Practice Paper G
Marking Scheme - Paper I Section A

1.

2	2	3	−11	−6
		4	14	6
	2	7	3	0

$2x^2 + 7x + 3 = 0$

$(2x+1)(x+3) = 0$

$x = -\frac{1}{2} : -3$

Answer: A

2. $x < 2$ and $x > 5$

Answer: A

3.

$-3y = -2x + 14$

$y = \frac{2}{3}x - \frac{14}{3}$

$m = \frac{2}{3}$

$m_{perp} = -\frac{3}{2}$

Answer: D

4. $6 + 12 - 8 = 10$

Answer: A

5.

$2\cos x \cos\frac{\pi}{6} + 2\sin x \sin\frac{\pi}{6}$

$= 2 \times \cos x \times \frac{\sqrt{3}}{2} + 2 \times \sin x \times \frac{1}{2}$

$= \sqrt{3}\cos x + \sin x$

Answer: D

6.

$3(x^2 + 5x) - 7$

$= 3[(x^2 + 2\cdot 5)^2 - 6\cdot 25] - 7$

$= 3(x^2 + 2\cdot 5)^2 - 18\cdot 75 - 7$

$= 3(x^2 + 2\cdot 5)^2 - 25\cdot 75$

$b = 25\cdot 75$

Answer: B

7.

$\frac{dy}{dx} = 3x^2 = 12$

$3k^2 = 12$

$k^2 = 4$

$k = 2$

Answer: D

8.

$\log_2 4 + \log_2 x = 0$

$2 + \log_2 x = 0$

$\log_2 x = -2;\ x = 2^{-2};\ x = \frac{1}{4}$

Answer: C

9.

$\frac{d}{dx}\frac{1}{2}x^{-3}$

$= -\frac{3}{2}x^{-4}$

$= -\frac{3}{2x^4}$

Answer: D

10. $b^2 - 4ac = 25 - 4.1.3 = 13$

Answer: C

11. $8 - 12 + 4 = 0$

so perpendicular

$|u| = \sqrt{2^2 + (-3)^2 + 1^2} = \sqrt{14}$

(1) and (2) correct

Answer: C

12.

