LEMMA PRACTICE PAPER · MARK SCHEME

Level 1

Pure Mathematics

Paper 1 · Foundation

GENERAL MARKING GUIDANCE

- All candidates must receive the same treatment: mark positively, and give credit for what is shown rather than penalising what is missing.
- **M** marks: method marks, for knowing and applying a correct method to the problem, even if there are small slips.
- **A** marks: accuracy marks, which can only be awarded if the relevant M mark has been earned.
- **B** marks: unconditional accuracy marks, independent of method.
- **dM**: a method mark that depends on the previous M mark. **ft**: follow through from an earlier error. *****: the answer is given in the question, so full working must be seen with no errors. **cao**: correct answer only.
- Correct alternative methods earn full credit. The model solutions show several of them.

QUESTION	SCHEME	MARKS	NOTES
1 (a)	$(2x^3)^2 = 4x^6$, or a correct use of a power law on the whole expression	**M1**	Allow 2^2x^6.
	$12x^5$	**A1**	cao
(b)	$\sqrt{48} = 4\sqrt{3}$ or $\sqrt{27} = 3\sqrt{3}$	**M1**	One surd correctly simplified.
	$7\sqrt{3}$	**A1**	cao
(c)	$8^{\frac{1}{3}} = 2$ or $8^{\frac{2}{3}} = 4$ or $8^2 = 64$ seen, or the negative power treated as a reciprocal	**M1**	
	$\frac{1}{4}$	**A1**	Accept 0.25.
	Total for Question 1	**(6)**	

QUESTION	SCHEME	MARKS	NOTES
2	Substitutes $y = x + 1$ into $x^2 + y^2 = 13$ (or $x = y - 1$)	**M1**	Must give an equation in one variable.
	$x^2 + x - 6 = 0$ (or $2x^2 + 2x - 12 = 0$)	**A1**	Any correct three-term quadratic $= 0$.
	Solves their three-term quadratic	**M1**	Factorising, formula or completing the square.
	$x = 2$ and $x = -3$	**A1**	
	Substitutes at least one x value into $y = x + 1$	**M1**	
	$(2, 3)$	**A1**	Must be paired correctly.

QUESTION	SCHEME	MARKS	NOTES
	$(-3, -2)$	**A1**	
	Total for Question 2	**(7)**	

QUESTION	SCHEME	MARKS	NOTES
3 (a)	Gradient $= \dfrac{11-3}{5-1} = 2$	**M1**	Correct method for the gradient.
	Uses $y - 3 = m(x-1)$ or $y = mx + c$ with a point	**M1**	With their gradient.
	$y = 2x + 1$	**A1**	
(b)	Midpoint $(3, 7)$	**B1**	
	Uses gradient $-\dfrac{1}{2}$ through their midpoint	**M1**	Negative reciprocal of their (a) gradient.
	$x + 2y - 17 = 0$	**A1**	Or any integer multiple.
	Total for Question 3	**(6)**	

QUESTION	SCHEME	MARKS	NOTES
4 (a)	$(17, 0)$	**B1ft**	Follow through from their (b).
(b)	Correct method for a relevant length, e.g. $AB = \sqrt{80}$ and $MC = \sqrt{245}$; or a correct start to the shoelace formula	**M1**	
	$\frac{1}{2} \times \sqrt{80} \times \sqrt{245}$, or a complete correct method	**M1**	
	70	**A1**	
	Total for Question 4	**(4)**	

QUESTION	SCHEME	MARKS	NOTES
5 (a)	$(x-3)^2$	**M1**	$p = -3$
	$(x-3)^2 - 4$	**A1**	
(b)	$(3, -4)$	**B1ft**	From their (a).
(c)	Correct method, e.g. $(x-1)(x-5) = 0$ or $(x-3)^2 = 4$	**M1**	
	$x = 1,\ x = 5$	**A1**	
(d)	U-shaped parabola crossing the x-axis at 1 and 5	**B1**	
	y-intercept $(0, 5)$ and turning point $(3, -4)$ marked	**B1**	
(e)	Chooses the region between the roots	**M1**	
	$1 < x < 5$	**A1**	Accept $\{x : 1 < x < 5\}$ or $(1, 5)$.
	Total for Question 5	**(9)**	

QUESTION	SCHEME	MARKS	NOTES
6 (a)	$x^n \to x^{n-1}$ for at least one term	**M1**	

QUESTION	SCHEME	MARKS	NOTES
	$6x^2 - 6x - 12$	**A1**	
(b)	Sets their $\dfrac{dy}{dx} = 0$ and solves a three-term quadratic	**M1**	
	$x = 2,\ x = -1$	**A1**	
	Substitutes an x value into y	**M1**	
	$(2, -16)$ and $(-1, 11)$	**A1**	
(c)	$\dfrac{d^2y}{dx^2} = 12x - 6$	**M1**	Or a correct sign test either side.
	Evaluates at both points: 18 and -18	**M1**	
	$(2, -16)$ minimum, $(-1, 11)$ maximum, with reasons	**A1**	
	Total for Question 6	**(9)**	

