Higher Grade Paper - Unit 3 Mini-Prelim 3   (Answers + Marking Scheme)

Section A - Answers

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

2 marks each (16 marks)

Section B - Marking Scheme

	Give 1 mark for each •	Illustration(s) for awarding each mark
9(a)	**ans:** **Q(2, 11, – 2)** **(3 marks)** •^{1} knows to use section formula •^{2} uses section formula correctly •^{3} states coordinates of D	•^{1} evidence •^{2} $\dfrac{1}{3}\begin{pmatrix} 6 \\ 33 \\ -6 \end{pmatrix} = \begin{pmatrix} 2 \\ 11 \\ -2 \end{pmatrix}$ •^{3} Q(2, 11, – 2)
(b)	**ans:** **proof** **(4 marks)** •^{1} knows condition for perp. vectors •^{2} finds $\overrightarrow{QS}$ •^{3} finds $\overrightarrow{QR}$ •^{4} finds scalar product	•^{1} if SQR is right – angled scalar prod. = 0 •^{2} $\overrightarrow{QS} = \begin{pmatrix} 1 \\ 2 \\ 6 \end{pmatrix}$ •^{3} $\overrightarrow{QR} = \begin{pmatrix} 4 \\ -8 \\ 2 \end{pmatrix}$ •^{4} $4 - 16 + 12 = 0$ so right angle
10	**ans:** **2** **(5 marks)** •^{1} prepares to integrate •^{2} integrates •^{3} simplifies •^{4} substitutes values •^{5} answer	•^{1} $\int_{0}^{1} 6(3 - 2x)^{-2}\,dx$ •^{2} $\dfrac{6(3 - 2x)^{-1}}{-1} \times \dfrac{1}{-2}$ •^{3} $\left[\dfrac{3}{3 - 2x} \right]_{0}^{1}$ •^{4} $\left[\dfrac{3}{3 - 2(1)} \right] - \left[\dfrac{3}{(3 - 2(0))} \right]$ •^{5} $3 - 1 = 2$

	Give 1 mark for each •	**Illustration(s) for awarding each mark**
11	**ans: 69·2°, 327·6°** **(6 marks)**	
	•[1] recognises wave form	•[1] evidence [eg. $k\cos(x-\alpha) = k\cos x \cos\alpha + k\sin x \sin\alpha$]
	•[2] finds k	•[2] $k = \sqrt{10}$
	•[3] finds α	•[3] $\tan\alpha = \dfrac{1}{3}$; $\alpha = 18\cdot4°$ Quadrant I
	•[4] equates to 2	•[4] $\sqrt{10}\cos(x-18\cdot4)° = 2$
	•[5] finds 1st value	•[5] $x = 69\cdot2°$
	•[6] finds 2nd value	•[6] $x = 327\cdot6°$
12	**ans: (− 1, 4)** **(4 marks)**	
	•[1] knows to find derivative	•[1] $\dfrac{dy}{dx} = 3x^2 - 2x - 4$
	•[2] equates derivative to 1	•[2] $3x^2 - 2x - 4 = 1$
	•[3] solves for x and states correct x	•[3] $(3x-5)(x+1) = 0$; $x = -1$
	•[4] subs value and states coords.	•[4] $(-1)^3 - (-1)^2 - 4(-1) + 2 = 4$; $(-1, 4)$
13(a)	**ans: proof** **(3 marks)**	
	•[1] finds scalar product	•[1] $\mathbf{a}\cdot\mathbf{b} = 24 + 0 + 0 = 24$
	•[2] finds magnitude of both vectors	•[2] $|\mathbf{a}| = \sqrt{20}$; $|\mathbf{b}| = \sqrt{45}$
	•[3] substitutes in formula and simplifies	•[3] $\dfrac{24}{\sqrt{20}\,\sqrt{45}}$
(b)	**ans: $\dfrac{7}{25}$** **(2 marks)**	
	•[1] chooses replacement for $\cos 2\theta$ and subs	•[1] $\cos 2\theta = 2\cos^2\theta - 1 = 2(\dfrac{4}{5})^2 - 1$
	•[2] answer	•[2] $\dfrac{7}{25}$

Give 1 mark for each	Illustration(s) for awarding each mark

14(a)   **ans:**   **– 0·00045**   **(5 marks)**

- $\bullet^1$ substitutes into formula
- $\bullet^2$ takes natural logs of both sides
- $\bullet^3$ releases power
- $\bullet^4$ evaluates for k
- $\bullet^5$ correct rounding

- $\bullet^1$ $0 \cdot 8 = e^{500k}$
- $\bullet^2$ $\log_e 0 \cdot 8 = \log_e e^{500k}$
- $\bullet^3$ $\log_e 0 \cdot 8 = 500k \log_e e$
- $\bullet^4$ $k = \dfrac{\log_e 0 \cdot 8}{500}$
- $\bullet^5$ $-0 \cdot 000446 = -0 \cdot 00045$

(b)   **ans:**   **11% remains**   **(2 marks)**

- $\bullet^1$ substitutes into formula
- $\bullet^2$ evaluates

- $\bullet^1$ $m_t = 100e^{-0 \cdot 000446 \times 5000}$
- $\bullet^2$ 11

Sect. B   **(34 marks)**

$$16 \ + \ 34 \quad \text{Total: } 50 \text{ marks}$$