$\log_2(x-1) = 3$

$2^3 = x - 1$

$x - 1 = 8$

$x = 9$

Answer: A

13. $L = \dfrac{12}{0 \cdot 75} = 12 \times \dfrac{4}{3}$

$= 16$

Answer: D

14. $f'(x) = 6x^2$

$x = -2$

$= 6(-2)^2 = 24$

Answer: A

15. $3(4x + x^2)(4 + 2x)$

$x = 1$

$= 3(4+1)^2 \times 6 = 450$

Answer: C

16. Centre: $(3, -2)$

$r = \sqrt{3^2 + (-2)^2 + 12} = \sqrt{25} = 5$

Answer: B

17. $\cos 2\alpha = 2\cos^2 - 1$

$= 2 \times (\dfrac{2}{3})^2 - 1$

$= \dfrac{8}{9} - 1 = -\dfrac{1}{9}$

Answer: C

18. $7 - 2 - 4 + 8 = 9$

Answer: A

19. $y = 2x^2 + x + C$

$-1 = 2 + 1 + C$

$C = -3$

$y = 2x^2 + x - 4$

Answer: C

20. $1 - (-5) = 6$

Answer: D

Practice Paper G - Paper 1 Section B — Marking Scheme

	Give 1 mark for each •	Illustration(s) for awarding each mark
21a	**ans:** proof **3 marks**	
	•[1] set up composite function	•[1] $g(f(x)) = \left(\frac{x-2p}{3}\right)^2 + p$
	•[2] squaring out bracket	•[2] $g(f(x)) = \frac{x^2-4px+4p^2}{9} + p$
	•[3] desired form	•[3] $g(f(x)) = \frac{1}{9}\left(x^2-4px+4p^2+9p\right)$
b	**ans:** $0 < p < \frac{1}{4}$ **5 marks**	
	•[1] for equating and simplifying	•[1] $\frac{1}{9}\left(x^2-4px+4p^2+9p\right) = 4p^2$ $x^2-4px+9p-32p^2 = 0$
	•[2] for discriminant statement	•[2] $b^2-4ac < 0$ (stated or implied)
	•[3] for a, b and c	•[3] $a=1,\ b=-4p,\ c=9p-32p^2$
	•[4] substituting and solving	•[4] $36p(4p-1)=0\ \therefore\ p=0$ *or* $p=\frac{1}{4}$
	•[5] final statement	•[5] answer between the roots since min.
22a	**ans:** T(1,7) **2 marks**	
	•[1] for substitution	•[1] $y = 10-3(1)$
	•[2] for answer	•[2] $\therefore y = 7$
b	**ans:** $y = 8-x^3$ (or equiv.) **4 marks**	
	•[1] for knowing to integrate	•[1] $y = \int \frac{dy}{dx}.dx$ (stated or implied)
	•[2] for integrating correctly	•[2] $y = \frac{-3x^3}{3} + C$
	•[3] for subst. (1,7) to find C	•[3] $7 = -(1)^3 + C$
	•[4] for answer	•[4] C = 8 leading to answer
23.	**ans: proof, *PQ* : *QR* = 3 : 2** **4 marks**	
	•[1] selecting correct displacements	•[1] $\overrightarrow{PQ}$ *and* $\overrightarrow{QR}$
	•[2] calculating displacements	•[2] $\overrightarrow{PQ} = \begin{pmatrix}6\\-9\\3\end{pmatrix}$ *and* $\overrightarrow{QR} = \begin{pmatrix}4\\-6\\2\end{pmatrix}$
	•[3] for collinear statement	•[3] since $\overrightarrow{PQ} = \frac{3}{2}\overrightarrow{QR}$
	•[4] for correct ratio	•[4] $PQ : QR = 3 : 2$

	Give 1 mark for each •	Illustration(s) for awarding each mark
24a	**ans:** $E = 2\sin(t+30)^\circ + 10$ **3 marks**	
	•[1] for finding k	•[1] $k = \sqrt{(\sqrt{3})^2 + 1^2} = \sqrt{4} = 2$
	•[2] for finding $\tan\theta$	•[2] $\tan\theta = \frac{1}{\sqrt{3}}$.
	•[3] for θ in degrees and answer	•[3] $\therefore\ \theta = 30^\circ \Rightarrow E = 2\sin(t+30)^\circ + 10$
b	**ans:** $E_{\max} = 12 \quad @ \quad t = 60^\circ$ **2 marks**	
	•[1] for maximum value of E	•[1] $E_{\max} = 2 + 10 = 12$
	•[2] for corresponding replacement	•[2] $\sin(t+30)^\circ = \sin 90^\circ = 1\ \therefore\ t = 60^\circ$
25a	**ans:** $2y = 3x + 7$ **4 marks**	
	•[1] finds coordinates of midpoint	•[1] M(1,5)
	•[2] for gradient of AC	•[2] $m_{AC} = \frac{-5-1}{3+6} = -\frac{2}{3}$
	•[3] for perpendicular gradient	•[3] $m_{MD} = \frac{3}{2}$
	•[4] equation (any form)	•[4] $y - 5 = \frac{3}{2}(x-1)$
b	**ans:** D(-3,-1) **3 marks**	
	•[1] for strategy (system of equ's)	•[1] using a system
	•[2] equation of AC	•[2] $y - 1 = -\frac{2}{3}(x+6)$
	•[3] finding coordinates	•[3] $2(-1) = 3x + 7\ \therefore\ x = -3,\ y = -1$

