Practice Paper I
Marking Scheme - Paper I Section A

$$m_{AB} = \frac{3-2}{2-3} = -1$$

$$m_{CD} = \frac{5+1}{p+2} = \frac{6}{p+2}$$

1.

$$\frac{6}{p+2} = -1$$

$$-p-2 = 6$$

$$-p = 8$$

$$8 = -8$$

Answer: A

2.

$$2(x^2 - 3x) = 11$$

$$= 2[3(x-1\cdot5)^2 - 2\cdot25] + 11$$

$$= 2(x-1\cdot5)^2 - 4\cdot5 + 11$$

$$= 2(x-1\cdot5)^2 + 6\cdot5$$

Turning point $(1\cdot5, 6\cdot5)$

Answer: A

3.

$$f'(x) = 2x + 4 < 0$$

$$2x < -4$$

$$x < -2$$

Answer: A

4. graph is moved 2 to the left and 3 down.

$(-3, 2) \rightarrow (-5, -1)$

Answer: C

5.

$$\frac{dy}{dx} = 5 - 4x$$

$$x = 2$$

$$\frac{dy}{dx} = 5 - 4(2) = -3$$

Answer: C

6.

$$\frac{p}{0\cdot8} = \frac{q}{0\cdot7}$$

$$0\cdot7p = 0\cdot8q$$

$$p = \frac{0\cdot8q}{0\cdot7}$$

$$p = \frac{8}{7}q$$

Answer: B

7.

3	1	p	0	-5	11
		3	$9+3p$	$27+9p$	$66+27p$
	1	$3+p$	$9+3p$	$22+9p$	$77+27p$

$$77 + 27p = -4$$

$$27p = -81$$

$$p = -3$$

Answer: D

8. since $b^2 - 4ac = 1 - 4.1.7 = -27$

for $x^2 - x + 7$

there are no other real roots

Answer: B

9.

$$\left[\frac{x^2}{2}\right]_{-4}^{4} = \frac{16}{2} - \frac{16}{2} = 0$$

Answer: C

10.

$$(x+3)^2 + (y-1)^2 = 25$$

Answer: A

11. Centre (0, 0)

$m = \frac{4}{-5} = -\frac{4}{5}; \quad m_{perp} = \frac{5}{4}$

Answer: B

12.

$y = \int 2x - 5 \, dx = x^2 - 5x + C$

$x = 2; \; y = 6$

$6 = 4 - 10 + C$

$6 = -6 + C$

$C = 12$

$y = x^2 - 5x + 12$

Answer: B

13.

$y = -\sqrt{3}x2$

$= -\sqrt{3}$

$\tan^{-1}(\sqrt{3}) = 60°$

$\tan^{-1}(-\sqrt{3}) = 120°$

Answer: C

(6, 1, 7) (–9, 6, – 3)

4:1

14.

$x_K = \frac{6 - 36}{5} = -6$

$y_K = \frac{1 + 24}{5} = 5$

$z_K = \frac{7 - 12}{5} = -1$

$K(-6, 5, -1)$

Answer: B

15.

$4 \sin 2x \times \frac{1}{2} + C$

$= 2 \sin 2x + C$

Answer: D

16.

$\frac{d}{dx}\sqrt{x^2 - 4} = (x^2 - 4)^{\frac{1}{2}}$

$= \frac{1}{2}(x^2 - 4)^{-\frac{1}{2}} \times 2x$

$= x(x^2 - 4)^{-\frac{1}{2}}$

Answer: A

17.

$x = 2^5 = 32$

Answer: C

18.

$\cos\frac{7\pi}{6}(210°) = -\cos\frac{\pi}{6}(30°)$

$= -\frac{\sqrt{3}}{2}$

Answer: A

19.

$k = \sqrt{(-1)^2 + 1^2} = \sqrt{2}$

$\tan\alpha = \frac{1}{-1}$

$\alpha = 135°$

** S	A*
* T	C

Answer: C

20. $\boldsymbol{a} \cdot \boldsymbol{a} + \boldsymbol{a} \cdot \boldsymbol{b} = 9 + 7 = 16$

