Higher Grade Paper - Unit 3 Mini-Prelim 2008/2009 (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	•[1] evidence
	•[2] uses section formula correctly	•[2] $\frac{1}{3}\begin{pmatrix}6\\33\\-6\end{pmatrix}=\begin{pmatrix}2\\11\\-2\end{pmatrix}$
	•[3] states coordinates of D	•[3] Q(2, 11, – 2)
(b)	**ans: proof (4 marks)**	
	•[1] knows condition for perp. vectors	•[1] if SQR is right – angled scalar prod. = 0
	•[2] finds $\overrightarrow{QS}$	•[2] $\vec{QS}=\begin{pmatrix}1\\2\\6\end{pmatrix}$
	•[3] finds $\overrightarrow{QR}$	•[3] $\vec{QR}=\begin{pmatrix}4\\-8\\2\end{pmatrix}$
	•[4] finds scalar product	•[4] $4-16+12=0$ so right angle
10	**ans: 2 (5 marks)**	
	•[1] prepares to integrate	•[1] $\int_0^1 6(3-2x)^{-2}dx$
	•[2] integrates	•[2] $\frac{6(3-2x)^{-1}}{-1}\times\frac{1}{-2}$
	•[3] simplifies	•[3] $\left[\frac{3}{(3-2x)}\right]_0^1$
	•[4] substitutes values	•[4] $\left[\frac{3}{(3-2(1))}\right]-\left[\frac{3}{(3-2(0)}\right]$
	•[5] answer	•[5] 3 – 1 = 2

	Give 1 mark for each •	Illustration(s) for awarding each mark
11	**ans: $69{\cdot}2^o$, $327{\cdot}6^o$ (6 marks)**	
	$\bullet^1$ recognises wave form	$\bullet^1$ evidence [eg. $k\cos(x-\alpha)=k\cos x\cos\alpha+k\sin x\sin\alpha$]
	$\bullet^2$ finds k	$\bullet^2$ $k=\sqrt{10}$
	$\bullet^3$ finds α	$\bullet^3$ $\tan\alpha=\frac{1}{3};\ \alpha=18\cdot4°$ Quadrant I
	$\bullet^4$ equates to 2	$\bullet^4$ $\sqrt{10}\cos(x-18\cdot4)°=2$
	$\bullet^5$ finds 1st value	$\bullet^5$ $x=69{\cdot}2^o$
	$\bullet^6$ finds 2nd value	$\bullet^6$ $x=327{\cdot}6^o$
12	**ans: (– 1, 4) (4 marks)**	
	$\bullet^1$ knows to find derivative	$\bullet^1$ $\frac{dy}{dx}=3x^2-2x-4$
	$\bullet^2$ equates derivative to 1	$\bullet^2$ $3x^2-2x-4=1$
	$\bullet^3$ solves for x and states correct x	$\bullet^3$ $(3x-5)(x+1)=0;\ x=-1$
	$\bullet^4$ subs value and states coords.	$\bullet^4$ $(-1)^3-(-1)^2-4(-1)+2=4$; (– 1, 4)
13(a)	**ans: proof (3 marks)**	
	$\bullet^1$ finds scalar product	$\bullet^1$ $\boldsymbol{a}\ .\ \boldsymbol{b}$ = 24 + 0 + 0 = 24
	$\bullet^2$ finds magnitude of both vectors	$\bullet^2$ $\lvert\boldsymbol{a}\rvert=\sqrt{20};\ \lvert\boldsymbol{b}\rvert=\sqrt{45}$
	$\bullet^3$ substitutes in formula and simplifies	$\bullet^3$ $\frac{24}{\sqrt{20}\sqrt{45}}$
(b)	**ans: $\frac{7}{25}$ (2 marks)**	
	$\bullet^1$ chooses replacement for $\cos2\theta$ and subs	$\bullet^1$ $\cos2\theta=2\cos^2\theta-1=2(\frac{4}{5})^2-1$
	$\bullet^2$ answer	$\bullet^2$ $\frac{7}{25}$

	Give 1 mark for each	Illustration(s) for awarding each mark
14(a)	**ans: – 0·00045 (5 marks)**	
	$\bullet^1$ substitutes into formula	$\bullet^1$ $0 \cdot 8 = e^{500k}$
	$\bullet^2$ takes natural logs of both sides	$\bullet^2$ $\log_e 0 \cdot 8 = \log_e e^{500k}$
	$\bullet^3$ releases power	$\bullet^3$ $\log_e 0 \cdot 8 = 500k \log_e e$
	$\bullet^4$ evaluates for k	$\bullet^4$ $k = \dfrac{\log_e 0 \cdot 8}{500}$
	$\bullet^5$ correct rounding	$\bullet^5$ $-0{\cdot}000446 = -0 \cdot 00045$
(b)	**ans: 11% remains (2 marks)**	
	$\bullet^1$ substitutes into formula	$\bullet^1$ $m_t = 100e^{-0{\cdot}000446 \times 5000}$
	$\bullet^2$ evaluates	$\bullet^2$ 11
		Sect. B (34 marks)
		16 + 34 Total: 50 marks