

A Level Maths Pure 2: Trigonometry, Sequences and Vectors Practice Exam: Mark Scheme

Pearson Edexcel A Level Mathematics (9MA0) · 22 questions · 60 marks

- M marks are for a correct method; A marks for an accurate answer that follows a correct method; B marks are independent of method.
- Accept any correct method that reaches a correct answer, unless the question says which method to use.
- Practise these topics online with instant feedback: alevelmathrevision.com/alevel-frontend/alevel-unit.html?course=uk&unit=2

Question 1

2 marks

M1 $x = \ln 7$

A1 $x = 1.95$

Final answer: $x = \ln 7 = 1.95$

Question 2

2 marks

B1 The period of $y = \sin\left(\frac{x}{2}\right)$ is 720° , so the interval is exactly one cycle

B1 In one cycle the curve goes below $y = 0$ once and crosses the line $y = -0.4$ twice: exactly two solutions

Final answer: one full cycle (period 720°), which crosses $y = -0.4$ twice

Question 3

2 marks

M1 Difference of two squares: $(\sin^2 x - \cos^2 x)(\sin^2 x + \cos^2 x)$

A1* $\sin^2 x + \cos^2 x = 1$, giving $\sin^2 x - \cos^2 x$

Final answer: proof: $(\sin^2 x - \cos^2 x)(\sin^2 x + \cos^2 x) = \sin^2 x - \cos^2 x$

Question 4

2 marks

M1 $\sec^2 x - 1 = \tan^2 x$, so the expression is $\tan^2 x \cos^2 x$

A1* $= \frac{\sin^2 x}{\cos^2 x} \times \cos^2 x = \sin^2 x$

Final answer: shown: $\tan^2 x \cos^2 x = \sin^2 x$

Question 5

2 marks

M1 Let $\theta = \arccos \frac{1}{3}$, so $\cos \theta = \frac{1}{3}$ with $0 \leq \theta \leq \pi$, and $\sin \theta \geq 0$

A1 $\sin \theta = \sqrt{1 - \frac{1}{9}} = \frac{2\sqrt{2}}{3}$

Final answer: $\frac{2\sqrt{2}}{3}$



Question 6**2 marks**

M1 $3^{x-2} = 3^x \times 3^{-2}$

A1 $= \frac{1}{9} \times 3^x$: a stretch parallel to the y -axis, scale factor $\frac{1}{9}$

Final answer: scale factor $\frac{1}{9}$

Question 7**2 marks**

M1 $\log_a \left(\frac{1}{x} \right) = \log_a 1 - \log_a x$ (or $\log_a x^{-1}$)

A1* $\log_a 1 = 0$, so $= -\log_a x$

Final answer: proof: $\log_a 1 - \log_a x = -\log_a x$

Question 8**2 marks**

M1 $y = e^{3 \ln x - 2} = e^{\ln x^3} e^{-2}$

A1 $y = e^{-2} x^3$

Final answer: $y = e^{-2} x^3$

Question 9**3 marks**

B1 The largest angle is opposite the 9 cm side

M1 $\cos \theta = \frac{5^2 + 7^2 - 9^2}{2 \times 5 \times 7} = -\frac{7}{70} = -0.1$

A1 $\theta = 95.7^\circ$

Final answer: 95.7°

Question 10**3 marks**

B1 Each triangle has two sides of 5 cm with an angle of $\frac{360^\circ}{5} = 72^\circ$ between them

M1 Area $= 5 \times \frac{1}{2} \times 5 \times 5 \times \sin 72^\circ$

A1 59.4 cm^2

Final answer: 59.4 cm^2

Question 11**3 marks**

M1 Sector area $= \frac{1}{2} \times 36 \times \frac{\pi}{3} = 6\pi$

M1 Triangle $OAB = \frac{1}{2} \times 36 \times \sin \frac{\pi}{3} = 9\sqrt{3}$, and subtracts

A1 $6\pi - 9\sqrt{3} \text{ cm}^2$

Final answer: $6\pi - 9\sqrt{3} \text{ cm}^2$



Question 12**3 marks**

M1 $x - 40^\circ = 60^\circ \text{ or } 300^\circ \text{ (for } -40^\circ \leq x - 40^\circ < 320^\circ \text{)}$