Answer: B

Practice Paper I - Paper 1 Section B — Marking Scheme

	Give 1 mark for each •	Illustration(s) for awarding each mark
21a	**ans:** $a=1,\ b=-3,\ c=2$ **4 marks**	
	$\bullet^1$ for knowing g through f	$\bullet^1$ strategy
	$\bullet^2$ for correct substitution (algebra)	$\bullet^2$ $f(g(x)) = (x-1)\left((x-1)^2-1\right)$
	$\bullet^3$ expanding and simplifying	$\bullet^3$ $f(g(x)) = x^3-3x^2+2x$
	$\bullet^4$ for a, b and c	$\bullet^4$ $a=1,\ b=-3,\ c=2$
b	**ans:** $x=3$ **4 marks**	
	$\bullet^1$ solving to zero	$\bullet^1$ $x^3-3x^2+2x-6=0$
	$\bullet^2$ strategy - synthetic division	$\bullet^2$ 1 | -3 2 -6
	$\bullet^3$ finding root	$\bullet^3$ 3 | 1 -3 2 -6 / 3 0 6 / 1 0 2 0 $\quad x=3$
	$\bullet^4$ showing only one solution	$\bullet^4$ $x^2+2=0\ \therefore\ x^2=-2$ .. no solution
22a	**ans:** $y=\frac{1}{4}x-1$; A(4,0) **3 marks**	
	$\bullet^1$ for gradient	$\bullet^1$ $y=\frac{1}{4}x+\frac{13}{4}\ \ \therefore\ m=\frac{1}{4}$
	$\bullet^2$ writing down equation of line	$\bullet^2$ $y=\frac{1}{4}x-1$
	$\bullet^3$ establishing the coordinates of A	$\bullet^3$ $0=\frac{1}{4}x-1\ \Rightarrow\ 0=x-4\ \therefore\ x=4$
b	**ans:** B(3,4) **5 marks**	
	$\bullet^1$ for perpendicular gradient	$\bullet^1$ $m=-4$
	$\bullet^2$ equation of line AB	$\bullet^2$ $y-0=-4(x-4)\ \Rightarrow y=-4x+16$
	$\bullet^3$ for strategy of a system	$\bullet^3$ $y+4x=16$; $4y-x=13$ ….. or equiv.
	$\bullet^4$ for first coordinate	$\bullet^4$ $y=4$
	$\bullet^5$ second coordinate	$\bullet^5$ $x=3$
c	**ans:** $\sqrt{17}$ units **2 marks**	
	$\bullet^1$ strategy + lengths to use in Pyth	$\bullet^1$ Pyth + using 1 and 4
	$\bullet^2$ calculation to answer	$\bullet^2$ $d^2=1^2+4^2\ =\ 17\ \ \therefore\ d=\sqrt{17}$

	Give 1 mark for each •	Illustration(s) for awarding each mark
23.	**ans:** Proof **3 marks**	
	•[1] for preparing column vectors	•[1] $F_1 = \begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix}$; $F_2 = \begin{pmatrix} 2 \\ -3 \\ -6 \end{pmatrix}$
	•[2] for statement re: scalar product	•[2] If perp. then $F_1.F_2 = 0$ (stated or implied)
	•[3] calculating scalar product as proof	•[3] $F_1.F_2 = \begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix}\begin{pmatrix} 2 \\ -3 \\ -6 \end{pmatrix} = 6 - 12 + 6 = 0$
24a	**ans:** Q(-2,6) **1 mark**	
	•[1] answer	•[1] stepping out to answer
b	**ans:** $k = 6$ **1 mark**	
	•[1] answer	•[1] answer
c	**ans:** $(x-8)^2 + (y-6)^2 = 100$ **3 marks**	
	•[1] for strategy …. radius and centre •[2] finding radius	•[1] strategy •[2] r can be found from horiz. line but some pupils will use points P and C. $r^2 = 6^2 + 8^2 = 100$
	•[3] answer	•[3] $(x-8)^2 + (y-6)^2 = 100$
25.	**ans:** $x = 8$ **4 marks**	
	•[1] bringing up power	•[1] ..... $- \log_2 3^2$
	•[2] combining logs	•[2] $\log_2 \frac{x^2+8}{9} = 3$
	•[3] removing log	•[3] $2^3 = \frac{x^2+8}{9}$ (or equivalent)
	•[4] answer	•[4] $x^2 = 64 \quad \therefore \; x = 8$

