



Higher Mathematics

Wave Function - Questions

Marks are indicated in brackets after each question number

2013 Paper 1 Question 23, (4) (2)

- (a) The expression $\sqrt{3}\sin x^\circ - \cos x^\circ$ can be written in the form $k \sin(x - a)^\circ$, where $k > 0$ and $0 \leq a < 360$.

Calculate the values of k and a .

- (b) Determine the maximum value of $4 + 5\cos x^\circ - 5\sqrt{3}\sin x^\circ$, where $0 \leq x < 360$.

2014 Paper 1 Question 4, (2)

If $3\sin x - 4\cos x$ is written in the form $k\cos(x - a)$, what are the values of $k\cos a$ and $k\sin a$?

2015 Paper 2 Question 9, (8)

The blades of a wind turbine are turning at a steady rate.

The height, h metres, of the tip of one of the blades above the ground at time, t seconds, is given by the formula

$$h = 36\sin(1.5t) - 15\cos(1.5t) + 65.$$

Express $36\sin(1.5t) - 15\cos(1.5t)$ in the form

$$k\sin(1.5t - a), \text{ where } k > 0 \text{ and } 0 < a < \frac{\pi}{2},$$

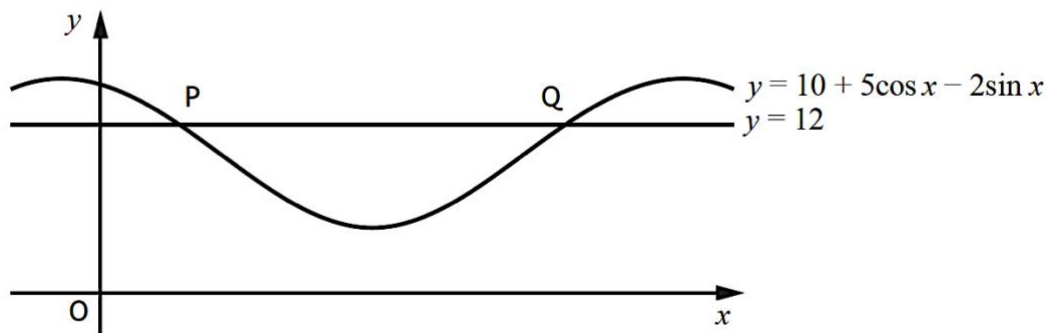
and hence find the **two** values of t for which the tip of this blade is at a height of 100 metres above the ground during the first turn.



2016 Paper 2 Question 8, (4) (4)

- (a) Express $5\cos x - 2\sin x$ in the form $k \cos(x + a)$,
where $k > 0$ and $0 < a < 2\pi$.
- (b) The diagram shows a sketch of part of the graph of $y = 10 + 5\cos x - 2\sin x$
and the line with equation $y = 12$.

The line cuts the curve at the points P and Q.



Find the x -coordinates of P and Q.

2017 Paper 1 Question 14, (4) (3)

- (a) Express $\sqrt{3} \sin x^\circ - \cos x^\circ$ in the form $k \sin(x - a)^\circ$,
where $k > 0$ and $0 < a < 360$.
- (b) Hence, or otherwise, sketch the graph with equation
 $y = \sqrt{3} \sin x^\circ - \cos x^\circ$, $0 \leq x \leq 360$.

2018 Paper 2 Question 8, (4) (1) (2)

- (a) Express $2\cos x^\circ - \sin x^\circ$ in the form $k \cos(x - a)^\circ$, $k > 0$, $0 < a < 360$.
- (b) Hence, or otherwise, find
- (i) the minimum value of $6\cos x^\circ - 3\sin x^\circ$ and
 - (ii) the value of x for which it occurs where $0 \leq x < 360$.



2019 Paper 2 Question 6, (4) (3)

- (a) Express $2 \cos x^\circ - 3 \sin x^\circ$ in the form $k \cos(x+a)^\circ$ where $k > 0$ and $0 \leq a < 360$.
- (b) Hence solve $2 \cos x^\circ - 3 \sin x^\circ = 3$ for $0 \leq x < 360$.

2022 Paper 2 Question 3, (4) (3)

- (a) Express $4 \sin x + 5 \cos x$ in the form $k \sin(x+a)$ where $k > 0$ and $0 < a < 2\pi$.
- (b) Hence solve $4 \sin x + 5 \cos x = 5.5$ for $0 \leq x < 2\pi$.

