

Maths Facts

Symbols

Number

+	plus or add
-	minus or subtract
×	multiplied by, times, lots of
÷	divided by, into groups of
=	equals, is equal to
≠	is not equal to
≈	is approximately equal to
<	is less than, $4 < 6$
>	is greater than, $8 > 5$
≤	is less than or equal to
≥	is greater than or equal to
()	brackets, a grouping symbol
%	percent, $12\% = \frac{12}{100}$
.	decimal point as in 7.9
-3	negative 3
6^3	6 raised to the 3 rd 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
$2.\bar{4}$	recurring decimal
$2.\bar{13}$	recurring decimal

Algebra

$3x$	3 times x , 3 lots of x , $3 \times x$, $3x$
x^2	x raised to the 2 nd 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
°	degree (a right angle measures 90°)
≡	is congruent to, ≡
~	is similar to, ~
	is parallel to
⊥	is perpendicular to
$\triangle ABC$	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

Set Notation

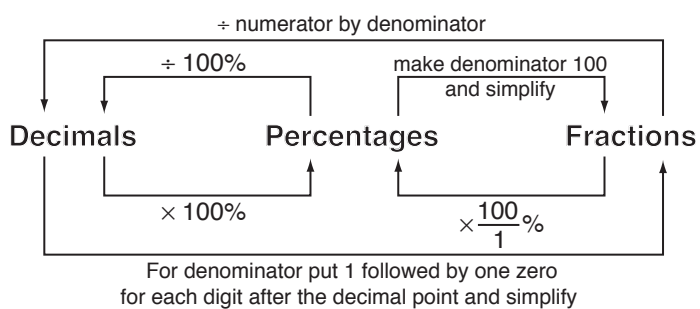
ξ	universal set
\emptyset	null set
\cap	intersection
\cup	union
'	complement of a set
\in	is an element of
\notin	is not an element of
\subset	is a subset of
$\not\subset$	is not a subset of

Number Facts

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	1 000	100	10	1	↓	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Decimals / Percentages / Fractions



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

Real Numbers \mathbb{R}

IRRATIONAL

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

 \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 \times and \div from left to right.
- 4) Calculate $+$ and $-$ from left to right.

Sign Rules

$$++ = +$$

$$-- = +$$

$$+- = -$$

$$-+ = -$$

Ratios 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

$$\text{Distance } (d) = \text{average speed } (v) \times \text{time taken } (t)$$

$$d = vt$$

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

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

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 squares rules

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

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

Difference of two squares rule

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

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

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 = $\frac{1}{10}$

Measurement conversions

Length

10 millimetres (mm) = 1 centimetre (cm)

$$\left. \begin{array}{l} 100 \text{ cm} = \\ 1000 \text{ mm} = \end{array} \right\} 1 \text{ metre (m)}$$

1000 m = 1 kilometre (km)

Area

100 square mm (mm²) = 1 square cm (cm²)

10 000 cm² = 1 square metre (m²)

10 000 m² = 1 hectare (ha)

1 000 000 m² = 1 square km (km²)

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

$$\left. \begin{array}{l} 365 = \\ 52 \text{ weeks (approx.)} = \\ 12 \text{ months} = \end{array} \right\} 1 \text{ year}$$

366 days = 1 leap year

10 years = 1 decade

100 years = 1 century

Liquid Capacity

1000 millilitres (mL) = 1 litre (L)

1 000 000 L = 1 megalitre (ML)

1000 cubic cm (cm³) = 1 L

1000 L = 1 cubic metre (m³)

Volume

1000 cubic mm (mm³) = 1 cubic cm (cm³)

1 000 000 cm³ = 1 cubic metre (m³)

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)

Measurement Facts

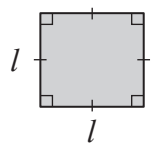
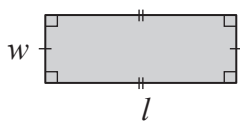
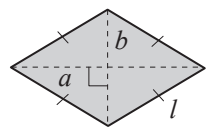
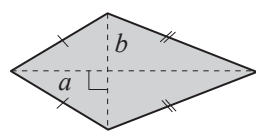
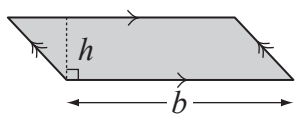
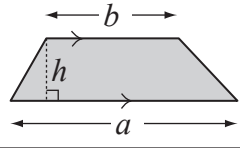
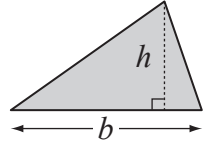
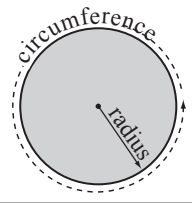
Prefixes

poly - many	mono - one
equi - equal	bi or di - two
hedra - face	tri - three
gon - angle	quad or tetra - four
lateral - side	penta - five
	hexa - six
	hepta - seven
	octa - eight
	nona - nine
	deca - ten