QUESTION	SCHEME	MARKS	NOTES
7 (a)	$x^n \to x^{n+1}$ for at least one term	**M1**	
	Two terms correct (unsimplified)	**A1**	
	$x^3 + 2x^2 - 5x + c$	**A1**	Including $+c$.
(b)	Substitutes 2 and 1 into their integral	**M1**	
	Subtracts the right way round: $(8 + 8 - 10) - (1 + 2 - 5)$	**dM1**	Dependent on the previous M mark.
	8	**A1**	
	Total for Question 7	**(6)**	

QUESTION	SCHEME	MARKS	NOTES
8	$f(x) = x^3 + 2x^2 - 5x + c$	**M1**	
	Substitutes $(1, 4)$: $1 + 2 - 5 + c = 4$	**M1**	
	$f(x) = x^3 + 2x^2 - 5x + 6$	**A1**	
	Total for Question 8	**(3)**	

QUESTION	SCHEME	MARKS	NOTES
9 (a)	Correct binomial coefficients $\binom{6}{1}, \binom{6}{2}, \binom{6}{3}$ with powers of $2x$	**M1**	Allow $6, 15, 20$.
	$1 + 12x$	**A1**	
	$+60x^2$	**A1**	
	$+160x^3$	**A1**	
(b)	Multiplies the correct pair of terms: $3 \times 60x^2$ and $-x \times 12x$	**M1**	

QUESTION	SCHEME	MARKS	NOTES
	One of 180 or -12 correct	**A1**	
	168	**A1**	
(c)	$x = 0.01$	**M1**	
	Substitutes into their four terms	**M1**	
	1.12616	**A1**	cao
	Total for Question 9	**(10)**	

QUESTION	SCHEME	MARKS	NOTES
10 (a)	30°	**B1**	
	150°	**B1**	And no extra answers in range.
(b)	Uses $\cos^2 x = 1 - \sin^2 x$	**M1**	
	$2\sin^2 x - 3\sin x + 1 = 0$	**A1**	Or any equivalent three-term quadratic.
	Solves the quadratic in $\sin x$	**M1**	
	$\sin x = 1,\ \sin x = \frac{1}{2}$	**A1**	
	$x = 30^\circ,\ 90^\circ,\ 150^\circ$	**A1**	All three, no extras.
	Total for Question 10	**(7)**	

QUESTION	SCHEME	MARKS	NOTES
11 (a)	$BC^2 = 7^2 + 5^2 - 2(7)(5)\cos 60^\circ$	**M1**	
	$BC = 6.24$ cm	**A1**	From $\sqrt{39}$.
(b)	$\frac{1}{2} \times 7 \times 5 \times \sin 60^\circ$	**M1**	
	$\dfrac{35\sqrt{3}}{4}$ cm^2	**A1**	
	Total for Question 11	**(4)**	

QUESTION	SCHEME	MARKS	NOTES
12 (a)	$x = \dfrac{\ln 20}{\ln 3}$ or $\log_3 20$	**M1**	
	2.73	**A1**	
(b)	Uses $\log a + \log b = \log ab$: $\log_2 x(x+2) = 3$	**M1**	
	Removes the log: $x(x+2) = 2^3$	**M1**	
	$x^2 + 2x - 8 = 0$	**A1**	
	$x = 2$ only, with $x = -4$ rejected	**A1**	
	Total for Question 12	**(6)**	

QUESTION	SCHEME	MARKS	NOTES
13 (i)	200	**B1**	
(ii)	$200e^{0.03t} = 500$	**M1**	
	$0.03t = \ln 2.5$	**M1**	
	$t = 30.5$ hours	**A1**	
(iii)	$\dfrac{dP}{dt} = 6e^{0.03t}$	**M1**	
	8.10 bacteria per hour	**A1**	
	Total for Question 13	**(6)**	

QUESTION	SCHEME	MARKS	NOTES
14 (a)	Attempts $(x-3)^2 + (y+2)^2 = \ldots$	**M1**	
	Centre $(3, -2)$	**A1**	
	Radius 5	**A1**	
(b)	$36 + 4 - 36 + 8 - 12 = 0$ shown	**B1**	Or $3^2 + 4^2 = 25$.
(c)	Gradient of radius $= \dfrac{2-(-2)}{6-3} = \dfrac{4}{3}$	**M1**	
	Tangent gradient $-\dfrac{3}{4}$	**M1**	Negative reciprocal.
	$y - 2 = -\dfrac{3}{4}(x-6)$	**M1**	
	$3x + 4y - 26 = 0$	**A1**	
	Total for Question 14	**(8)**	

QUESTION	SCHEME	MARKS	NOTES
15 (a)	Substitutes $y = x + k$ into the equation of C	**M1**	
	$2x^2 + (2k-2)x + k^2 + 4k - 12 = 0$	**A1**	
	Uses $b^2 - 4ac = 0$	**M1**	
	$k^2 + 10k - 25 = 0$ or equivalent	**A1**	
	Solves their quadratic in k	**M1**	
	$k = -5 + 5\sqrt{2}$	**A1**	
	$k = -5 - 5\sqrt{2}$	**A1**	
(b)	Chooses the inside region	**M1**	
	$-5 - 5\sqrt{2} < k < -5 + 5\sqrt{2}$	**A1**	
	Total for Question 15	**(9)**	

TOTAL FOR PAPER: 100 MARKS