

Higher Mini Prelim 2 - Unit 3

(Answers + Marking Scheme)

Section A - Answers

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

2 marks each (16 marks)

Section B - Marking Scheme

	Give 1 mark for each •	Illustration(s) for awarding each mark
9(a)	ans: $k = 64; n = 3$ (4 marks) <ul style="list-style-type: none"> •¹ prepares to differentiate •² starts to differentiate •³ completes differentiation •⁴ simplifies and states values of k and n 	<ul style="list-style-type: none"> •¹ $f(x) = -16(2x-1)^{-2}$ •² $f'(x) = 32(2x-1)^{-3} \dots$ •³ $\dots \times 2$ •⁴ $f'(x) = \frac{64}{(2x-1)^3}; k = 64; n = 3$
(b)	ans: $x = \frac{5}{2}$ (3 marks) <ul style="list-style-type: none"> •¹ equates derivative to 1 •² starts to simplify •³ completes simplification 	<ul style="list-style-type: none"> •¹ $\frac{64}{(2x-1)^3} = 1$ •² $(2x-1)^3 = 64$ •³ $(2x-1) = 4; x = \frac{5}{2}$
10(a)	ans: $k = 10$ (3 marks) <ul style="list-style-type: none"> •¹ finds change in x-coords/y-coords •² realises $\vec{CP} = \frac{1}{4} \vec{CB}$ •³ establishes z-coordinate of P 	<ul style="list-style-type: none"> •¹ CB - 6 to 6 = 12; CP - 6 to -3 = 3 [x] CB 1 to -3 = 4; CP 1 to 0 = 1 •² evidence •³ 12 - 4 = 8 so change in z-coord is 2; $k = 10$
(b)	ans: 139.5° (5 marks) <ul style="list-style-type: none"> •¹ know how to find angles •² finds \vec{PA} and \vec{PB} •³ finds scalar product •⁴ finds magnitudes of vectors •⁵ substitutes in formula and finds angle 	<ul style="list-style-type: none"> •¹ evidence of $\cos\theta = \frac{a \cdot b}{ a b }$ •² $\vec{PA} = \begin{pmatrix} -1 \\ 0 \\ 3 \end{pmatrix}; \vec{PB} = \begin{pmatrix} 9 \\ -3 \\ -6 \end{pmatrix}$ •³ $\vec{PA} \cdot \vec{PB} = -9 + 0 - 18 = -27$ •⁴ $\vec{PA} = \sqrt{10}; \vec{PB} = \sqrt{126}$ •⁵ $\cos\theta = \frac{-27}{\sqrt{10}\sqrt{126}}; \theta = 139.5^\circ$

	Give 1 mark for each •	Illustration(s) for awarding each mark
11	ans: 17 hours 50 minutes (5 marks) <ul style="list-style-type: none"> •¹ substitutes values in formula and simplifies •² takes natural logs of both sides •³ releases power and removes $\log_e e$ •⁴ evaluates for t •⁵ changes hours to hours and minutes 	<ul style="list-style-type: none"> •¹ $28 = 40e^{-0.02t}; e^{-0.02t} = 0.7$ •² $\log_e e^{-0.02t} = \log_e 0.7$ •³ $-0.02t \log_e e = \log_e 0.7; 0.02t = \log_e 0.7$ •⁴ $t = \frac{\log_e 0.7}{-0.02} = 17.8337\dots$ •⁵ 17 hours 50 minutes
12	ans: $y = \frac{1}{6}(4x+1)^{\frac{3}{2}} + 5$ (5 marks) <ul style="list-style-type: none"> •¹ knows to integrate and prepares •² starts to integrate •³ completes integration and adds C •⁴ knows to substitute to find C •⁵ evaluates for C 	<ul style="list-style-type: none"> •¹ $y = \int (4x+1)^{\frac{1}{2}} dx$ •² $y = \frac{(4x+1)^{\frac{3}{2}}}{\frac{3}{2}} \dots\dots$ •³ $\dots\dots \times \frac{1}{4} + C; y = \frac{1}{6}(4x+1)^{\frac{3}{2}} + C$ •⁴ $9 \cdot 5 = \frac{1}{6}(4(2)+1)^{\frac{3}{2}} + C;$ •⁵ $C = 9 \cdot 5 - \frac{27}{6} = 5$
13(a)	ans: $y = 2\cos(x - 45)^\circ$ (3 marks) <ul style="list-style-type: none"> •¹ uses correct expansion •² finds k •³ finds 	<ul style="list-style-type: none"> •¹ $k \cos x \cos \alpha + k \sin x \sin \alpha$ •² $k = 2$ •³ $\tan \alpha = 1; \alpha = 45^\circ$ Quadrant I
(b)	ans: A(135°, 0); B(0, 1.4) (2 marks) <ul style="list-style-type: none"> •¹ makes $y = 0$ and finds x •² makes $x = 0$ and finds y 	<ul style="list-style-type: none"> •¹ $2\cos(x - 45)^\circ = 0; x = 135^\circ$ •² $y = 2 \cos(-45)^\circ; y = 1.4$
(c)	ans: C(77°, 1.7) (4 marks) <ul style="list-style-type: none"> •¹ replaces LHS •² finds value for $\cos(x - 45)^\circ$ •³ finds values of x •⁴ chooses appropriate value and states C 	<ul style="list-style-type: none"> •¹ $2 \cos(x - 45)^\circ = 1.7$ •² $\cos(x - 45)^\circ = 0.85$ •³ $(x - 45)^\circ = 32^\circ$ or $328^\circ; x = 77^\circ$ or 373° [13°] •⁴ C(77°, 1.7)
Sect. B (34 marks)		16 + 34 Total: 50 marks