




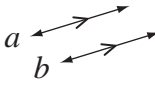
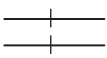




MATHS FACTS

SYMBOLS

Number	Geometry
+	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
2.4	recurring decimal
2.13	recurring decimal
	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

Algebra

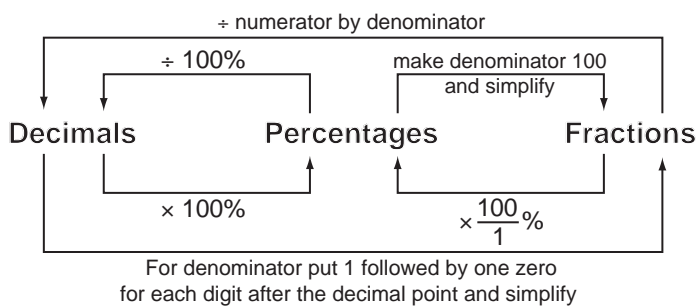
$3x$	3 times x , 3 lots of x , $3 \times x$, $3(x)$
x^2	x raised to the 2 nd power, $x \times x$
$-x$	opposite of x
$\frac{1}{x}$	reciprocal of x
(x,y)	coordinates in a Cartesian plane
m	gradient of a linear graph
c	y-intercept of a linear graph

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	1 000	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

$\pi, \varphi, e, \sqrt{2}, \sqrt{3}, \sqrt{5},$
 $2.6293045632\dots$
 $\cos 30^\circ$

\mathbb{Q}

RATIONAL

$-2\frac{3}{7}, 3.010101\dots,$
 $\frac{4}{10}, 0.56, \sqrt{\frac{4}{9}}$

\mathbb{Z}

Integers

$\dots, -3, -2, -1, 0, 1, 2, 3, \dots$

\mathbb{N}

Natural (Whole Numbers)
 $0, 1, 2, 3, 4, 5, 6, \dots$

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

Applied number - money

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

$$\frac{P}{100} = P\%$$

Commission = % \times Selling price

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.

Simple Interest = Principal \times rate \times time

$$SI = PRT$$

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

Sign Rules

$$+ + = +$$

$$- - = +$$

$$+ - = -$$

$$- + = -$$

Applied number - distance

Distance (d) = average speed (v) \times time taken (t)

$$d = vt$$

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

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

Rates and Proportions

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

$$a : b = c : d$$

$$\frac{a}{b} = \frac{c}{d}$$

$$a \times d = b \times c$$

$$ad = bc$$

Applied number - rates

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

Inverse operation rules

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

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 $a = b$
 $\frac{a}{c} = \frac{b}{c}, c \neq 0$

MEASUREMENT FACTS (1)

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)

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)

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

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 = $\frac{1}{1\,000\,000}$

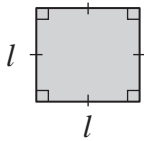
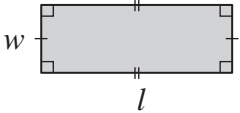
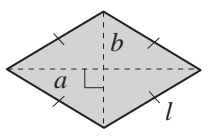
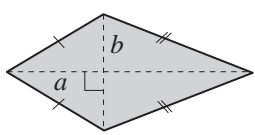
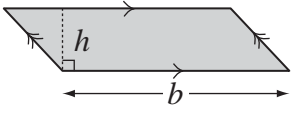
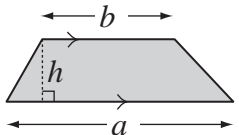
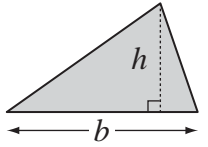
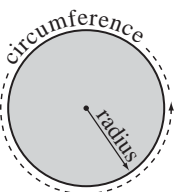
milli (m) = 1 thousandth = $\frac{1}{1000}$

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

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

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		$P = \text{Sum of all sides}$	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$
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 $\frac{22}{7}$

