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Coordinate Geometry Formulas

The following formulas and properties are likely to be helpful for solving questions in this topic:

1. Distance formula

$$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$

where (x_1, y_1) and (x_2, y_2) are two points on the graph

2. Gradient formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

3. Midpoint formula

where the midpoint is (x_0, y_0)

$$\left(x_0 = \frac{x_1+x_2}{2}, \quad y_0 = \frac{y_1+y_2}{2}\right)$$

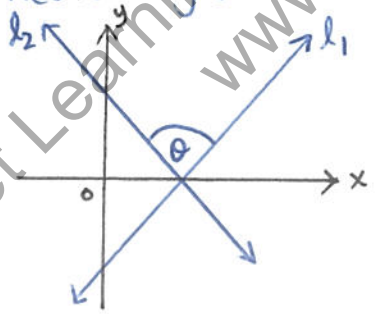
4. Perpendicular distance from a point to a line

where the $\perp$ distance from (x_1, y_1) to a line $ax + by + c = 0$ is given by:

$$\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$$

→ Absolute value is used since we only require distance.

5. Acute angle between two lines (or tangents)



$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$$

where m_1 and m_2 are the gradients of the lines l_1 and l_2 respectively.

6. Parallel lines have the property

$$m_1 = m_2$$

where m_1 and m_2 are the gradients of the lines

7. Perpendicular lines have the property

$$m_1 \times m_2 = -1$$

OR

$$m_1 = -\frac{1}{m_2}$$

TOPIC 3 - TRIGONOMETRY

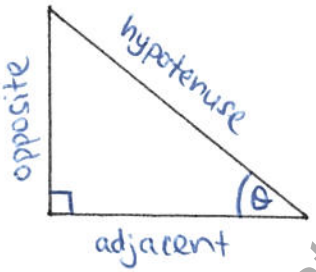
5.1 Review of the trigonometric ratios, using the unit circle.

Recall that:

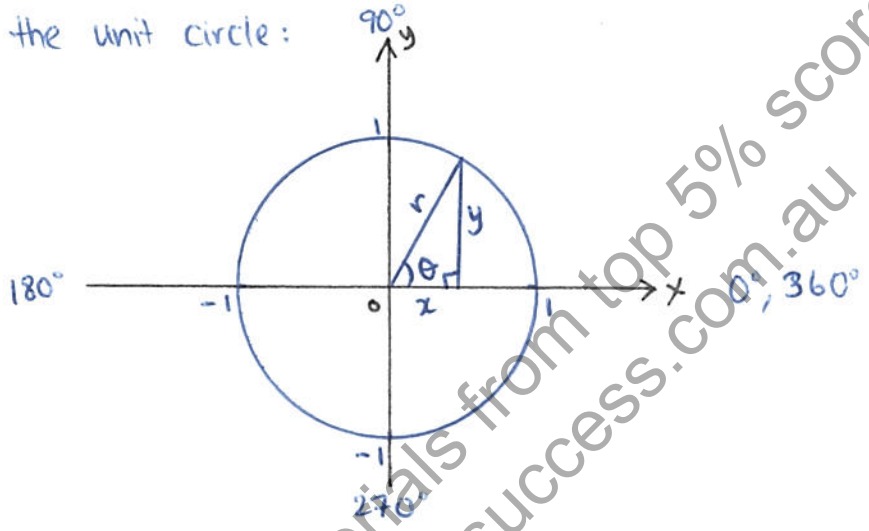
$$\text{Sine} = \frac{\text{opposite}}{\text{hypotenuse}} \quad \text{SOH}$$

$$\text{cosine} = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \text{CAH}$$

$$\text{tangent} = \frac{\text{opposite}}{\text{adjacent}} \quad \text{TOA}$$



Using the unit circle:



$\sin\theta = \frac{y}{r} = y$ (since it is a unit circle, $r = 1$)

$\cos\theta = \frac{x}{r} = x$

$\tan\theta = \frac{y}{x}$

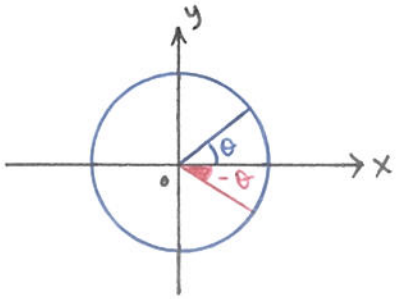
5.2 Trigonometric ratios of: $-\theta$, $90° - \theta$, $180° \pm \theta$, $360° \pm \theta$