Total 30 marks

Practice Paper I - Paper 2 **Marking Scheme**

	Give 1 mark for each •	Illustration(s) for awarding each mark
1a	**ans:** $2y = -x - 11$ (or equiv.) **2 marks**	
	•[1] for gradient	•[1] $m = \frac{-10+2}{9+7} = -\frac{1}{2}$
	•[2] for equation of line	•[2] $y + 10 = -\frac{1}{2}(x - 9)$ (or equivalent)
b	**ans:** $y = 2x + 2$ **3 marks**	
	•[1] knowing gradients mult. to -1	•[1] *if perpen.* $m_1 \times m_2 = -1$; stated or implied
	•[2] for gradient	•[2] $m = 2$
	•[3] equation of altitude	•[3] $y - 8 = 2(x - 3)$ (or equiv.)
c	**ans:** S(-3,-4) **3 marks**	
	•[1] knowing to solve as a system	•[1] $2y = -x - 11$; $y = 2x + 2$
	•[2] first coordinate	•[2] $5y = -20 \ \therefore \ y = -4$
	•[3] second coordinate	•[3] $-4 = 2x + 2 \ \therefore \ x = -3$
d	**ans:** $(x-6)^2 + (y+1)^2 = 90$ **4 marks**	
	•[1] realising strategy of R.A. $\therefore$ QR = diam	•[1] strategy
	•[2] finding centre	•[2] $C(\frac{3+9}{2}, \frac{8+(-10)}{2}) \rightarrow C(6,-1)$
	•[3] calculating value of r^2	•[3] $r^2 = 9^2 + 3^2 = 90$
	•[4] equation of circle	•[4] $(x-6)^2 + (y+1)^2 = 90$
2.	**ans:** $6 \cdot 75$ **3 marks**	
	•[1] for finding U_1	•[1] $U_1 = 0 \cdot 75(32) + 12 = 36$
	•[2] for U_2 and U_3	•[2] $U_2 = 0 \cdot 75(36) + 12 = 39$
		$U_3 = 0 \cdot 75(39) + 12 = 41 \cdot 25$
	•[3] knowing how to find limit	•[3] $L = \frac{b}{1-a}$ (or equivalent)
	•[4] finding limit	•[4] $L = \frac{12}{1 - 0 \cdot 75} = 48$
	•[5] calculating difference	•[5] diff. $= 48 - 41 \cdot 25 = 6 \cdot 75$

	Give 1 mark for each •	Illustration(s) for awarding each mark
3.	**ans:** A(2,0) , B(1,-4) **7 marks**	
	•[1] **to find A** … set up synth. division	•[1] set up synth. division for root
	•[2] use -1 ….. or other	•[2] $-1 \mid 1 \quad 0 \quad -3 \quad -2$ $\quad\quad -1 \quad 1 \quad 2$ $\quad 1 \quad -1 \quad -2 \quad 0$
	•[3] find x coordinate of A and hence A	•[3] $x^2 - x + 2 = 0 \;\; \therefore \;\; (x-2)(x+1) = 0$ $x = 2 \;\; , \;\; \cancel{x = -1} \;\; \therefore$ A(2,0)
	•[4] **for B** … know to diff. and solve to 0	•[4] know S.P. $\therefore \frac{dy}{dx} = 0$
	•[5] differentiate correctly	•[5] $\frac{dy}{dx} = 3x^2 - 3 = 0$
	•[6] find x coordinate of B	•[6] $3(x^2 - 1) = 0 \;\; \therefore \;\; x = 1 \quad (discard \;\; -1)$
	•[7] find y coordinate of B	•[7] $y = 1^3 - 3(1) - 2 = -4 \;\; \therefore$ B(1,–4)
4a	**ans:** B(-6,2,-2) **1 mark**	
	•[1] for coordinates	•[1] pupils should compare D $\rightarrow$ C with A $\rightarrow$ B … step out to answer (or equi
b	**ans:** $k = 6$ **3 marks**	
	•[1] establishing displacements	•[1] $\vec{AE} = \begin{pmatrix} 8 \\ -4 \\ k-2 \end{pmatrix}$; $\vec{ED} = \begin{pmatrix} 2 \\ -1 \\ 7-k \end{pmatrix}$
	•[2] forms equation (or ratio equivalent)	•[2] $4\vec{ED} = \vec{AE} \;\; \therefore \;\; 4(7-k) = k-2$
	•[3] solves for k	•[3] $k = 6$
c	**ans:** $\angle BEA = 17^\circ$ **6 marks**	
	•[1] for selecting correct displacements	•[1] $\vec{EB} =$ ..... $\vec{EA} =$ .....
	•[2] for finding both displacements	•[2] $\vec{EB} = \begin{pmatrix} -8 \\ 6 \\ -8 \end{pmatrix}$ $\vec{EA} = \begin{pmatrix} -8 \\ 4 \\ -4 \end{pmatrix}$
	•[3] for both magnitudes	•[3] $\left\lvert \vec{EB} \right\rvert = \sqrt{164}$, $\left\lvert \vec{EA} \right\rvert = \sqrt{96}$
	•[4] calculating scalar product	•[4] $\vec{EB} . \vec{EA} = \begin{pmatrix} -8 \\ 6 \\ -8 \end{pmatrix} . \begin{pmatrix} -8 \\ 4 \\ -4 \end{pmatrix} = 64 + 24 + 32 = 120$
	•[5] substitution in formula	•[5] $\cos\theta = \frac{120}{\sqrt{164} \times \sqrt{96}}$
	•[6] answer (no marks off for not rounding)	•[6] $\theta = 17^\circ$

