Higher Mathematics

Trigonometric Identities - **Questions** - 2013-2019

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 $\cos(270 - a)°$?

A $\cos a°$

B $\sin a°$

C $-\cos a°$

D $-\sin a°$

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

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

Calculate the values of k and a.

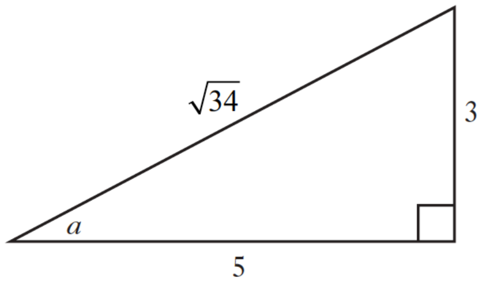
(*b*) Determine the maximum value of $4 + 5\cos x° - 5\sqrt{3}\sin x°$, where $0 \leq x < 360$.

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 $1 - 2\sin^2 15°$?

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

$$h = 36\sin(1{\cdot}5t) - 15\cos(1{\cdot}5t) + 65.$$

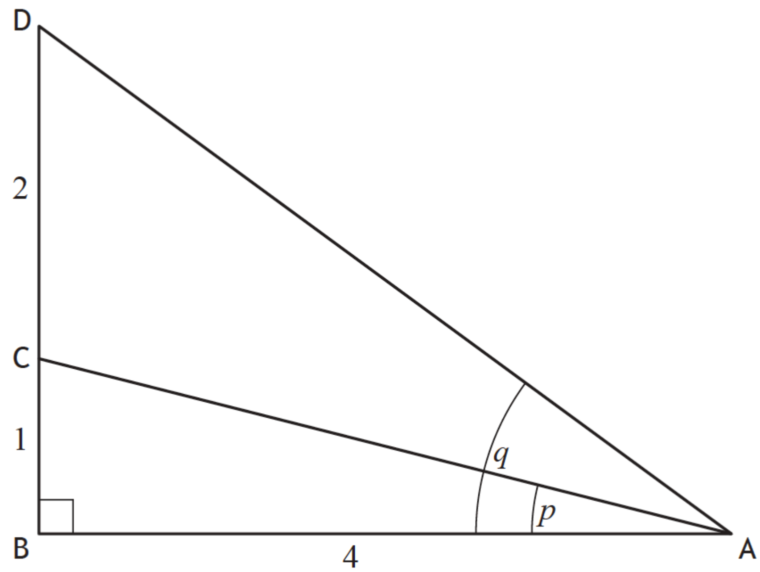
Express $36\sin(1{\cdot}5t) - 15\cos(1{\cdot}5t)$ in the form

$$k\sin(1{\cdot}5t - a), \text{ where } k > 0 \text{ and } 0 < a < \frac{\pi}{2},$$

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.



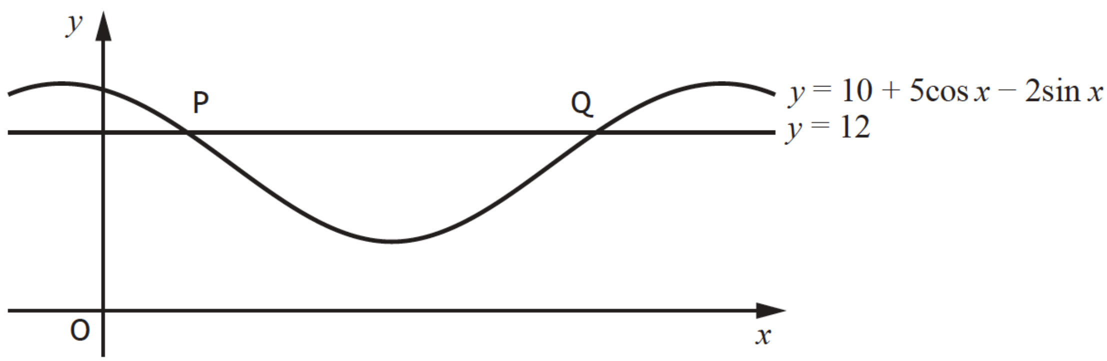
Show that the exact value of $\cos(q-p)$ is $\dfrac{19\sqrt{17}}{85}$.

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 $\sqrt{3}\sin x° - \cos x°$ in the form $k\sin(x - a)°$, where $k > 0$ and $0 < a < 360$.

(b) Hence, or otherwise, sketch the graph with equation $y = \sqrt{3}\sin x° - \cos x°$, $0 \leq x \leq 360$.

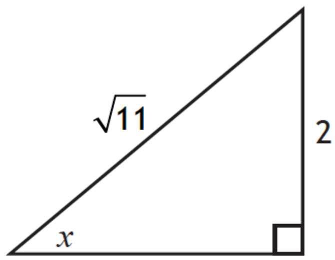
2017 Paper 2 Question 11, (3) (3)

(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 $0 < x < \frac{\pi}{2}$.

2018 Paper 1 Question 13, (3) (1) (3)

The right-angled triangle in the diagram is such that $\sin x = \frac{2}{\sqrt{11}}$ and $0 < x < \frac{\pi}{4}$.



(a) Find the exact value of:

(i) $\sin 2x$

(ii) $\cos 2x$.

(b) By expressing $\sin 3x$ as $\sin(2x + x)$, find the exact value of $\sin 3x$.

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

(a) Express $2\cos x° - \sin x°$ in the form $k\cos(x - a)°$, $k > 0$, $0 < a < 360$.

(b) Hence, or otherwise, find

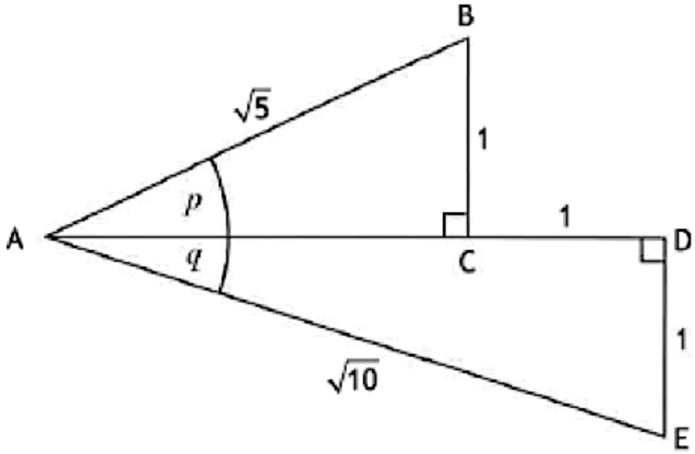
(i) the minimum value of $6\cos x° - 3\sin x°$ and

(ii) the value of x for which it occurs where $0 \le x < 360$.

2019 Paper 1 Question 13, (1) (1) (3)

Triangles ABC and ADE are both right angled.

Angles p and q are as shown in the diagram.



(a) Determine the value of

(i) $\cos p$

(ii) $\cos q$.

(b) Hence determine the value of $\sin(p+q)$.

2019 Paper 1 Question 17, (3) (2)

(a) Express $(\sin x - \cos x)^2$ in the form $p + q\sin rx$ where p, q and r are integers.

(b) Hence, find $\int (\sin x - \cos x)^2 \, dx$.

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

(a) Express $2\cos x° - 3\sin x°$ in the form $k\cos(x+a)°$ where $k > 0$ and $0 \leq a < 360$.

(b) Hence solve $2\cos x° - 3\sin x° = 3$ for $0 \leq x < 360$.