Negative angles

$$\sin(-\theta) = -\sin\theta$$

$$\cos(-\theta) = \cos\theta$$

$$\tan(-\theta) = -\tan\theta$$



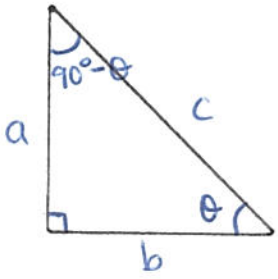
Complementary Identities

$\sin\theta = \frac{a}{c} = \cos(90°-\theta)$

$\cos\theta = \frac{b}{c} = \sin(90°-\theta)$

$\tan\theta = \frac{a}{b} = \cot(90°-\theta)$

$\sec\theta = \frac{c}{b} = \operatorname{cosec}(90°-\theta)$

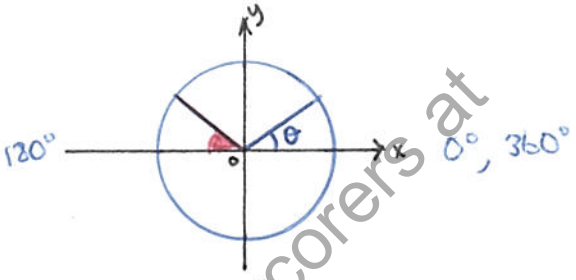


Formulas with General Angles

$\sin(180°-\theta) = \sin\theta$

$\cos(180°-\theta) = -\cos\theta$

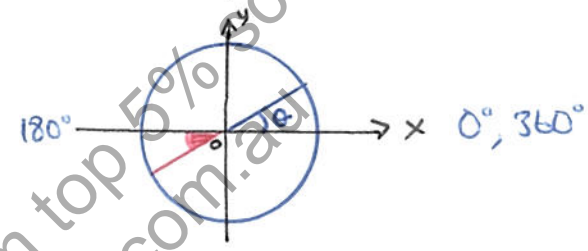
$\tan(180°-\theta) = -\tan\theta$



$\sin(180°+\theta) = -\sin\theta$

$\cos(180°+\theta) = -\cos\theta$

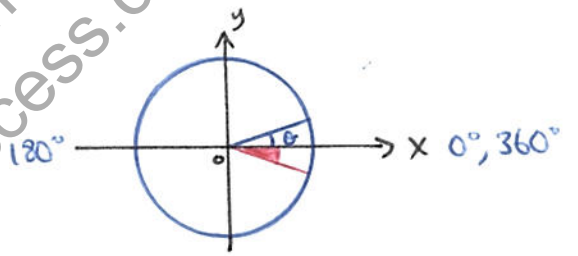
$\tan(180°+\theta) = \tan\theta$



$\sin(360°-\theta) = -\sin\theta$

$\cos(360°-\theta) = \cos\theta$

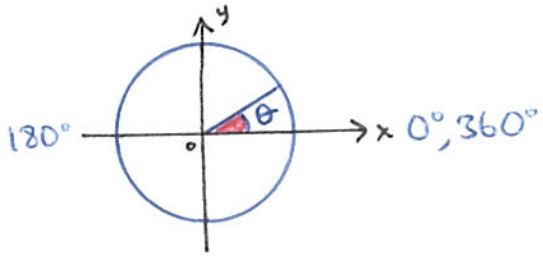
$\tan(360°-\theta) = -\tan\theta$



$\sin(360°+\theta) = \sin\theta$

$\cos(360°+\theta) = \cos\theta$

$\tan(360°+\theta) = \tan\theta$



5.3 The exact ratios

$\theta =$	$0°$	$30°$	$45°$	$60°$	$90°$	$180°$	$270°$
$\sin\theta$	$\frac{\sqrt{0}}{2} = 0$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$\frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{4}}{2} = 1$	0	-1
$\cos\theta$	$\frac{\sqrt{4}}{2} = 1$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$\frac{\sqrt{0}}{2} = 0$	-1	0
$\tan\theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Undefined	0	Undefined

TIP: The numbers under the square root sign are $+1$ each time!!