National 5 Mathematics

Trigonometry - **Solutions** - 2014-2019

Marks are indicated in brackets after each question number

2014 Paper 1 Question 10, (2)

The graph has been stretched vertically by a factor of 3 so $a = 3$

The graph has been moved to the right by $40°$ so $b = -40$

2014 Paper 2 Question 12, (3)

$11\cos x° - 2 = 3$

$11\cos x° = 5$

$\cos x° = \frac{5}{11}$

$x = cos^{-1}\left(\frac{5}{11}\right) = 63°$

Second solution is $360 - 63 = 297°$

2015 Paper 1 Question 6, (2)

Since the amplitude is 4, $a = 4$

Since there are 3 copies of the Sine graph in $0 \leq x \leq 360°$, $b = 3$

2015 Paper 1 Question 7, (1) (1) (1)

a) i) $a = -2$

ii) $b = -4$

b) $x = -4$

2015 Paper 1 Question 9, (2)

$\cos 90° = 0$

$\cos 100° < 0$ from inspection of the graph

$\cos 300° > 0$ from inspection of the graph

So, $\cos 100° < \cos 90° < \cos 300°$

2016 Paper 1 Question 11, (2)

$tan^2 x \, cos^2 x$

Use $\tan x = \frac{\sin x}{\cos x}$ to give

$$\left(\frac{\sin x}{\cos x}\right)^2 cos^2 x$$

$$= \frac{sin^2 x}{cos^2 x} \bullet cos^2 x$$

$sin^2 x$

2016 Paper 2 Question 14, (3)

$2\tan x + 5 = -4$

$2\tan x = -9$

$\tan x = -4.5$

$x = tan^{-1}(-4.5)$

$x = 77$

Using CAST we have

$x = 180 - 77 = 103°$

$x = 360 - 77 = 283°$

2017 Paper 2 Question 15, (1) (1) (4)

a) $h = 40 + 23\cos x$

When $x = 60°$

$h = 40 + 23\cos 60°$

$= 51.5\ m$

b) Minimum height occurs where $x = 180°$

$h = 40 + 23\cos 180°$

$= 17\ m$

c) Let $h = 61$ to give

$61 = 40 + 23\cos x$

$\cos x = \frac{21}{23}$

$x = cos^{-1}\left(\frac{21}{23}\right) = 24°$

$x = 360 - 24 = 336°$

2018 Paper 1 Question 6, (2)

$y = 5\cos 4x$

$a = 5, b = 4$

2018 Paper 1 Question 10, (3)

$z^2 = x^2 + y^2 - 2xy\cos Z$

$= 8^2 + 10^2 - 2(8)(10)(\frac{1}{8})$

$= 164 - 20$

$= 144$

$z = 12$

So, $XY = 12$ cm

2018 Paper 1 Question 12, (1)

Sketch the graph of $y = \cos x$

Mark on a horizontal line through 0.5

The line passes through the graph where $x = 60$

From the symmetry of the graph, $\cos 240° = -0.5$

Or use a CAST diagram

2018 Paper 1 Question 18, (2)

$\sin x \cos x \tan x$

Substitute $\tan x = \frac{\sin x}{\cos x}$ to give

$\sin x \cos x \frac{\sin x}{\cos x}$

$= \sin x \sin x$

$= sin^2 x$

2018 Paper 2 Question 8, (3)

$7\sin x + 2 = 3$

$$\sin x = \frac{1}{7}$$

$$x = sin^{-1}\left(\frac{1}{7}\right) = 8.2°$$

From CAST diagram

$x = 180 - 8.2 = 171.8°$

2018 Paper 2 Question 17, (5)

Area of Triangle $= \frac{1}{2}(38)(55)\sin 75$

$$= 1009.39\ cm^2$$

Area of Sector $= \frac{75}{360}\ x\ \pi\ x\ 60$

$$= 39.27\ cm^2$$

Shaded Area $= 1009.39 - 39.27$

$$= 970.12\ cm^2$$

2019 Paper 1 Question 13, (2)

$x-$co-ordinate of $A = 180 - 45 = 135$

$y-$co-ordinate of $A = -1\ x\ 3 = -3$

Co-ordinates of $A = (135,\ -3)$

2019 Paper 2 Question 7, (3)

The smallest angle is at vertex Z

Using the Cosine Rule gives

$$Cos\, Z = \frac{8.5^2 + 7.2^2 - 6.3^2}{2\,(8.5)\,(7.2)}$$

$$= \frac{84.4}{122.4}$$

$$Z = cos^{-1}\left(\frac{84.4}{122.4}\right)$$

$$= 46.4°$$

2019 Paper 2 Question 14, (3)

$$5\cos x + 2 = 1$$

$$5\cos x = -1$$

$$\cos x = -\frac{1}{5}$$

$$\cos x = -\ 0.2$$

$$cos^{-1}(0.2) = 78°$$

From CAST solutions lie in quadrants 2 & 3, giving

$$x = 180 - 78 = 102°$$

$$x = 180 + 78 = 258°$$

2019 Paper 2 Question 17, (2)

$$(\sin x + \cos x)^2 = (\sin x + \cos x)(\sin x + \cos x)$$

$$= sin^2 x + 2\sin x \cos x + cos^2 x$$

$$= sin^2 x + cos^2 x + 2\sin x \cos x$$

[$sin^2 x + cos^2 x = 1$ from Trig Identities]

$$= 2\sin x \cos x + 1$$