

3.3 Trigonometric Functions

Question Paper

Course	Edexcel IAL Maths: Pure 1
Section	3. Trigonometry
Topic	3.3 Trigonometric Functions
Difficulty	V. Hard

Time allowed: 60

Score: /51

Percentage: /100

Question 1

By sketching an appropriate graph, find all the solutions to $\tan \theta = \frac{-1}{\sqrt{3}}$, in the interval $0^\circ \leq \theta \leq 360^\circ$.

[4 marks]**Question 2**

- (i) On the same set of axes, sketch the graphs of $y = \cos(-2\theta)$ and $y = \cos \frac{1}{2}\theta$ in the interval $-2\pi \leq \theta \leq 2\pi$. Label the axes appropriately to show all points of intersection between the graphs and the coordinate axes.
- (ii) State the periodicity of each function.

[6 marks]

Question 3

- (a) On the same set of axes, sketch the graphs of $y = \sin \frac{1}{2}\theta$ and $y = \sin(\theta + 30^\circ)$ in the interval $-270^\circ \leq \theta \leq 270^\circ$. Label the coordinates of points of intersection with the coordinate axes and of maximum and minimum points where appropriate.

[4 marks]**Question 3**

- (b) Find the solution to the equation $\sin \frac{1}{2}\theta = \sin(\theta + 30^\circ)$ within the interval $-90^\circ \leq \theta \leq 0^\circ$. Hence, determine the coordinates of the corresponding point of intersection between the two graphs in part (a).

[2 marks]**Question 4**

- (a) On the same set of axes, sketch the graphs of $y = \tan \frac{1}{2}\theta$ and $y = \tan\left(\theta - \frac{\pi}{6}\right)$ in the interval $-2\pi \leq \theta \leq 2\pi$. Label the coordinates of points of intersection with the coordinate axes.

[4 marks]

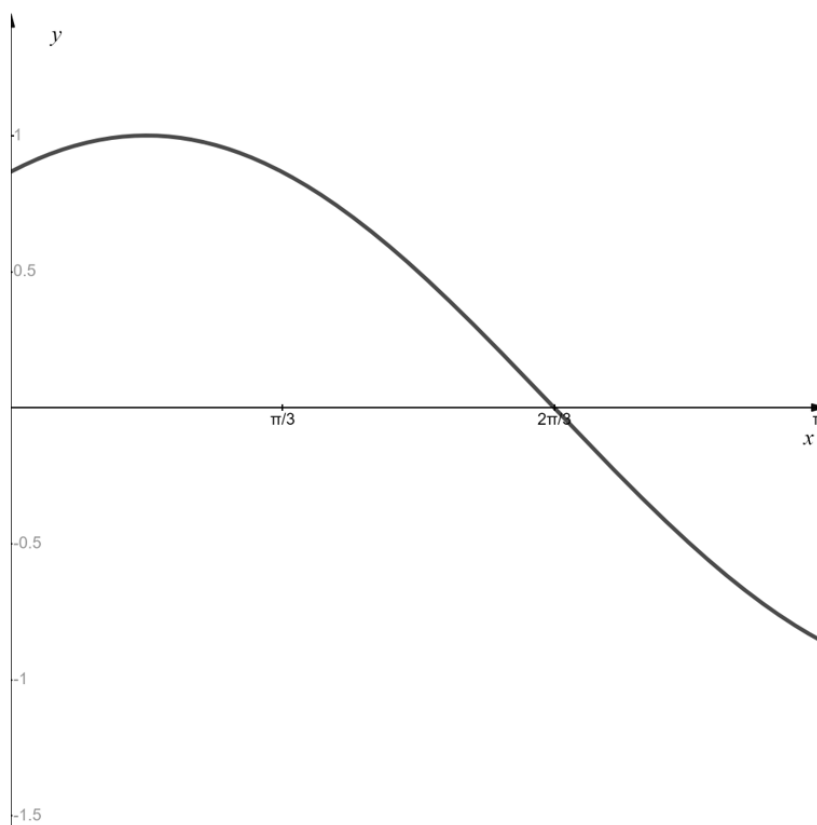
Question 4

- (b) Within the interval $-2\pi \leq \theta \leq 2\pi$, determine the coordinates of the two points where $\tan \frac{1}{2}\theta = \tan \left(\theta - \frac{\pi}{6} \right)$. Give your answer in surd form.

[3 marks]

Question 5

The graph below shows part of the curve with equation $y = \sin(x + k)$, where the angle is measured in radians and k is a constant.



- (a) A student states that there are an infinite number of possible values for k . Is the student correct? You must explain your answer fully.

[2 marks]

