateral (all 4 vertices are on the circumference) add up to 180° (are supplementary).



$\angle a + \angle c = 180°$
$\angle b + \angle d = 180°$

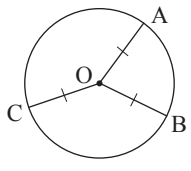
Property 5
Any tangent drawn on a circle meets the radius of the circle at right angles.



$\angle a = 90°$

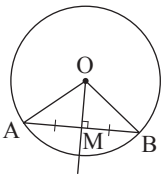
Properties of lines related to a circle

Property 1
The radii in a circle are the same length.



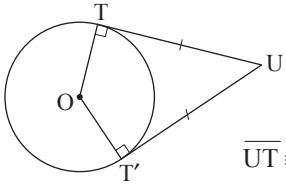
$\overline{OA} \equiv \overline{OB} \equiv \overline{OC}$

Property 2
A line through the circle centre perpendicular to a chord bisects the chord.



$\overline{AM} \equiv \overline{MB}$

Property 3
The common tangents from a point to a circle are equal in length.



$\overline{UT} \equiv \overline{UT'}$

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