



National 5 Mathematics

Using Trigonometry - Solutions

Marks are indicated in brackets after each question number

2014 Paper 1 Question 5, (3)

Using the Sine Rule gives

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

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

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

$$LM = 0.4 \times 20$$

$$LM = 8$$

2014 Paper 2 Question 10, (3) (2)

a) Using the Cosine Rule, we have

$$\begin{aligned}\cos B &= \frac{a^2 + c^2 - b^2}{2ac} \\ &= \frac{11^2 + 8^2 - 13^2}{2 \times 11 \times 8} \\ &= 0.09 \dots\end{aligned}$$

$$\begin{aligned}B &= \cos^{-1}(0.09 \dots) \\ &= 85^\circ.\end{aligned}$$

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

$$\text{So, shaded angle} = 360 - 85 - 120 = 155^\circ.$$



2015 Paper 2 Question 3, (3)

Using the Cosine Rule gives

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

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

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

$$AB = 0.78$$

So, $AB = 0.78 \text{ km}$.

2015 Paper 2 Question 13, (4)

$$PQR = 180 - 128 = 56^\circ$$

$$QRP = 180 - (52 + 72) = 56^\circ$$

Using the Sine Rule gives

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

$$\frac{q}{\sin 52^\circ} = \frac{25}{\sin 56^\circ}$$

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

So, the distance is 23.67 km.

2016 Paper 2 Question 8, (3)

Using the Sine Rule gives

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

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

$$\sin x = 0.978 \dots$$

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

$$x = 78.2^\circ$$

2016 Paper 2 Question 16, (4)

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

Using the Sine Rule on ADE gives



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

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

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

$$= 0.661 \dots$$

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

$$= 41^\circ.$$

2017 Paper 1 Question 7, (2)

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

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

$$= 32 \text{ cm}^2.$$

2017 Paper 2 Question 10, (4)

$$EDF = 126 - 90 = 36^\circ$$

$$DEF = 360 - 230 - 90 = 40^\circ$$

$$\text{So, } DFE = 180 - 36 - 40 = 104^\circ.$$

Using the Sine Rule gives

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

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

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

$$DF = 9.9$$

$$\text{Distance} = 9.9 \text{ km.}$$

**2018 Paper 1 Question 10, (3)**

$$\begin{aligned}z^2 &= x^2 + y^2 - 2xy \cos Z \\&= 8^2 + 10^2 - 2(8)(10)\left(\frac{1}{8}\right) \\&= 164 - 20 \\&= 144 \\z &= 12\end{aligned}$$

So, $XY = 12$ cm.

2018 Paper 2 Question 9, (3)

Using the Sine Rule gives

$$\begin{aligned}\frac{20}{\sin 37} &= \frac{DC}{\sin 105} \\DC &= \frac{20 \sin 105}{\sin 37} \\&= 32 \text{ cm}\end{aligned}$$

2018 Paper 2 Question 13, (4)

$$\begin{aligned}\cos T &= \frac{5.6^2 + 10.3^2 - 7.2^2}{2 \times 5.6 \times 10.3} \\&= \frac{85.61}{115.36} \\&= 0.742 \dots \\T &= \cos^{-1}(0.742 \dots) \\&= 42^\circ\end{aligned}$$

$$\begin{aligned}\text{Bearing} &= 240 + 42 \\&= 282^\circ.\end{aligned}$$

2018 Paper 2 Question 17, (5)

$$\begin{aligned}\text{Area of Triangle} &= \frac{1}{2}(38)(55) \sin 75 \\&= 1009.39 \text{ cm}^2.\end{aligned}$$

$$\begin{aligned}\text{Area of Sector} &= \frac{75}{360} \times \pi \times 60 \\&= 39.27 \text{ cm}^2.\end{aligned}$$



$$\begin{aligned}\text{Shaded Area} &= 1009.39 - 39.27 \\ &= 970.12 \text{ cm}^2.\end{aligned}$$

2019 Paper 2 Question 3, (2)

$$\begin{aligned}\text{Area} &= \frac{1}{2} \times 45 \times 70 \times \sin 129^\circ \\ &= 1,224 \text{ cm}^2.\end{aligned}$$

2019 Paper 2 Question 7, (3)

The smallest angle is at vertex Z.