Prefixes

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

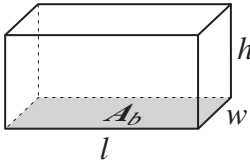
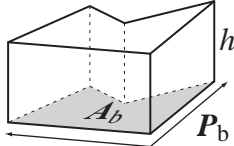
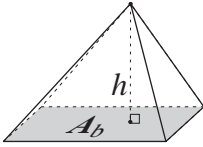
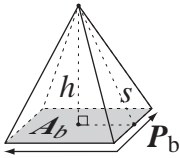
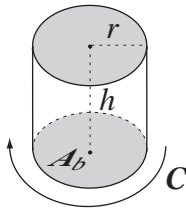
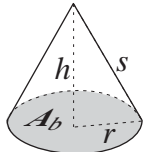
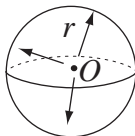
mono - one
bi or di - two
tri - three
quad or tetra - four
penta - five
hexa - six
hepta - seven
octa - eight
nona - nine
deca - ten

Abbreviations

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

MEASUREMENT FACTS (3)

3D shapes - Formulae

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		$TSA = 4\pi r^2$	$V = \frac{4}{3} \pi r^3$

Abbreviations

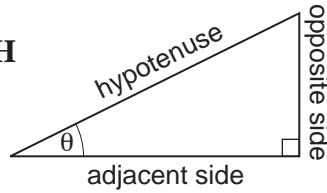
l	length
w	width
h	height
b	base length
P	perimeter
r	radius
C	circumference
A	area

TSA	total surface area
V	volume
A_b	base area
P_b	perimeter of base
s	slant height

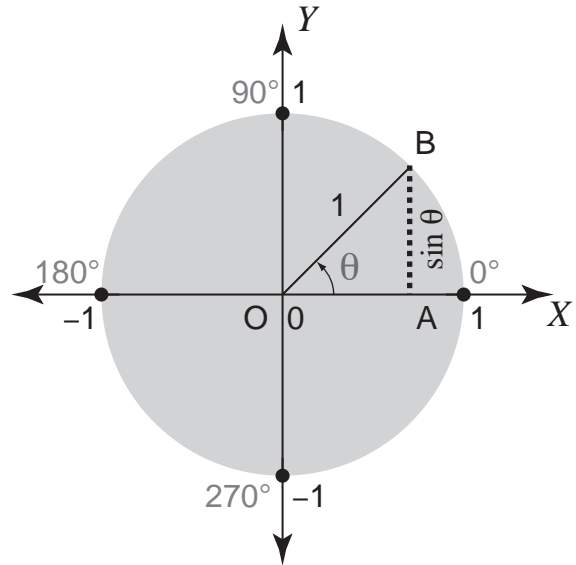
TRIGONOMETRY FACTS

Sine

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



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

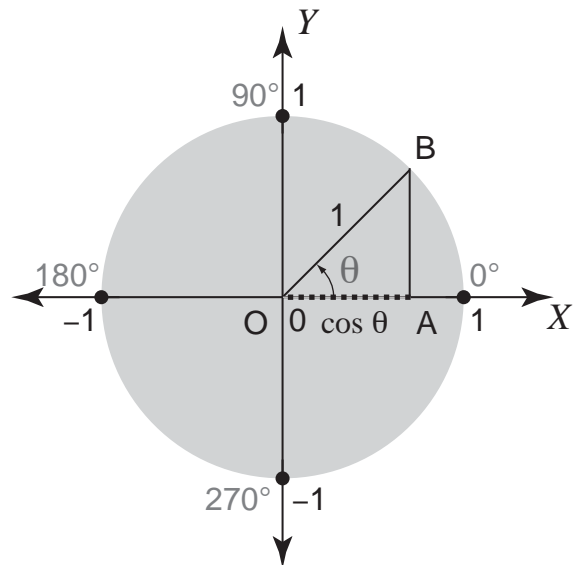


Degree	0°	30°	45°	60°	90°	180°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0

Cosine

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

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



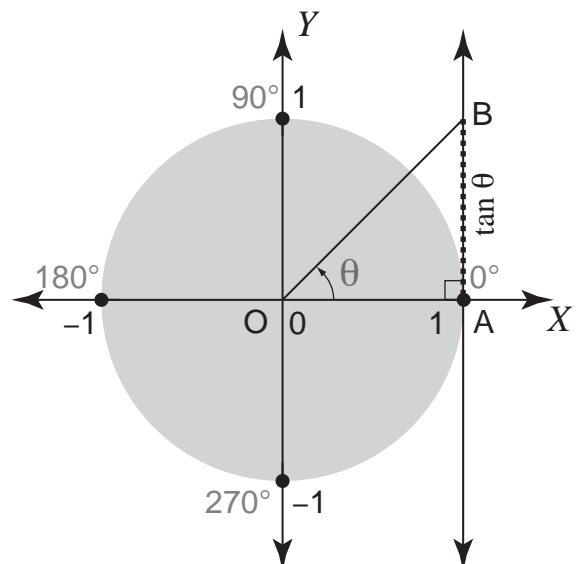
Degree	0°	30°	45°	60°	90°	180°
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1