Total 30 marks

Practice Paper G - Paper 2 **Marking Scheme**

	Give 1 mark for each •	Illustration(s) for awarding each mark
1a	**ans:** $k = 11$ **2 marks**	
	•[1] for substituting	•[1] $9^2 + y^2 + 6(9) - 10y - 146 = 0$
	•[2] for solving and choosing answer	•[2] $(y-11)(y+1) = 0$ $y = 11$ *or* $y = -1$ $\therefore\ k = 11$
b	**ans:** $p = 13$ **5 marks**	
	•[1] for gradient strategy	•[1] $m_1 \times m_2 = -1$ (stated or implied)
	•[2] for centre C_1	•[2] from circle equat…. $C_1(-3,5)$
	•[3] for gradient of C_1A	•[3] $m_{C_1A} = \frac{11-5}{9+3} = \frac{1}{2}$
	•[4] for gradient of AC_2	•[4] $\therefore m_{AC_2} = -2$
	•[5] for equating and answer	•[5] $\frac{3-11}{p-9} = -2$, $\therefore\ p = 13$
c	**ans:** $(x-5)^2 + (y-4)^2 = 65$ **4 marks**	
	•[1] for realising C_1C_2 is a diameter	•[1] strategy from right-angle
	•[2] for mid-point of C_1C_2	•[2] centre is (5,4)
	•[3] for the value of r^2	•[3] $r^2 = 4^2 + 7^2 = 65$ (or equivalent)
	•[4] for answer	•[4] $(x-5)^2 + (y-4)^2 = 65$
2a	**ans:** 930 ^{o} F **3 marks**	
	•[1] for correct a	•[1] $a = (0.98)^6$
	•[2] for setting up calculation	•[2] $u_1 = (0.98)^6 \times 1050$
	•[3] for answer (ignore rounding)	•[3] $930 \cdot 13$
b	**ans:** $\approx$ 751 ^{o} F **3 marks**	
	•[1] for setting up recurrence (line 1)	•[1] •1 $u_1 = (0 \cdot 98)^6 \times 1050 = 930 + 60 = 990$
	•[2] for working lines down to u_5	•[2] $u_2 = 937$, $u_3 = 890$, $u_4 = 848$
	•[3] for realising not to add 60 at final ans	•[3] $u_5 = (0 \cdot 98)^6 \times 848 = 751$
c	**ans:** $\approx$ 466 ^{o} F **3 marks**	
	•[1] for knowing how to find the limit	•[1] $L = \frac{b}{1-a}$
	•[2] for calculating the limit	•[2] $L = \frac{60}{1-(0 \cdot 98)^6} \approx 526$
	•[3] for realising to subtract 60 to find ans	•[3] $526 - 60 = 466$

	Give 1 mark for each •	Illustration(s) for awarding each mark
3a	**ans:** proof **4 marks**	
	•[1] for equating	•[1] $(x+2)^2 = (3x-k)(k+1)$
	•[2] for expansions	•[2] $x^2+4x+4 = 3kx-k^2+3x-k$
	•[3] organising	•[3] $x^2+x-3kx+k^2+k+4$
	•[4] common factor to answer	•[4] $x^2+(1-3k)x+(k^2+k+4)=0$
b	**ans:** $k=3$, Area = 36 m^2 **5 marks**	
	•[1] for discriminant statement and a, b & c	•[1] $b^2-4ac=0$ (stated or implied) $a=1, b=1-3k, c=k^2+k+4$ (only 1 mark for above, mark given for a, b & c in PI)
	•[2] for substitution and expansion	•[2] $(1-3k)^2-4(k^2+k+4)=0$ $1-6k+9k^2-4k^2-4k-16=0$
	•[3] for solving and choosing correct root	•[3] $5(k-3)(k+1)=0$, $\therefore\ k=3\ or\ -1$
	•[4] for using k in original equ. to find x	•[4] $x^2-8x+16=0$, $\therefore x=4$
	•[5] for answer	•[5] $A=(x+2)^2=(4+2)^2=36$ (or equiv.)
4a	**ans:** $y=9x$ **3 marks**	
	•[1] for differentiating	•[1] $\frac{dy}{dx}=3x^2-12x+9=m$
	•[2] for substituting for gradient	•[2] @ $x=0$, $m=9$
	•[3] correct equation	•[3] line through origin $\therefore y=9x$
b	**ans:** P(6,54) **4 marks**	
	•[1] strategy of a system	•[1] attempts to form a system of equat.s
	•[2] combining and equating to zero	•[2] $x^3-6x^2+9x=9x$ $x^3-6x^2=0$
	•[3] for x- coordinate	•[3] $x^2(x-6)=0\ \therefore x=0\ or\ x=6$
	•[4] for y-coordinate	•[4] $y=9(6)=54$
5a	**ans:** proof **4 marks**	
	•[1] for attempting composite	•[1] $g(2\cos x+2\sin x)=(2\cos x+2\sin x)^2$
	•[2] for expansion	•[2] $\ldots\ =4\cos^2 x+8\sin x\cos x+4\sin^2 x$
	•[3] for realising 4	•[3] $\ldots\ =4+8\sin x\cos x$
	•[4] for introducing double angle then ans.	•[4] $\ldots\ =4+4(2\sin x\cos x)$ $\ldots\ =4+4\sin 2x \Rightarrow 4(1+\sin 2x)$