A1 $x = 100^\circ$

A1 $x = 340^\circ$

Final answer: $x = 100^\circ, 340^\circ$

Question 13**3 marks**

M1 $\sin x \cos 30^\circ + \cos x \sin 30^\circ + \cos x \cos 60^\circ - \sin x \sin 60^\circ$

M1 $\frac{\sqrt{3}}{2} \sin x + \frac{1}{2} \cos x + \frac{1}{2} \cos x - \frac{\sqrt{3}}{2} \sin x$

A1* $= \cos x$

Final answer: proof: the $\sin x$ terms cancel and the $\cos x$ terms add to $\cos x$

Question 14**3 marks**

M1 $1 - \cos 2x = 2 \sin^2 x$

M1 $\sin 2x = 2 \sin x \cos x$

A1* $\frac{2 \sin^2 x}{2 \sin x \cos x} = \frac{\sin x}{\cos x} = \tan x$

Final answer: proof: $\frac{2 \sin^2 x}{2 \sin x \cos x} = \tan x$

Question 15**3 marks**

M1 $\cos 2\theta \approx 1 - 2\theta^2$, so $1 - \cos 2\theta \approx 2\theta^2$

M1 $\theta \tan \theta \approx \theta^2$

A1* $\frac{2\theta^2}{\theta^2} = 2$

Final answer: shown: $\frac{2\theta^2}{\theta^2} = 2$

Question 16**3 marks**

M1 $x \ln 7 = \ln 2 + x \ln 5$

M1 $x = \frac{\ln 2}{\ln 7 - \ln 5} = \frac{\ln 2}{\ln 1.4}$

A1 $x = 2.06$

Final answer: $x = 2.06$

Question 17**3 marks**

M1 $e^{-8k} = \frac{1}{2}$

A1 $k = \frac{\ln 2}{8}$

A1 $k = 0.0866$

Final answer: $k = \frac{\ln 2}{8} = 0.0866$



Question 18**3 marks**

M1 $\vec{AB} = 3\mathbf{i} + 6\mathbf{j}, \vec{BC} = 2\mathbf{i} + 4\mathbf{j}$

M1 $\vec{BC} = \frac{2}{3}\vec{AB}$, so they are parallel

A1* They share the point B , so A, B and C are collinear

Final answer: $\vec{BC} = \frac{2}{3}\vec{AB}$ with B in common: collinear

Question 19**3 marks**

M1 $g(0) = 1, g(1) = -1$

M1 $g(3) = -1, g(4) = 4$

A1 Both intervals show a change of sign and g is continuous, so there is a root in each

Final answer: $g(0) = 1, g(1) = -1; g(3) = -1, g(4) = 4$: changes of sign, g continuous

Question 20**3 marks**

B1 $x_1 = 2.41, x_2 = 3.8081$

M1 $g'(x) = 2x$, so $g'(2) = 4$

A1 $|g'(2)| > 1$: the terms move away from the root in a diverging staircase

Final answer: $x_1 = 2.41, x_2 = 3.8081; g'(2) = 4 > 1$, so it diverges

Question 21**4 marks**

M1 $\tan^2 x - 3 \tan x + 2 = 0$

M1 $(\tan x - 1)(\tan x - 2) = 0$

A1 $x = 45^\circ, 225^\circ$

A1 $x = 63.4^\circ, 243.4^\circ$

Final answer: $x = 45^\circ, 63.4^\circ, 225^\circ, 243.4^\circ$

Question 22**4 marks**

B1 (a) $6x = x^2 + 2$, divided by 6

M1 (b) $x_1 = \frac{0.25 + 2}{6} = 0.375$

A1 $x_2 = 0.3568$

A1 $x_3 = 0.3545$

Final answer: (a) shown (b) $x_1 = 0.375, x_2 = 0.3568, x_3 = 0.3545$

End of mark scheme · More free exams: alevelmathrevision.com/alevel-frontend/free-practice-exams

