

Higher Mathematics

Trigonometric Identities - Questions - 2013-2017

Marks are indicated in brackets after each question number

2013 Paper 1 Question 10, (2)

If $0 < a < 90$, which of the following is equivalent to $\cos(270 - a)^\circ$?

- A $\cos a^\circ$
- B $\sin a^\circ$
- C $-\cos a^\circ$
- D $-\sin a^\circ$

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 .

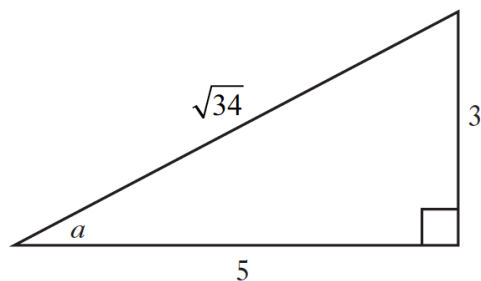
(b) Determine the maximum value of $4 + 5 \cos x^\circ - 5\sqrt{3} \sin x^\circ$, where $0 \leq x < 360$.

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 $k\sin a$?

2014 Paper 1 Question 7, (2)

A right-angled triangle has sides and angles as shown in the diagram.



What is the value of $\sin 2a$?

2014 Paper 1 Question 18, (2)

What is the value of $1 - 2\sin^2 15^\circ$?

2015 Paper 1 Question 10, (1) (2)

Given that $\tan 2x = \frac{3}{4}$, $0 < x < \frac{\pi}{4}$, find the exact value of

(a) $\cos 2x$

(b) $\cos x$.

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

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

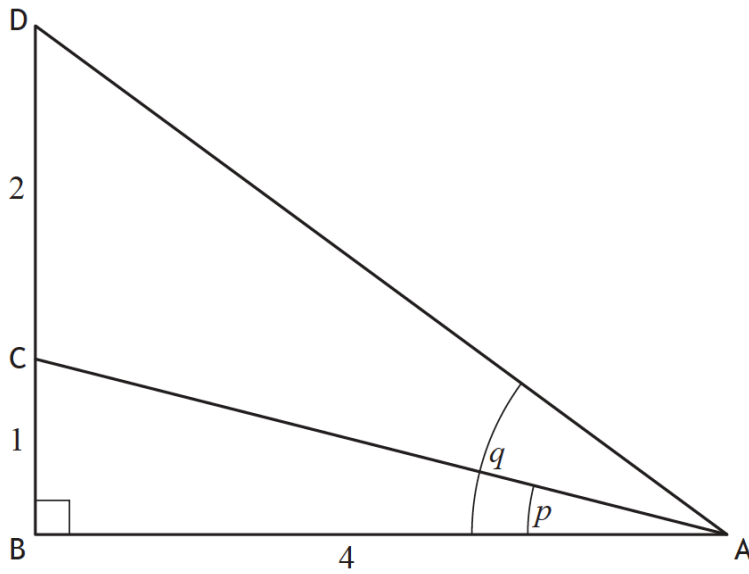
Express $36\sin(1.5t) - 15\cos(1.5t)$ in the form

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

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 1 Question 13, (5)

Triangle ABD is right-angled at B with angles $BAC = p$ and $BAD = q$ and lengths as shown in the diagram below.

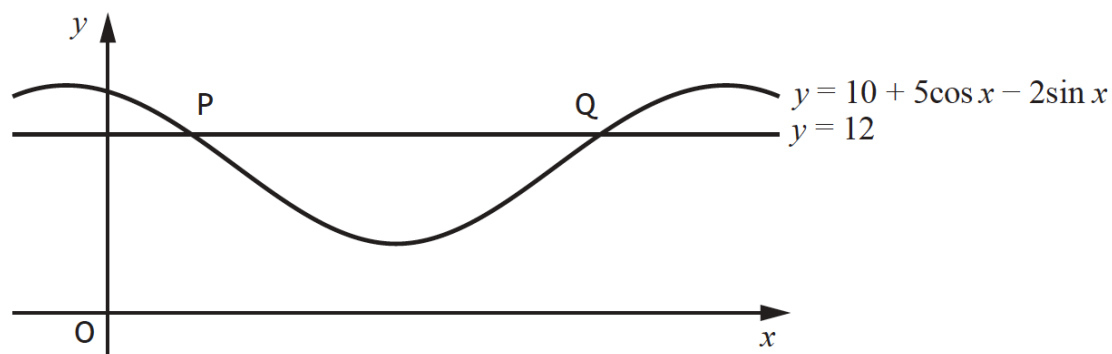


Show that the exact value of $\cos(q-p)$ is $\frac{19\sqrt{17}}{85}$.

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.

2016 Paper 2 Question 11, (4) (2)

- (a) Show that $\sin 2x \tan x = 1 - \cos 2x$, where $\frac{\pi}{2} < x < \frac{3\pi}{2}$.
- (b) Given that $f(x) = \sin 2x \tan x$, find $f'(x)$.

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
 $y = \sqrt{3} \sin x^\circ - \cos x^\circ$, $0 \leq x \leq 360$.

2017 Paper 2 Question 11, (3) (3)

(a) Show that $\frac{\sin 2x}{2 \cos x} - \sin x \cos^2 x = \sin^3 x$, where $0 < x < \frac{\pi}{2}$.

(b) Hence, differentiate $\frac{\sin 2x}{2 \cos x} - \sin x \cos^2 x$, where $0 < x < \frac{\pi}{2}$.