AS
MATHS
Trigonometry (Topic E)

Total number of marks: 39

1 State the number of solutions to the equation $\tan 4\theta = 1$ for $0° < \theta < 180°$

Circle your answer.

[1 mark]

1 2 4 8

3 It is given that $\sin\theta = -0.1$ and $180° < \theta < 270°$

Find the exact value of $\cos\theta$

[2 marks]

3 State the interval for which $\sin x$ is a decreasing function for $0° \leq x \leq 360°$

[2 marks]

3 Jia has to solve the equation

$$2 - 2\sin^2\theta = \cos\theta$$

where $-180° \leq \theta \leq 180°$

Jia's working is as follows:

$$2 - 2(1 - \cos^2\theta) = \cos\theta$$
$$2 - 2 + 2\cos^2\theta = \cos\theta$$
$$2\cos^2\theta = \cos\theta$$
$$2\cos\theta = 1$$
$$\cos\theta = 0.5$$
$$\theta = 60°$$

Jia's teacher tells her that her solution is incomplete.

3 (a) Explain the **two** errors that Jia has made.

[2 marks]

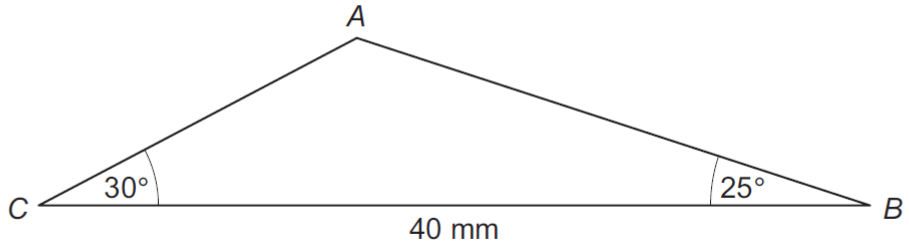
3 (b) Write down all the values of θ that satisfy the equation

$$2 - 2\sin^2\theta = \cos\theta$$

where $-180° \leq \theta \leq 180°$

[2 marks]

5 A triangular prism has a cross section *ABC* as shown in the diagram below.



Angle $ABC = 25°$

Angle $ACB = 30°$

$BC = 40$ millimetres.

The length of the prism is 300 millimetres.

Calculate the volume of the prism, giving your answer to three significant figures.

[4 marks]

4 Find all the solutions of

$$9\sin^2 x - 6\sin x + \cos^2 x = 0$$

where $0° \leq x \leq 180°$

Give your solutions to the nearest degree.

Fully justify your answer.

[4 marks]

4 Solve the equation $\tan^2 2\theta - 3 = 0$ giving all the solutions for $0° \leq \theta \leq 360°$

[4 marks]

10 On 18 March 2019 there were 12 hours of daylight in Inverness.

On 16 June 2019, 90 days later, there will be 18 hours of daylight in Inverness.

Jude decides to model the number of hours of daylight in Inverness, N, by the formula

$$N = A + B\sin t°$$

where t is the number of days after 18 March 2019.

10 (a) (i) State the value that Jude should use for A.

[1 mark]

10 (a) (ii) State the value that Jude should use for B.

[1 mark]

10 (a) (iii) Using Jude's model, calculate the number of hours of daylight in Inverness on 15 May 2019, 58 days after 18 March 2019.

[1 mark]

10 (a) (iv) Using Jude's model, find how many days during 2019 will have at least 17.4 hours of daylight in Inverness.

[4 marks]

10 (a) (v) Explain why Jude's model will become inaccurate for 2020 and future years.

[1 mark]

10 (b) Anisa decides to model the number of hours of daylight in Inverness with the formula

$$N = A + B\sin\left(\frac{360}{365}t\right)^\circ$$

Explain why Anisa's model is better than Jude's model.

[1 mark]

6 (a) (i) Show that $\cos\theta = \frac{1}{2}$ is one solution of the equation

$$6\sin^2\theta + 5\cos\theta = 7$$

[2 marks]

6 (a) (ii) Find all the values of θ that solve the equation

$$6\sin^2\theta + 5\cos\theta = 7$$

for $0^\circ \leq \theta \leq 360^\circ$

Give your answers to the nearest degree.

[2 marks]

6 (b) Hence, find all the solutions of the equation

$$6\sin^2 2\theta + 5\cos 2\theta = 7$$

for $0^\circ \leq \theta \leq 360^\circ$

Give your answers to the nearest degree.

[2 marks]

9 It is given that $\cos 15^\circ = \frac{1}{2}\sqrt{2+\sqrt{3}}$ and $\sin 15^\circ = \frac{1}{2}\sqrt{2-\sqrt{3}}$

Show that $\tan^2 15^\circ$ can be written in the form $a + b\sqrt{3}$, where a and b are integers.

Fully justify your answer.

[3 marks]