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

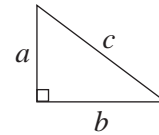
GEOMETRY FACTS (1)

Euler's formula

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

Pythagoras' theorem

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



Angle types

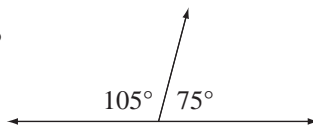
Acute < 90°	Right 90°	Obtuse more than 90° less than 180°	Straight 180°	Reflex more than 180° less than 360°	Revolution 360°

Properties of angles

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

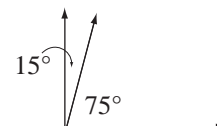
Supplementary Angles

Add to 180°



Complementary Angles

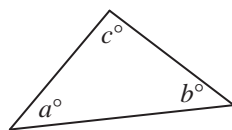
Add to 90°



Properties of angles in a triangle

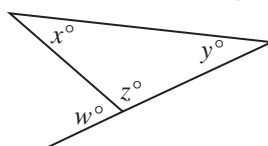
The sum of interior angles of a triangle is 180°.

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



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

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

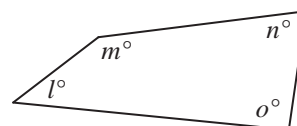


Sides and angles	Triangle type
no equal sides/angles	scalene
two equal sides/angles	isosceles
three equal sides/angles	equilateral
all acute angles	acute-angled
one right angle	right-angled
one obtuse angle	obtuse-angled

Properties of angles in a quadrilateral

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

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

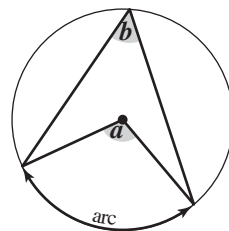


GEOMETRY FACTS (2)

Properties of angles in a circle

Property 1

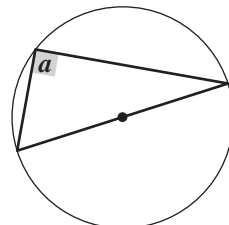
The angle that an arc forms at the centre of a circle is twice the size of the angle formed by the same arc on the circumference.



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

Property 2

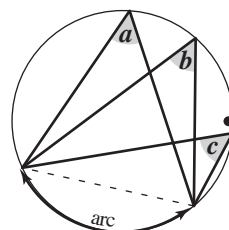
The angle formed on the circumference from a diameter of a circle is always a right angle.



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

Property 3

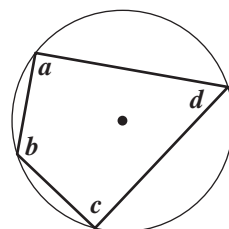
All angles at the circumference standing on the same arc, in the same segment, are equal.



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

Property 4

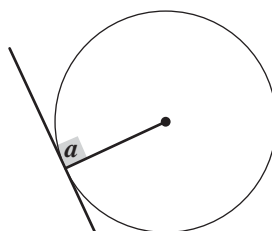
the opposite angles in a cyclic quadrilateral (all 4 vertices are on the circumference) add up to 180° (are supplementary).



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

Property 5

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

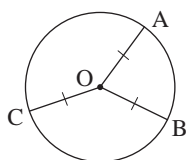


$$\angle a = 90^\circ$$

Properties of lines related to a circle

Property 1

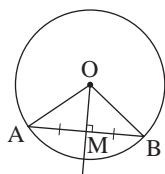
The radii in a circle are the same length.



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

Property 2

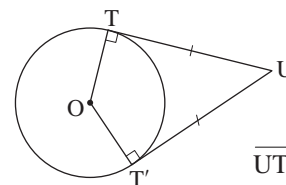
A line through the circle centre perpendicular to a chord bisects the chord.



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

Property 3

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



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