Paper 1

Marking instructions for each question

Question	Generic scheme	Illustrative scheme	Max mark
1.	•¹ differentiate •² calculate gradient •³ find the value of y •⁴ find equation of tangent	•¹ $2x-4$ •² 6 •³ 12 •⁴ $y=6x-18$	**4**
2.	•¹ find the centre •² calculate the radius •³ state equation of circle	•¹ $(-3,4)$ •² $\sqrt{17}$ •³ $(x+3)^2+(y-4)^2=17$ or equivalent	**3**
3. (a)	•¹ find gradient l_1 •² state gradient l_2	•¹ $\frac{1}{\sqrt{3}}$ •² $-\sqrt{3}$	**2**
3. (b)	•³ using $m=\tan\theta$ •⁴ calculating angle	•³ $\tan\theta=-\sqrt{3}$ •⁴ $\theta=\frac{2\pi}{3}$ or $120°$	**2**
4.	•¹ complete integration •² substitute limits •³ evaluate	•¹ $-\frac{1}{6}x^{-1}$ •² $\left(-\frac{1}{6\times2}\right)-\left(-\frac{1}{6\times1}\right)$ •³ $\frac{1}{12}$	**3**

Question	Generic scheme	Illustrative scheme	Max mark
5.			**4**
	•[1] find $\overrightarrow{CD}$	•[1] $\begin{pmatrix} x-4 \\ -3 \\ -1 \end{pmatrix}$	
	•[2] find $\overrightarrow{AB}$	•[2] $\begin{pmatrix} 5 \\ -10 \\ -5 \end{pmatrix}$	
	•[3] equate scalar product to zero	•[3] $5(x-4)+(-10)(-3)+(-5)(-1)=0$	
	•[4] calculate value of x	•[4] $x=-3$	
6.			**4**
	•[1] substitute into discriminant	•[1] $(p+1)^2-4\times1\times9$	
	•[2] apply condition for no real roots	•[2] $\ldots<0$	
	•[3] determine zeroes of quadratic expression	•[3] $-7, 5$	
	•[4] state range with justification	•[4] $-7<p<5$ with eg sketch or table of signs	
7.			**5**
	•[1] substitute for y in equation of circle	•[1] $x^2+(3x-5)^2+2x-4(3x-5)-5=0$	
	•[2] express in standard quadratic form	•[2] $10x^2-40x+40=0$	
	•[3] demonstrate tangency	•[3] $10(x-2)^2=0$ only one solution implies tangency	
	•[4] find x-coordinate	•[4] $x=2$	
	•[5] find y-coordinate	•[5] $y=1$	

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8. (a)	•[1] use appropriate strategy •[2] obtain an expression for a and b •[3] obtain a second expression for a and b •[4] find the value of a or b •[5] find the second value	•[1] $(1)^3 - 4(1)^2 + a(1) + b = 0$ •[2] $a + b = 3$ •[3] $2a + b = -4$ •[4] $a = -7$ or $b = 10$ •[5] $b = 10$ or $a = -7$	**5**
8. (b)	•[6] obtain quadratic factor •[7] complete factorisation •[8] state solutions	•[6] $\left(x^2 - 3x - 10\right)$ •[7] $(x-1)(x-5)(x+2)$ •[8] $x = 1$, $x = 5$, $x = -2$	**3**
9. (a)	•[1] interpret information •[2] solve to find m	•[1] $13 = 28m + 6$ •[2] $m = \frac{1}{4}$	**2**
9. (b) (i)	•[3] state condition	•[3] a limit exists as $-1 < \frac{1}{4} < 1$	**1**
9. (b) (ii)	•[4] know how to calculate limit •[5] calculate limit	•[4] $L = \frac{1}{4}L + 6$ •[5] $L = 8$	**2**