	Give 1 mark for each •	Illustration(s) for awarding each mark
b	**ans:** $\{7\cdot2^\circ\ ,\ 90^\circ\ ,\ 172\cdot8^\circ\ ,\ 270^\circ\}$ **4 marks**	
	$\bullet^1$ for equating and solving to zero	$\bullet^1$ $4+4\sin 2x=\cos x+4$ $4\sin 2x-\cos x=0$
	$\bullet^2$ double angle replacement	$\bullet^2$ $4(2\sin x\cos x)-.....$
	$\bullet^3$ factorising and finding roots	$\bullet^3$ $\cos x(8\sin x-1)=0$ $\cos x=0$ *or* $\sin x=\frac{1}{8}$
	$\bullet^4$ answers	$\bullet^4$ $90^\circ\ ,\ 270^\circ$ *or* $7\cdot2^\circ\ ,\ 172\cdot8^\circ$
6a	**ans:** proof **1 mark**	
	$\bullet^1$ for clear working to answer	$\bullet^1$ $y=3(-1^2)-(-1^3)=3-(-1)=4$ horizontal line $\therefore\ y=4$
b	**ans:** $a=2$ **3 marks**	
	$\bullet^1$ for knowing to solve equ. of curve to 4	$\bullet^1$ $3x^2-x^3=4$
	$\bullet^2$ for arranging to zero and synth. division	$\bullet^2$ $-x^3+3x^2-4=0$ -1 3 0 -4
	$\bullet^3$ for finding other root	$\bullet^3$ 2 | -1 3 0 -4 -2 2 4 -1 1 2 0
c	**ans:** $6\frac{3}{4}$ units^2 **4 marks**	
	$\bullet^1$ for setting up integral	$\bullet^1$ $A=\int_{-1}^{2}4-\left[3x^2-x^3\right]\,dx$
	$\bullet^2$ for integrating correctly	$\bullet^2$ $A=\left[4x-x^3+\frac{x^4}{4}\right]_{-1}^{2}$
	$\bullet^3$ substituting limits of integration	$\bullet^3$ $A=(8-8+4)-(-4+1+\frac{1}{4})$
	$\bullet^4$ calculating answer	$\bullet^4$ $A=(4)-(-2\frac{3}{4})=6\frac{3}{4}$

	Give 1 mark for each	Illustration(s) for awarding each mark
7a	**ans:** proof **1 mark**	
	●[1] clear working to answer	●[1] $64\pi = \pi r^2 h \qquad 64 = r^2 h \quad \Rightarrow \quad h = \dfrac{64}{r^2}$
b	**ans:** proof **2 marks**	
	●[1] for knowing how to find surface area	●[1] $A = 2\pi rh + \pi r^2$
	●[2] substitution and manipulation to ans.	●[2] $A = 2\pi r\dfrac{64}{r^2} + \pi r^2 \quad = \dfrac{128\pi}{r} + \pi r^2$
c	**ans:** $r = 4$ cm , $h = 4$ cm **5 marks**	
	●[1] knowing to differentiate and solve to zero	●[1] @ min $A'(r) = 0$ (stated or implied)
	●[2] differentiating correctly	●[2] $A'(r) = -128\pi r^{-2} + 2\pi r$
	●[3] for dealing with fraction	●[3] $2\pi r - \dfrac{128\pi}{r^2} = 0 \quad \ldots\ldots \times r^2$
		$2\pi r^3 - 128\pi = 0$
	●[4] solving to find r	●[4] $2r^3 = 128 \quad \Rightarrow \quad r^3 = 64 \quad \therefore \quad r = 4$
	●[5] finding h	●[5] $h = 64 \div 4^2 = 4$

Total 60 marks