Using the Cosine Rule gives

$$\begin{aligned}\cos Z &= \frac{8.5^2 + 7.2^2 - 6.3^2}{2(8.5)(7.2)} \\ &= \frac{84.4}{122.4} \\ Z &= \cos^{-1}\left(\frac{84.4}{122.4}\right) \\ &= 46.4^\circ\end{aligned}$$

2022 Paper 1 Question 9, (2)

$$\begin{aligned}\cos B &= \frac{a^2 + c^2 - b^2}{2ac} \\ \cos B &= \frac{3^2 + 7^2 - 5^2}{2(3)(7)} \\ \cos B &= \frac{9 + 49 - 25}{42} \\ \cos B &= \frac{9 + 49 - 25}{42} \\ \cos B &= \frac{33}{42}\end{aligned}$$

2022 Paper 2 Question 6, (2)

$$\begin{aligned}\text{Area} &= \frac{1}{2} gh \sin F \\ &= \frac{1}{2} \times 32 \times 25 \times \sin 58 \\ &= 339.2 \text{ cm}^2\end{aligned}$$



2022 Paper 2 Question 14, (5)

Start by making all of the angles in the triangle ACD .

$$\text{Angle at } C = 180 - 28 = 152^\circ$$

$$\text{Angle at } A = 180 - (152 + 12) = 16^\circ$$

Using the Sine Rule on triangle ACD gives

$$\frac{a}{\sin A} = \frac{d}{\sin D}$$

$$\frac{15}{\sin 16} = \frac{d}{\sin 12}$$

$$d = \frac{15 \sin 12}{\sin 16} = 11.3 \text{ m}$$

Next, make all of the angles in the triangle ABC .

$$\text{Angle at } A = 180 - (90 + 28) = 62^\circ$$

Using the Sine Rule on triangle ABC gives

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{a}{\sin 62} = \frac{11.3}{\sin 90}$$

$$a = \frac{11.3 \sin 62}{\sin 90}$$

$$a = 9.98 \text{ m}$$

2023 Paper 1 Question 6, (3)

Using the Cosine rule gives

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

$$c^2 = 6^2 + 5^2 - 2(6)(5)\left(\frac{1}{5}\right)$$

$$c^2 = 36 + 25 - 12$$

$$c^2 = 49$$

$$c = 7 \text{ m}$$



2023 Paper 2 Question 4, (3)

Using the Sine Rule gives

$$\frac{\sin J}{j} = \frac{\sin K}{k}$$

$$\frac{\sin 25}{7} = \frac{\sin K}{10}$$

$$\sin K = \frac{10 \sin 25}{7}$$

$$\sin K = 0.60374 \dots$$

$$K = \sin^{-1}(0.60374 \dots)$$

$$K = 37.1^\circ$$

$$JKL = 37.1^\circ$$

2023 Paper 2 Question 15, (4)

Use SOHCAHTOA on triangle ABC to give

$$\sin A = \frac{8}{18}$$

$$A = \sin^{-1}\left(\frac{8}{18}\right) = 26.4^\circ$$

Area of triangle ADE is given by

$$\begin{aligned} \text{Area} &= \frac{1}{2} de \sin A \\ &= \frac{1}{2} d \sin 26.4 \end{aligned}$$

Since the area of ADE is 160 we have

$$\frac{1}{2} d(24) \sin 26.4 = 160$$

Multiply both sides by 2 to give

$$24 \sin 26.4 d = 320$$

Rearranging gives

$$d = \frac{320}{24 \sin 26.4}$$

$$d = 30 \text{ cm}$$

So, $AE = 30 \text{ cm}$