	Give 1 mark for each •	Illustration(s) for awarding each mark
5a	**ans:** A(10,0) , B(2,0) **4 marks**	
	$\bullet^1$ for solving to zero	$\bullet^1$ $\frac{1}{4}(60+4x-x^2)=0$
	$\bullet^2$ factorising and roots	$\bullet^2$ $\frac{1}{4}(10-x)(6+x)=0\,;\ x=10$ *or* $x=-6$
	$\bullet^3$ stating A	$\bullet^3$ A(10,0)
	$\bullet^4$ finding B	$\bullet^4$ B half way between roots …. $(10+(-6))\div 2=2\ \ \therefore$ B(2,0)
b	**ans:** $85\frac{1}{3}$ cm^2 **4 marks**	
	$\bullet^1$ for setting up integral	$\bullet^1$ $\text{A} = \int_2^{10}(15+x-\frac{1}{4}x^2)\ dx$
	$\bullet^2$ for integration	$\bullet^2$ $=\left[15x+\frac{x^2}{2}-\frac{x^3}{12}\right]_2^{10}$
	$\bullet^3$ substitution	$\bullet^3$ $=(150+50-\frac{1000}{12})-(30+2-\frac{8}{12})$
	$\bullet^4$ correct calculation to answer	$\bullet^4$ $=(116\frac{2}{3})-(31\frac{1}{3})=85\frac{1}{3}$ (or equiv.)
c	**ans:** 10 litres **3 marks**	
	$\bullet^1$ knows to double area	$\bullet^1$ $\text{A}_{\text{face}} = 85\frac{1}{3}\times 2=170\frac{2}{3}\ \text{cm}^2$
	$\bullet^2$ finds volume	$\bullet^2$ $V=170\frac{2}{3}\times 60=10240\ \text{cm}^3$
	$\bullet^3$ answers to nearest litre	$\bullet^3$ $V=10$ litres (to nearest litre)
6.	**ans:** $0\cdot 61$ **6 marks**	
	$\bullet^1$ for strategy and expansion	$\bullet^1$ $\sqrt{6}\cos\theta-\sqrt{3}\sin\theta=k\cos(\theta-\alpha)$ $\ldots\ldots=k\cos\theta\cos\alpha+k\sin\theta\sin\alpha$
	$\bullet^2$ finding alpha	$\bullet^2$ $\tan\alpha=-\frac{\sqrt{3}}{\sqrt{6}}\ \ \therefore\ \alpha=5\cdot 66$
	$\bullet^3$ finding k	$\bullet^3$ $k^2=(\sqrt{6})^2+(\sqrt{3})^2=\sqrt{9}=3$
	$\bullet^4$ solving to 1	$\bullet^4$ $3\cos(\theta-5\cdot 66)=1$
	$\bullet^5$ finding value in radians	$\bullet^5$ $\theta-5\cdot 66=1\cdot 23\ \ \therefore\ \theta=6\cdot 89$
	$\bullet^6$ knows to subtract 2π to answer	$\bullet^6$ $\therefore\ 6\cdot 89-6\cdot 28=0\cdot 61$ (or equiv.)
7.	**ans:** $v=20$ km/h **4 marks**	
	$\bullet^1$ knows to diff and solve to zero	$\bullet^1$ at min $F'(v)=0$ (stated or implied)
	$\bullet^2$ differentiates correctly	$\bullet^2$ $F'(v)=\frac{-100}{v^2}+0\cdot 0125v$
	$\bullet^3$ strategy for solving equation	$\bullet^3$ $\frac{-100}{v^2}+0\cdot 0125v=0\ \ (\times v^2)$
	$\bullet^4$ solves equation to answer	$\bullet^4$ $-100+0\cdot 0125v^3=0\ \ \therefore\ v=\sqrt[3]{8000}=20$

	Give 1 mark for each •	Illustration(s) for awarding each mark
8.	**ans:** 23 seconds **5 marks**	
	$\bullet^1$ for setting up equation correctly	$\bullet^1$ $60e^{-0\cdot04t} = 24 \Rightarrow e^{-0\cdot04t} = 0\cdot4$
	$\bullet^2$ introducing logs	$\bullet^2$ $\ln e^{-0\cdot04t} = \ln 0\cdot4$ (or equiv.)
	$\bullet^3$ releasing power	$\bullet^3$ $-0\cdot04t \ln e = \ln 0\cdot4$
	$\bullet^4$ t the subject	$\bullet^4$ $t = \dfrac{\ln 0\cdot4}{-0\cdot04}$
	$\bullet^5$ answer	$\bullet^5$ $t = 22\cdot91 = 23$ seconds

Total 60 marks