Question	Generic scheme	Illustrative scheme	Max mark
10. (a)	●¹ state value	●¹ 2	**1**
10. (b)	●¹ use laws of logarithms ●² link to part (a) ●³ use laws of logarithms ●⁴ write in standard quadratic form ●⁵ solve for x and identify appropriate solution	●¹ $\log_4 x(x-6)$ ●² $\log_4 x(x-6)=2$ ●³ $x(x-6)=4^2$ ●⁴ $x^2-6x-16=0$ ●⁵ 8	**5**
11.	●¹ start to differentiate ●² complete differentiation ●³ evaluate derivative	●¹ $3\times 4\sin^2 x\ldots$ ●² $\ldots\times\cos x$ ●³ $\dfrac{-3\sqrt{3}}{2}$	**3**
12.	●¹ calculate lengths AC and AD ●² select appropriate formula and express in terms of p and q ●³ calculate two of $\cos p,\ \cos q,\ \sin p,\ \sin q$ ●⁴ calculate other two and substitute into formula ●⁵ arrange into required form	●¹ $\text{AC}=\sqrt{17}$ and $\text{AD}=5$ stated or implied by ●³ ●² $\cos q\cos p+\sin q\sin p$ stated or implied by ●⁴ ●³ $\cos p=\dfrac{4}{\sqrt{17}}$, $\cos q=\dfrac{4}{5}$ $\sin p=\dfrac{1}{\sqrt{17}}$, $\sin q=\dfrac{3}{5}$ ●⁴ $\dfrac{4}{5}\times\dfrac{4}{\sqrt{17}}+\dfrac{3}{5}\times\dfrac{1}{\sqrt{17}}$ ●⁵ $\dfrac{19}{5\sqrt{17}}\times\dfrac{\sqrt{17}}{\sqrt{17}}=\dfrac{19\sqrt{17}}{85}$ or $\dfrac{19}{5\sqrt{17}}=\dfrac{19\sqrt{17}}{5\times 17}=\dfrac{19\sqrt{17}}{85}$	**5**

Question	Generic scheme	Illustrative scheme	Max mark
13.	●¹ know to and start to integrate ●² complete integration ●³ substitute for x and y ●⁴ state expression for y	●¹ eg $y=\frac{4}{2}x^2\ldots$ ●² $y=\frac{4}{2}x^2-\frac{6}{3}x^3+c$ ●³ $9=2(-1)^2-2(-1)^3+c$ ●⁴ $y=2x^2-2x^3+5$	**4**
14. (a)	●¹ use double angle formula ●² express as a quadratic in $\cos x°$ ●³ start to solve ●⁴ reduce to equations in $\cos x°$ only ●⁵ process solutions in given domain	**Method 1:** Using factorisation ●¹ $2\cos^2 x°-1\ldots$ **stated or implied by ●²** ●² $2\cos^2 x°-3\cos x°+1=0$ ●³ $(2\cos x°-1)(\cos x°-1)$ $=0$ must appear at either of these lines to gain ●² **Method 2:** Using quadratic formula ●¹ $2\cos^2 x°-1\ldots$ **stated or implied by ●²** ●² $2\cos^2 x°-3\cos x°+1=0$ **stated explicitly** ●³ $\dfrac{-(-3)\pm\sqrt{(-3)^2-4\times2\times1}}{2\times2}$ **In both methods:** ●⁴ $\cos x°=\frac{1}{2}$ and $\cos x°=1$ ●⁵ 0, 60, 300 Candidates who include 360 lose ●⁵. **or** ●⁴ $\cos x=1$ and $x=0$ ●⁵ $\cos x°=\frac{1}{2}$ and $x=60$ or 300 Candidates who include 360 lose ●⁵.	**5**
14. (b)	●⁶ interpret relationship with (a) ●⁷ state valid values	●⁶ $2x=0$ and 60 and 300 ●⁷ 0, 30, 150, 180, 210 and 330	**2**

Question	Generic scheme	Illustrative scheme	Max mark
15. (a)	●[1] interpret notation ●[2] complete process	●[1] $g\left(x^3-1\right)$ ●[2] $3x^3-2$	**2**
15. (b)	●[3] start to rearrange for x ●[4] rearrange ●[5] state expression for $h(x)$	●[3] $3x^3=y+2$ ●[4] $x=\sqrt[3]{\dfrac{y+2}{3}}$ ●[5] $h(x)=\sqrt[3]{\dfrac{x+2}{3}}$	**3**

[END OF SPECIMEN MARKING INSTRUCTIONS]