Transforming Trig Graphs

Specification: AQA 7357: E3, B9 · Edexcel 9MA0: 5.3, 2.9

INDEPENDENT **You do**

A · Key features

1 Describe the single transformation that maps the graph of $y = \cos x$ onto the graph of
(a) $y = \cos x + 3$
(b) $y = 4\cos x$
(c) $y = \cos(x - 50°)$
(d) $y = \cos 3x$

2 For each graph, $0° \le x \le 360°$, write down the maximum value, the minimum value, and the smallest value of x at which the maximum occurs.
(a) $y = 5\sin x$
(b) $y = \cos x + 2$
(c) $y = -3\sin x$
(d) $y = \sin 4x$

3 Write down the period of
(a) $y = \sin 3x$
(b) $y = \cos \frac{1}{2}x$
(c) $y = \tan 2x$
(d) $y = \tan(x + 40°)$

4 Write down the equations of the asymptotes of
(a) $y = \tan(x - 60°)$, $0° \le x \le 360°$
(b) $y = \tan 3x$, $0° \le x \le 180°$

B · Sketching

5 Sketch the graph of $y = 4\cos x$ for $0° \le x \le 360°$. Show the coordinates of the points where the graph meets the axes and of its maximum and minimum points.

6 Sketch the graph of $y = \sin x + 1$ for $-180° \le x \le 360°$. Show the coordinates of the points where the graph meets the axes and of its maximum and minimum points.

7 Sketch the graph of $y = \sin 3x$ for $0° \le x \le 360°$. Show the coordinates of the points where the graph meets the axes and of its maximum and minimum points.

8 Sketch the graph of $y = \cos(x + 45°)$ for $0° \le x \le 360°$. Show the coordinates of the points where the graph meets the axes and of its maximum and minimum points.

9 Sketch the graph of $y = \tan \frac{1}{2}x$ for $-360° \le x \le 360°$. Show the asymptotes and the coordinates of the points where the graph meets the axes.

C · Reasoning

No calculator for this section.

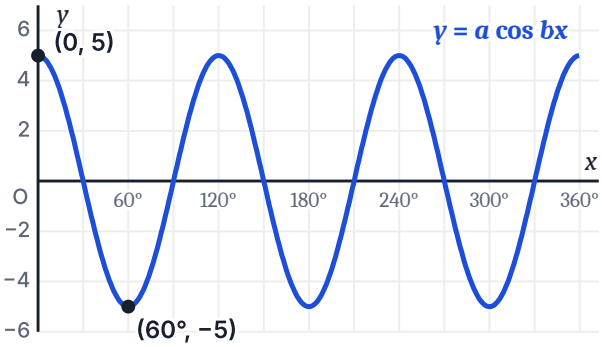
10 (a) Describe the transformation that maps the graph of $y = \sin x$ onto the graph of $y = \sin(-x)$.
(b) Use graphs to explain why $\sin(-x) = -\sin x$.
(c) Explain why $\cos(-x) = \cos x$.

11 The graph of $y = \sin x$ can be translated onto the graph of $y = \cos x$.
(a) Write down a translation vector that does this.
(b) Write down a different translation vector that also does this.
(c) Hence write $\cos x$ in the form $\sin(x + c)$.

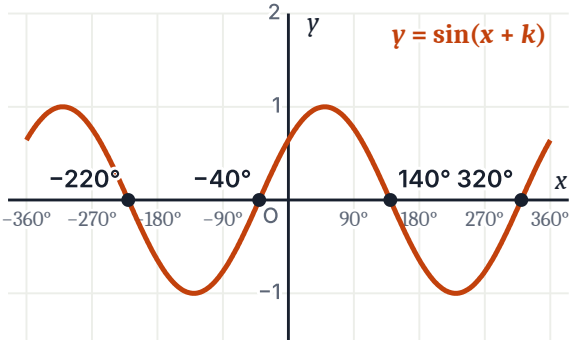
12 Use sketches to find the number of solutions of
(a) $\sin 2x = 0.4$, $0° \le x \le 360°$
(b) $\tan 3x = 1$, $0° \le x \le 180°$.

D · Finding constants · combined transformations Question 15 combines transformations: A-level content for AQA (extension at AS).

13 The graph shows $y = a\cos bx$, $0° \le x \le 360°$, where a and b are positive. It passes through (0, 5) and its first minimum point is (60°, −5). Find a and b.



14 The graph shows $y = \sin(x + k)$, $-360° \le x \le 360°$. It meets the x-axis at −220°, −40°, 140° and 320°, and is increasing at −40°.
(a) Find k, given that $0 < k < 360°$.
(b) Give a different value of k that gives the same graph.



15 *Extension: combined transformations.* For the graph of $y = 2\sin 3x + 1$, $0° \le x \le 180°$:
(a) describe, in order, the three transformations that map $y = \sin x$ onto it
(b) sketch it, showing the coordinates of its maximum and minimum points and of the point where it meets the y-axis.

E · Exam-style question Use the mark scheme to self-assess.

16 (a) Sketch the graph of $y = \sin(x - 45°)$ for $0° \le x \le 360°$. Show the coordinates of the points where the graph meets the axes. [3 marks]
(b) Write down the coordinates of the maximum and minimum points. [2 marks]
(c) State the number of solutions of $\sin(x - 45°) = 0.8$ for $0° \le x \le 360°$. [1 mark]