

Section A - Answers

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|---|---|---|---|
| 1 | D | 2 | B |
| 5 | A | 6 | C |
| 3 | B | 7 | B |
| 4 | A | 8 | A |

2 marks each (16 marks)

Section B - Marking Scheme

| | Give 1 mark for each • | Illustration(s) for awarding each mark |
|-------------|---|--|
| 9(a) | <p>ans: $k = 8$ (4 marks)</p> <ul style="list-style-type: none"> •¹ knows scalar product = 0 •² finds \vec{QP} and \vec{QR} •³ finds scalar product •⁴ solves for k | <ul style="list-style-type: none"> •¹ evidence •² $\vec{QP} = \begin{pmatrix} 3 \\ -2 \\ 5 \end{pmatrix}; \vec{QR} = \begin{pmatrix} k \\ 2 \\ -4 \end{pmatrix}$ •³ $3k - 4 - 20 = 0$ •⁴ $k = 8$ |
| (b) | <p>ans: 19.4° (6 marks)</p> <ul style="list-style-type: none"> •¹ finds S •² finds \vec{PS} and \vec{PR} •³ finds magnitudes of \vec{PS} and \vec{PR} •⁴ finds scalar product •⁵ subs values into formula •⁶ finds angle | <ul style="list-style-type: none"> •¹ S(4,7,-8) •² $\vec{PS} = \begin{pmatrix} 1 \\ 3 \\ -7 \end{pmatrix}; \vec{PR} = \begin{pmatrix} 5 \\ 4 \\ -9 \end{pmatrix}$ •³ $\vec{PS} = \sqrt{59}; \vec{PR} = \sqrt{122}$ •⁴ $5 + 12 + 63 = 80$ •⁵ $\cos\theta = \frac{80}{\sqrt{59}\sqrt{122}}$ •⁶ 19.4° |
| 10 | <p>ans: 400 seconds (5 marks)</p> <ul style="list-style-type: none"> •¹ subs values into formula •² takes natural logs of both sides •³ releases power •⁴ finds expression for t •⁵ answer correctly rounded | <ul style="list-style-type: none"> • $0.7 = e^{-0.0009t}$ •² $\ln 0.7 = \ln e^{-0.0009t}$ •³ $\ln 0.7 = -0.0009t \ln e$ •⁴ $t = \frac{\ln 0.7}{-0.0009}$ •⁵ 400 seconds |
| | | |

| | Give 1 mark for each • | Illustration(s) for awarding each mark |
|--------------|--|---|
| 11(a) | ans: $4\sin(x + 48 \cdot 6)^\circ$ (5 marks) <ul style="list-style-type: none"> •¹ expands and finds values of $\sin x^\circ$ and $\cos x^\circ$ •² evaluates k •³ finds value of $\tan a^\circ$ •⁴ finds angle •⁵ writes expression in appropriate form | <ul style="list-style-type: none"> •¹ $k \sin a^\circ = 3$; $k \cos a^\circ = \sqrt{7}$ •² $k = \sqrt{9+7} = 4$ •³ $\tan a^\circ = \frac{3}{\sqrt{7}}$ •⁴ $a = 48 \cdot 6$ •⁵ $4\sin(x + 48 \cdot 6)^\circ$ |
| (b) | ans: 5 (1 mark) <ul style="list-style-type: none"> •¹ answer | <ul style="list-style-type: none"> •¹ $20/4 = 5$ |
| 12(a) | ans: proof (2 marks) <ul style="list-style-type: none"> •¹ expression for U_1 •² expression for U_2 and rearranges to answer | <ul style="list-style-type: none"> •¹ $U_1 = 16a + 8$ •² $U_2 = a(16a + 8) + 8 = 16a^2 + 8a + 8$ $= 8(2a^2 + a + 1)$ |
| (b) | ans: $a = \frac{1}{4}$ (3 marks) <ul style="list-style-type: none"> •¹ equates to 11 •² simplifies and factorises •³ solves and discards | <ul style="list-style-type: none"> •¹ $8(2a^2 + a + 1) = 11$ •² $16a^2 + 8a - 3 = (4a - 1)(4a + 3) = 0$ •³ $a = \frac{1}{4} \left(-\frac{3}{4}\right)$ |
| 13 | ans: $-\frac{1}{2}$ (5 marks) <ul style="list-style-type: none"> •¹ differentiates 1st term •² differentiates 2nd term •³ subs angle into derivative •⁴ starts to evaluate •⁵ completes evaluation | <ul style="list-style-type: none"> •¹ $h'(x) = 4\cos 2x \dots\dots$ •² $\dots\dots + 2\sqrt{3}\cos x \sin x$ •³ $h'\left(\frac{\pi}{3}\right) = 4\cos\left(\frac{2\pi}{3}\right) + 2\sqrt{3}\cos\left(\frac{\pi}{3}\right)\sin\left(\frac{\pi}{3}\right)$ •⁴ $h'\left(\frac{\pi}{3}\right) = 4 \times -\frac{1}{2} + 2\sqrt{3} \times \frac{1}{2} \times \frac{\sqrt{3}}{2}$ •⁵ $h'\left(\frac{\pi}{3}\right) = -2 + \frac{3}{2} = -\frac{1}{2}$ |
| 14 | ans: $x = 1 \cdot 25$ (3 marks) <ul style="list-style-type: none"> •¹ write LHS as single log •² remove log from LHS •³ solve for x | <ul style="list-style-type: none"> •¹ $\log_3 4(x+1) = 2$ •² $4(x+1) = 3^2 = 9$ •³ $x = 1 \cdot 25$ |

Sect. B (34 marks)

16 + 34 Total: 50 marks