Abbreviations

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

2D shapes

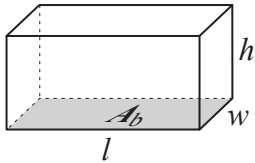
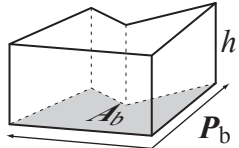
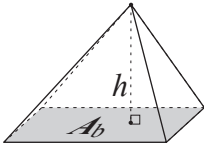
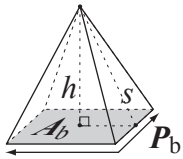
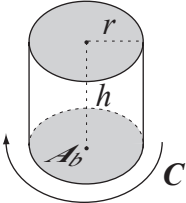
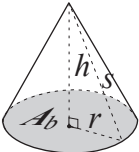
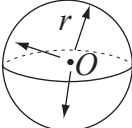
Name	Shape	Perimeter	Area
Square		$P = 4 \times l$ $= 4l$	$A = l \times l$ $= l^2$
Rectangle		$P = 2l + 2w$ $= 2(l + w)$	$A = l \times w$ $= lw$
Rhombus		$P = 4 \times l$ $= 4l$	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$
Kite		$P = \text{Sum of all sides}$	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$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

Measurement Facts

Abbreviations

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

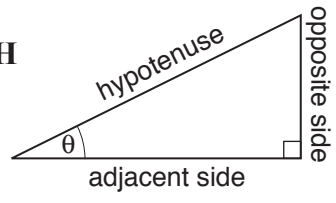
3D shapes

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

Trigonometry Facts

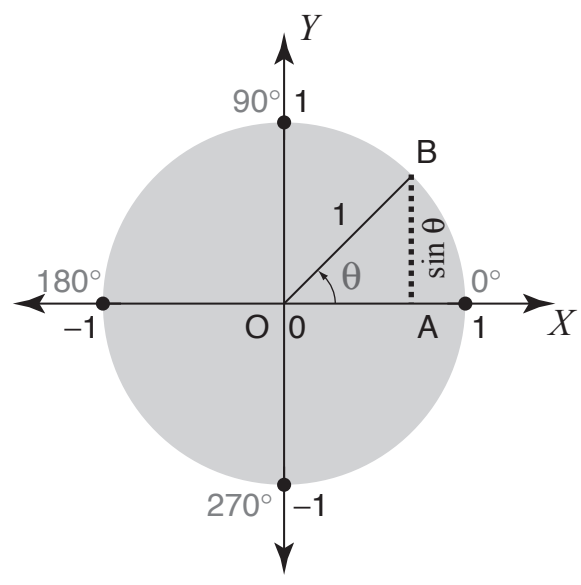
Sine

$$\sin \theta = \frac{\text{Opposite}}{\text{Hypotenuse}} \quad \text{SOH}$$



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

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

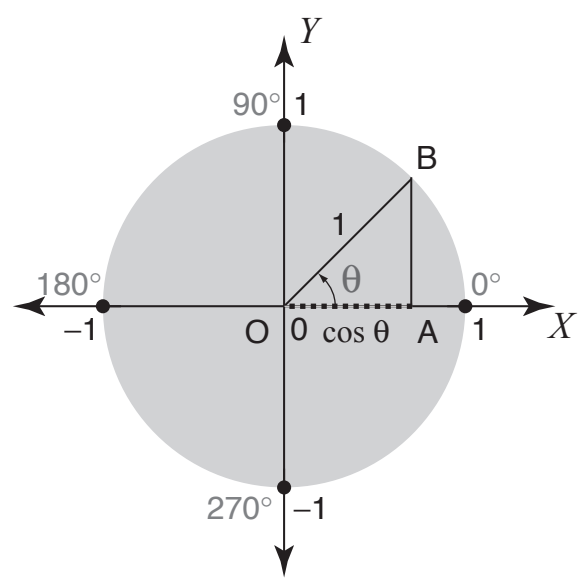


Cosine

$$\cos \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}} \quad \text{CAH}$$

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

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

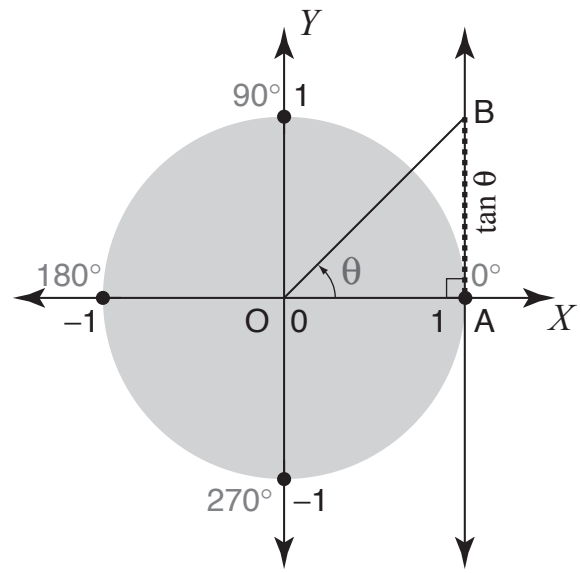


Tangent

$$\tan \theta = \frac{\text{Opposite}}{\text{Adjacent}} \quad \text{TOA}$$

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

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



Trigonometry hint: SOH - CAH - TOA

Geometry Facts

Euler's formula

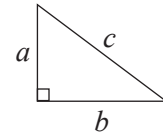
For any polyhedra:

