National 5 Mathematics

Trigonometry - **Solutions** - 2014-2017

Marks are indicated in brackets after each question number

2014 Paper 1 Question 5, (3)

Using the Sine Rule gives

$$\frac{k}{\sin K} = \frac{l}{\sin L}$$

$$\frac{LM}{0.4} = \frac{18}{0.9}$$

$$LM = 0.4\ x\ \frac{18}{0.9}$$

$$LM = 0.4\ x\ 20$$

$$LM = 8$$

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 10, (3) (2)

a) Using the Cosine Rule, we have

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$= \frac{11^2 + 8^2 - 13^2}{2x11x8}$$

$$= 0.09\ldots.$$

$$B = cos^{-1}(0.09\ldots) = 85°$$

b) Extending the line AB gives 'F' angles with the two North lines, with the 'F' angles being 60° 120°

So, shaded angle $= 360 - 85 - 120 = 155^\circ$

2014 Paper 2 Question 12, (3)

$11\cos x^\circ - 2 = 3$

$11\cos x^\circ = 5$

$\cos x^\circ = \frac{5}{11}$

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

Second solution is $360 - 63 = 297^\circ$

2015 Paper 1 Question 6, (2)

Since the amplitude is 4, $a = 4$

Since there are 3 copies of the Sine graph is $0 \leq x \leq 360^\circ$, $b = 3$

2015 Paper 1 Question 9, (2)

$\cos 90^\circ = 0$

$\cos 100^\circ < 0$ from inspection of the graph

$\cos 300^\circ > 0$ from inspection of the graph

So, $\cos 100^\circ < \cos 90^\circ < \cos 300^\circ$

2015 Paper 2 Question 3, (3)

Using the Cosine Rule gives

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$(AB)^2 = 1.35^2 + 1.2^2 - 2\ x\ 1.2\ x\ 1.35\ x\cos 35$$

$$(AB)^2 = 0.613\ldots$$

$$AB = 0.78$$

So, $AB = 0.78\ km$

2015 Paper 2 Question 13, (4)

$$PQR = 180 - 128 = 56°$$

$$QRP = 180 - \left(52 + 72\right) = 56°$$

Using the Sine Rule gives

$$\frac{q}{\sin Q} = \frac{r}{\sin R}$$

$$\frac{q}{\sin 52°} = \frac{25}{\sin 56°}$$

$$q = \frac{25\sin 52°}{\sin 56°} = 23.67$$

So, distance is 23.67 km

2016 Paper 1 Question 11, (2)

$tan^2x\ cos^2x$

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

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

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

$$= sin^2x$$

2016 Paper 2 Question 8, (3)

Using the Sine Rule gives

$$\frac{\sin x}{150} = \frac{\sin 66}{140}$$

$$\sin x = \frac{\sin 66}{140}\ x\ 150$$

$$\sin x = 0.978\ .\ .\ .$$

$$x = sin^{-1}(0.978\ldots)$$

$$x = 78.2°$$

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

$x = 180 - 77 = 103°$

$x = 360 - 77 = 283°$

2016 Paper 2 Question 16, (4)

Using Pythagoras gives $DE = \sqrt{4^2 - 3^2} = \sqrt{7}$

Using the Sine Rule on ADE gives

$$\frac{\sin A}{a} = \frac{\sin E}{e}$$

$$\frac{\sin A}{\sqrt{7}} = \frac{\sin 90}{4}$$

$$\sin A = \frac{\sqrt{7}\sin 90}{4}$$

$$= 0.661\ldots$$

$$A = sin^{-1}(0.661\ldots)$$

$$= 41°$$

2017 Paper 1 Question 7, (2)

$$\text{Area} = \frac{1}{2} df \sin E$$

$$= \frac{1}{2} x\ 12\ x\ 8\ x \frac{2}{3}$$

$$= 32\ cm^2$$

2017 Paper 2 Question 10, (4)

$EDF = 126 - 90 = 36°$

$DEF = 360 - 230 - 90 = 40°$

$DFE = 180 - 36 - 40 = 104°$

Using the Sine Rule gives

$$\frac{f}{\sin F} = \frac{e}{\sin E}$$

$$\frac{15}{\sin 104} = \frac{DF}{\sin 40}$$

$$DF = \frac{15\sin 40}{\sin 104}$$

$$DF = 9.9$$

Distance $= 9.9\ km$

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

$$61 = 40 + 23\cos x$$

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

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

$$x = 360 - 24 = 336°$$