

Higher Grade Paper - Unit 3 Mini-Prelim 2007/2008 (Answers + Marking Scheme)

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

2 marks each (16 marks)

Section B - Marking Scheme

	Give 1 mark for each •	Illustration(s) for awarding each mark
9(a)	ans: D(10,1,-6) (3 marks)	
	<ul style="list-style-type: none"> •¹ knows to use section formula •² uses section formula correctly •³ states coordinates of D 	<ul style="list-style-type: none"> •¹ evidence •² $\frac{1}{3} \begin{pmatrix} 30 \\ 3 \\ -18 \end{pmatrix} = \begin{pmatrix} 10 \\ 1 \\ -6 \end{pmatrix}$ •³ D(10,1,-6)
(b)	ans: 117.7° (5 marks)	
	<ul style="list-style-type: none"> •¹ construct appropriate vectors •² strategy of $\cos \theta = \dots\dots$ •³ calculate scalar product •⁴ finds magnitudes of vectors •⁵ substitutes values and calculates angle 	<ul style="list-style-type: none"> •¹ $\vec{DC} = \begin{pmatrix} 5 \\ 2 \\ 1 \end{pmatrix}, \vec{DA} = \begin{pmatrix} -6 \\ -2 \\ 8 \end{pmatrix}$ •² $\cos \theta = \dots\dots$ (formula may only appear when numbers are substituted) •³ $\vec{DA} \cdot \vec{DC} = -30 + (-4) + 8 = -26$ •⁴ $DC = \sqrt{30}; DA = \sqrt{104}$ •⁵ $\cos \theta = \frac{-26}{\sqrt{30}\sqrt{104}}; \theta = 117.7^\circ$
10	ans: 4 (4 marks)	
	<ul style="list-style-type: none"> •¹ prepares to differentiate •² starts to differentiate •³ completes differentiation •⁴ substitutes $x=1$ into $f(x)$ and evaluates 	<ul style="list-style-type: none"> •¹ $f(x) = 9(1-4x)^{-1} dx$ •² $-9(1-4x)^{-2} \dots\dots$ •³ $\dots\dots \times -4$ •⁴ $\frac{36}{(1-4x)^2} = \frac{36}{(1-4(1))^2} = 4$
11(a)	ans: $N = 6\sin(t + 19.5)^\circ + 30$ (4 marks)	
	<ul style="list-style-type: none"> •¹ expands and equates coefficients •² tan ratio and correct quadrant •³ finds k •⁴ finds α 	<ul style="list-style-type: none"> •¹ $k \sin t \cos \alpha + k \cos t \sin \alpha;$ $k \sin \alpha = 2; k \cos \alpha = 4\sqrt{2}$ •² $\tan \alpha = \frac{2}{4\sqrt{2}}; 1^{st}$ quadrant •³ $k = \sqrt{36} = 6$ •⁴ $\alpha = 19.5^\circ$

	Give 1 mark for each •	Illustration(s) for awarding each mark
11(b)	ans: 22.3 seconds (3 marks) <ul style="list-style-type: none"> •¹ equates answer (a) to 34 •² rearranges and takes inverse •³ finds t leading to solution 	<ul style="list-style-type: none"> •¹ $6\sin(t + 19 \cdot 5)^\circ + 30 = 34$ •² $\sin(t + 19 \cdot 5)^\circ = \frac{2}{3}$ •³ $t + 19 \cdot 5 = 41 \cdot 8; t = 22 \cdot 3$ seconds
12(a)	ans: $y = x^2$ (4 marks) <ul style="list-style-type: none"> •¹ takes power up •² moves term to LHS and divides •³ simplifies •⁴ finds y in terms of x 	<ul style="list-style-type: none"> •¹ $\log_x y^3$ •² $\log_x \frac{y^3}{y^2} = 2$ •³ $\log_x y = 2$ •⁴ $y = x^2$
(b)	ans: $y = 1$ or 4 (3 marks) <ul style="list-style-type: none"> •¹ substitutes expression for x •² reorganises to quadratic •³ factorises and solves 	<ul style="list-style-type: none"> •¹ $y = (y - 2)^2$ •² $y^2 - 5y + 4 = 0$ •³ $(y - 4)(y - 1) = 0; y = 1$ or 4
13(a)	ans: $y = 2x - 1$ (3 marks) <ul style="list-style-type: none"> •¹ realises 2 coordinate points •² finds gradient of line joining points •³ substitutes to find equation of line 	<ul style="list-style-type: none"> •¹ $(-1, -3); (4, 7)$ •² $m = \frac{7 + 3}{4 + 1} = 2;$ •³ $y - 7 = 2(x - 4)$
(b)	ans: 10 (5 marks) <ul style="list-style-type: none"> •¹ finds expression for $g(f(x))$ •² starts to integrate •³ completes integration •⁴ substitutes values •⁵ evaluates 	<ul style="list-style-type: none"> •¹ $(2x - 1)^3$ •² $\frac{(2x - 1)^4}{4} \dots$ •³ $\dots \times \frac{1}{2}$ •⁴ $\left(\frac{(2(2) - 1)^4}{8}\right) - \left(\frac{2(1) - 1)^4}{8}\right)$ •⁵ $\frac{81}{8} - \frac{1}{8} = \frac{80}{8} = 10$
		Sect. B (34 marks)
		16 + 34 Total: 50 marks