$$\text{Edges} = \text{Vertices} + \text{Faces} - 2$$

$$E = V + F - 2$$

Pythagoras' theorem

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



Angle types

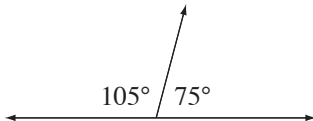
Acute $< 90^\circ$	Right 90°	Obtuse more than 90° less than 180°	Straight 180°	Reflex more than 180° less than 360°	Revolution 360°

Properties of angles

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

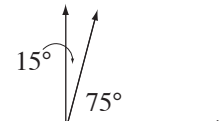
Supplementary Angles

Add to 180°



Complementary Angles

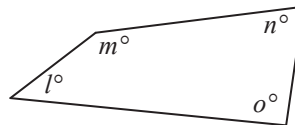
Add to 90°



Properties of angles in a quadrilateral

The sum of interior angles of a quadrilateral is 360° .

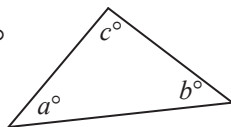
$$l^\circ + m^\circ + n^\circ + o^\circ = 360^\circ$$



Properties of angles in a triangle

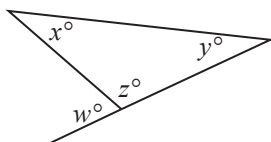
The sum of interior angles of a triangle is 180° .

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



An exterior angle of a triangle is equal to the sum of the two opposite interior angles of the triangle.

$$w^\circ = x^\circ + y^\circ$$



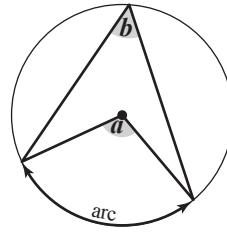
Sides and angles	Triangle type
no equal sides/angles	scalene
two equal sides/angles	isosceles
three equal sides/angles	equilateral
all acute angles	acute-angled
one right angle	right-angled
one obtuse angle	obtuse-angled

Geometry Facts

Properties of angles in a circle

Property 1

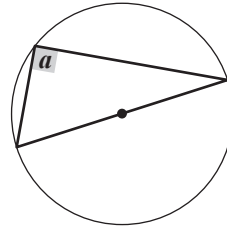
The angle that an arc forms at the centre of a circle is twice the size of the angle formed by the same arc on the circumference.



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

Property 2

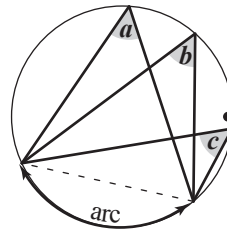
The angle formed on the circumference from a diameter of a circle is always a right angle.



$$\angle a = 90^\circ$$

Property 3

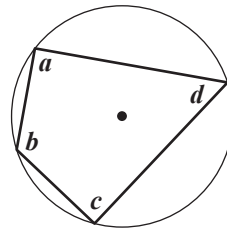
All angles at the circumference standing on the same arc, in the same segment, are equal.



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

Property 4

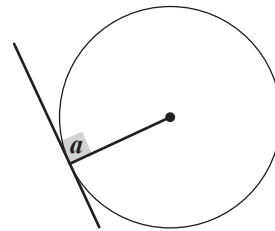
the opposite angles in a cyclic quadrilateral (all 4 vertices are on the circumference) add up to 180° (are supplementary).



$$\begin{aligned} \angle a + \angle c &= 180^\circ \\ \angle b + \angle d &= 180^\circ \end{aligned}$$

Property 5

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

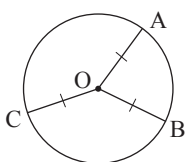


$$\angle a = 90^\circ$$

Properties of lines related to a circle

Property 1

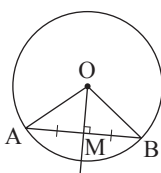
The radii in a circle are the same length.



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

Property 2

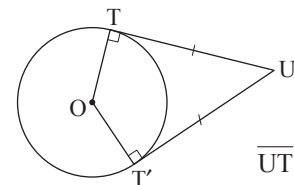
A line through the circle centre perpendicular to a chord bisects the chord.



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

Property 3

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



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