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## Coordinate Geometry Formulas www.examsuccess.com.au

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  $(x_0, y_0)$

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

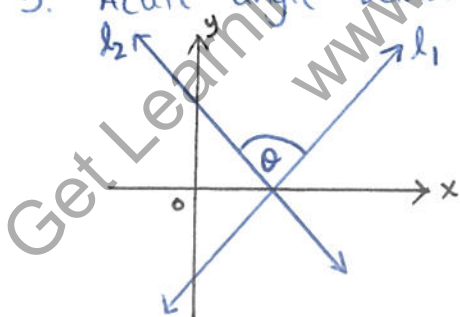
### 4. Perpendicular distance from a point to a line

where the  $h$  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

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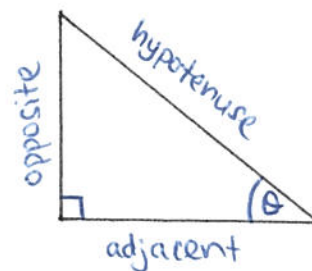
## 5.1 Review of the trigonometric ratios, using the unit circle.

Recall that:

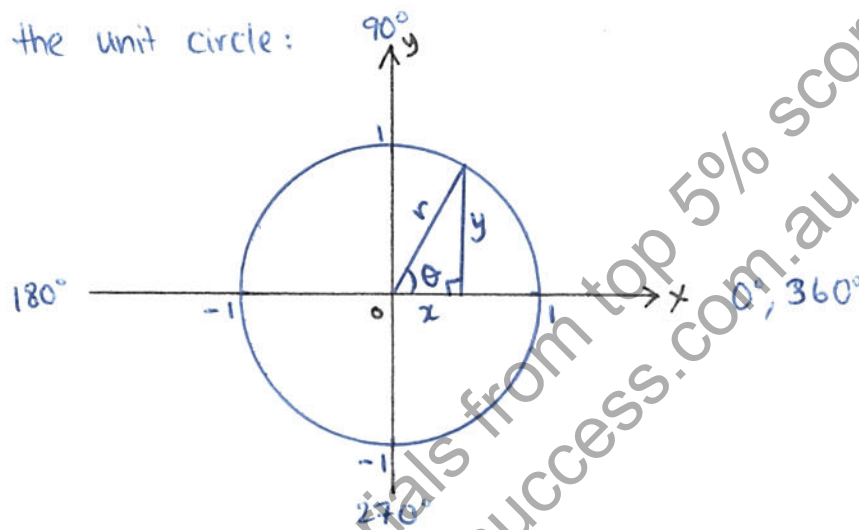
$$\text{sine} = \frac{\text{opposite}}{\text{hypotenuse}} \quad \text{SOH}$$

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

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



Using the unit circle:



$$\sin \theta = \frac{y}{r} = y$$

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

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

(since it is a unit circle,  $r=1$ )

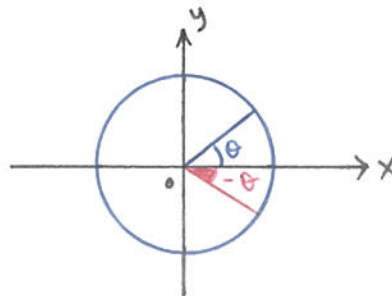
## 5.2 Trigonometric ratios of: $-\theta$ , $90^\circ - \theta$ , $180^\circ \pm \theta$ , $360^\circ \pm \theta$

Negative angles

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

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

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



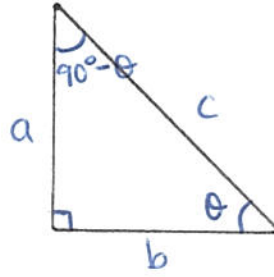
# Complementary Identities

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

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

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

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



## Formulas with General Angles

$$\sin (180^\circ - \theta) = \sin \theta$$

$$\cos (180^\circ - \theta) = -\cos \theta$$

$$\tan (180^\circ - \theta) = -\tan \theta$$

$$\sin (180^\circ + \theta) = -\sin \theta$$

$$\cos (180^\circ + \theta) = -\cos \theta$$

$$\tan (180^\circ + \theta) = \tan \theta$$

$$\sin (360^\circ - \theta) = -\sin \theta$$

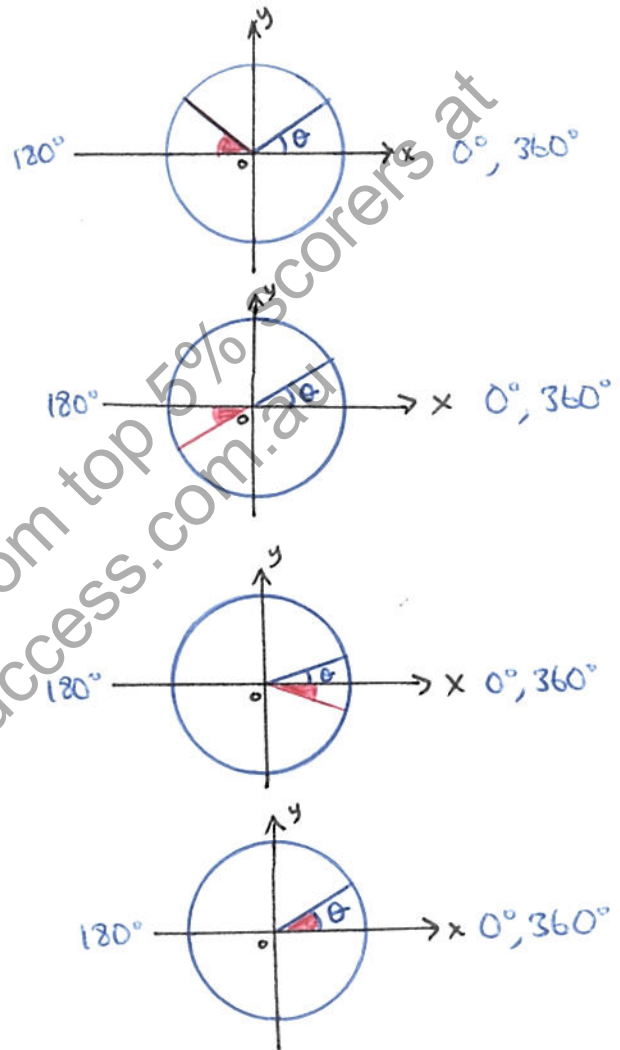
$$\cos (360^\circ - \theta) = \cos \theta$$

$$\tan (360^\circ - \theta) = -\tan \theta$$

$$\sin (360^\circ + \theta) = \sin \theta$$

$$\cos (360^\circ + \theta) = \cos \theta$$

$$\tan (360^\circ + \theta) = \tan \theta$$



### 5.3 The exact ratios

$\theta =$	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$	$180^\circ$	$270^\circ$
$\sin \theta$	$\frac{\sqrt{0}}{2} = 0$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$\frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{4}}{2} = 1$	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  $\pm 1$  each time!!