2023 Paper 2 Question 9, (4) (1) (2)

- (a) Express $7 \cos x^\circ - 3 \sin x^\circ$ in the form $k \sin(x+a)^\circ$ where $k > 0$, $0 < a < 360$.
- (b) Hence, or otherwise, find:
- (i) the maximum value of $14 \cos x^\circ - 6 \sin x^\circ$
 - (ii) the value of x for which it occurs where $0 \leq x < 360$.

2024 Paper 1 Question 11, (4) (3)

- (a) Express $\cos x^\circ + \sqrt{3} \sin x^\circ$ in the form $k \cos(x-a)^\circ$, where $k > 0$ and $0 < a < 360$.
- (b) Hence, or otherwise, sketch the graph with equation $y = \cos x^\circ + \sqrt{3} \sin x^\circ$, $0 \leq x \leq 360$.
- Use the diagram provided in your answer booklet.

2025 Paper 2 Question 6, (4) (3)

- (a) Express $5 \cos x - 9 \sin x$ in the form $k \cos(x+a)$ where $k > 0$ and $0 < a < 2\pi$.
- (b) Hence solve $5 \cos x - 9 \sin x = 7$ for $0 \leq x < 2\pi$.

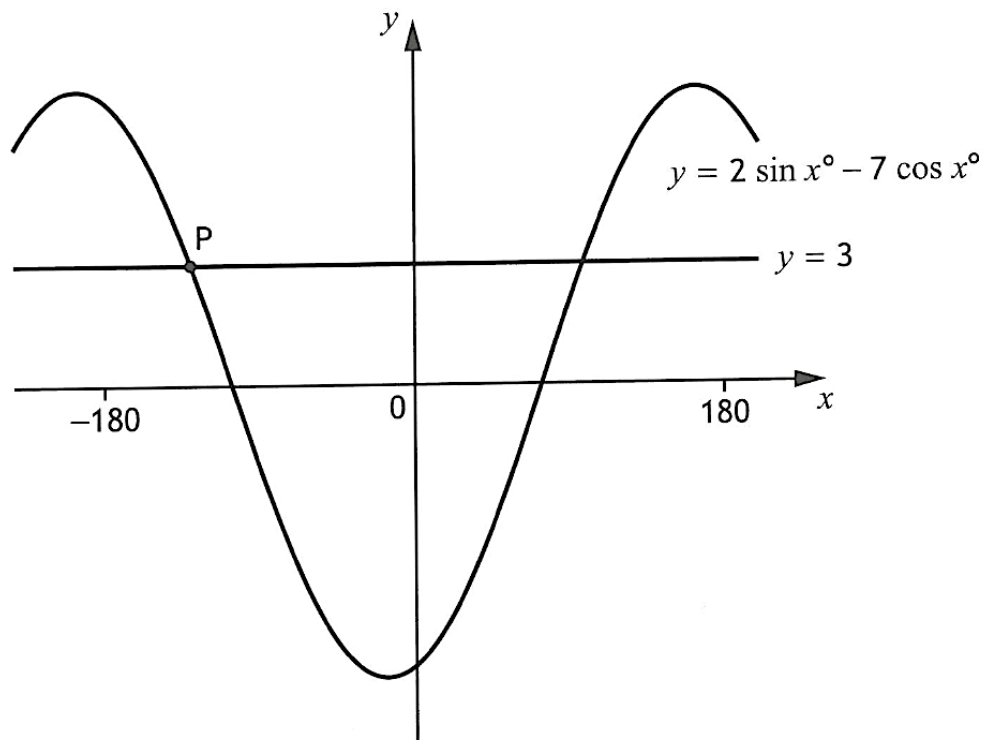


2026 Paper 2 Question 13, (4) (3)

- (a) Express $2\sin x^\circ - 7\cos x^\circ$ in the form $k\sin(x-a)^\circ$, where $k > 0$ and $0 < a < 360$.

The diagram shows part of the curve with equation $y = 2\sin x^\circ - 7\cos x^\circ$ and the line with equation $y = 3$.

The curve and the line intersect at the point P.



- (b) Find the x -coordinate of P.