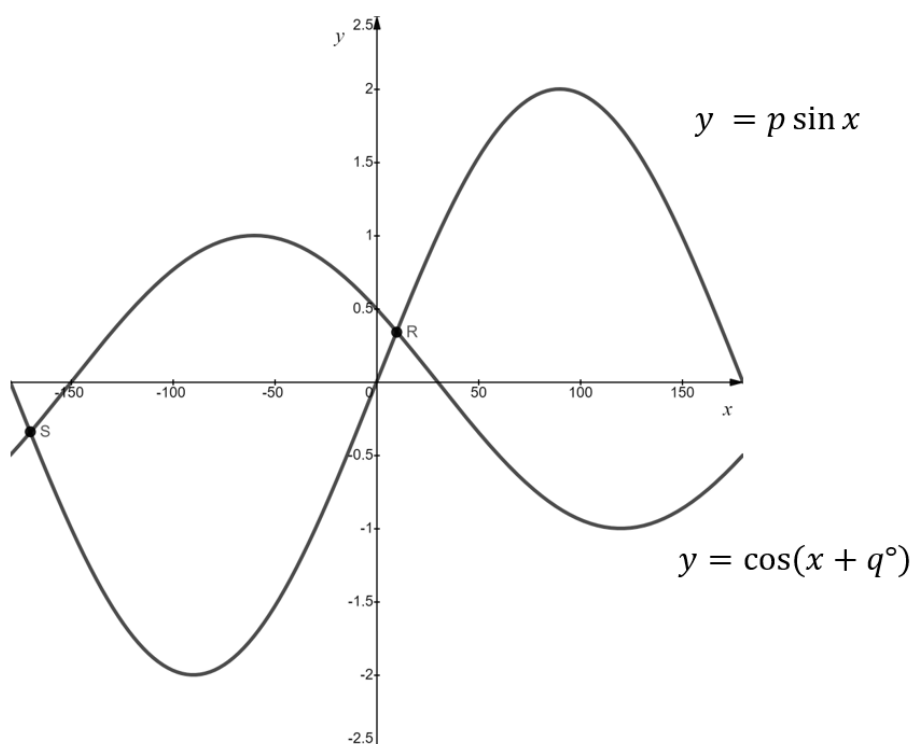
Question 5

- (b) Another student claims that the curve could also be the graph of the equation $y = \cos(x + k)$. Find a value for k to show that the student is correct.

[2 marks]

Question 6

The graph below shows two curves with equations $y = p \sin x$ and $y = \cos(x + q^\circ)$, in the interval $-180^\circ \leq x \leq 180^\circ$, where p and q are integers.



- (a) Using the graph above, find the values of p and q and label the points of intersection each graph has with the coordinate axes.

[4 marks]

Question 6

- (b) Within the stated interval, the curves intersect at the two points R and S as shown in the diagram. The coordinates of point R are $(9.90^\circ, 0.34)$, accurate to 2 decimal places. By considering the graph, as well as the properties of the sine and cosine functions, state the coordinates of Point S , to two decimal places.

[2 marks]**Question 7**

- (i) Describe geometrically the transformation that maps the graph of $y = \frac{1}{3} \tan x$ onto the graph of $y = 3 \tan x$.
- (ii) On the graph of $y = \tan x$, a point S has coordinates $\left(\frac{\pi}{3}, \sqrt{3}\right)$. State the new coordinates of point S after a transformation onto each of the graphs in part (i). Give your answers in surd form.

[6 marks]

Question 8

- (a) Describe geometrically the transformation that maps the graph of $y = \sin(x + 20^\circ)$ onto the graph of $y = \cos(x + 20^\circ)$.

[2 marks]

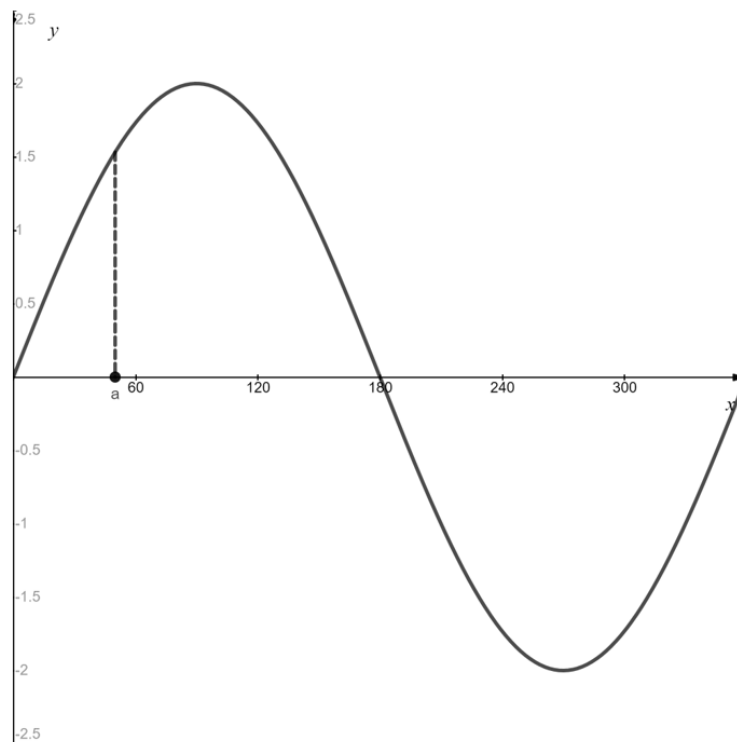
Question 8

- (b) On the same set of axes, sketch both graphs in the interval $-180^\circ \leq x \leq 180^\circ$.
Label the coordinates of any points of intersection between the two graphs.

[2 marks]

Question 9

The graph below shows the curve with equation $y = 2 \sin \theta$, in the interval $0^\circ \leq \theta \leq 360^\circ$. One value of θ has been labelled ($\theta = a^\circ$).



Use the graph, along with the symmetry properties of the sine function, to verify that

$$2 \sin a = 2 \sin(180^\circ - a) = -2 \sin(180^\circ + a) = -2 \sin(360^\circ - a).$$

[2 marks]

Question 10

A function $f(x) = \cos px$, $0 \leq x \leq 2\pi$, first crosses the x -axis at $\frac{\pi}{10}$.

(i) Determine the value of p and sketch the graph of $y = f(x)$.

(ii) State the period of $f(x)$.

[6 marks]