Version 1.0

Level 2 Certificate in Further Mathematics

Practice Paper Set 3

Paper 2 8360/2

Mark Scheme

Mark Schemes

Principal Examiners have prepared these mark schemes for practice papers. These mark schemes have not, therefore, been through the normal process of standardising that would take place for live papers.

It is not possible to indicate all the possible approaches to questions that would gain credit in a 'live' examination. The principles we work to are given in the glossary on page 3 of this mark scheme.

- Evidence of any method that would lead to a correct answer, if applied accurately, is generally worthy of credit.
- Accuracy marks are awarded for correct answers following on from a correct method. The correct method may be implied, but in this qualification there is a greater expectation that method will be appropriate and clearly shown.

Set and published by the Assessment and Qualifications Alliance.

Glossary for Mark Schemes

These examinations are marked in such a way as to award positive achievement wherever possible. Thus, for these papers, marks are awarded under various categories.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
M Dep	A method mark dependent on a previous method mark being awarded.
B Dep	A mark that can only be awarded if a previous independent mark has been awarded.
ft	Follow through marks. Marks awarded following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$

Paper 2 - Calculator

Q	Answer	Mark	Comments
1	Box 1 → $x^2 + y^2 = 4$	B1	Do not allow choice in any part
	Box 3 → $y = 1 - 2x$	B1	
	Box 4 → $y = 12 - 3x$	B1	
	Box 5 → $y = x^2 + 1$	B1	
2(a)	$h = 0.6m$	B1	oe eg, $h = \frac{60}{100}m$
2(b)	$\frac{\text{their } 0.6m}{0.75m}$ (= 0.8)	M1	oe
	80	A1 ft	ft From their 0.6
3(a)	$2(-3)^2 - 7$	M1	$18 - 7$
	11	A1	
3(b)	$2x^2 - 7 = 1$	M1	oe eg, $2x^2 = 8$
	(+) 2	A1	
	–2	A1	
4(a)	$-2 \leq x \leq 4$	B1	
4(b)	$\frac{14-2}{-2-4}$ (= – 2)	M1	oe Allow one sign error
	$y - 14 =$ their $- 2(x - -2)$ **or** $y - 2 =$ their $- 2(x - 4)$	M1	oe $y =$ their $- 2x + c$ and substitutes (–2, 14) or (4, 2)
	$y - 14 = -2(x + 2)$ **or** $y - 2 = -2(x - 4)$	A1	Any correct form eg, $y + 2x = 10$ Allow $f(x) = 10 - 2x$
5	$28 + 4t = 0$ **or** $-20 - 3t = 1$	M1	
	$4t = -28$ **or** $3t = -20 - 1$	M1	oe
	–7	A1	SC1 $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ seen

Q	Answer	Mark	Comments
6	$c + b = 5a^2$ **or** $\frac{c}{5} = a^2 - \frac{b}{5}$	B1	
	$\frac{c+b}{5} = a^2$	M1	oe ft From their B1 if a^2 the subject
	$(\pm)\sqrt{\frac{c+b}{5}} = a$	A1 ft	oe Only ft from B0 M1
7(a)	$\angle CBA = x$ **and** base angles of isosceles triangle (are equal)	M1	oe
	$\angle DCE = 2x$ **and** exterior angle = sum of interior opposite angles	A1	$\angle ACB = 180 - 2x$ **and** angle sum of triangle = 180 **and** $\angle DCE = 2x$ **and** (adjacent) angles on a straight line add up to 180 SC1 'Correct' solution without reasons
7(b)	$\angle CDE = (180 - 2x) \div 2$ **and** base angles of isosceles triangle (are equal)	M1	$\angle CED = (180 - 2x) \div 2$ **and** base angles of isosceles triangle (are equal)
	$90 - x$	A1	
	$\angle AFD = 180 - x - (90 - x)$ **and** angle sum of triangle = 180	A1	$\angle FEB = 90 - x$ **and** vertically opposite angles **and** $\angle EFB = 180 - x - (90 - x)$ **and** angle sum of triangle = 180 SC2 'Correct' solution without reasons

Q	Answer	Mark	Comments
8(a)	True	B1	
	False	B1	
	True	B1	
8(b)	$x^3 \quad x \quad x^2 \quad x^4$	B2	B1 One consecutive pair transposed eg $x^3 \quad x \quad x^4 \quad x^2$
9(a)	360 – 325 (= 35)	M1	Draws a North line at *A* and marks 40 in correct place
	40 + 35	A1	Accept any clear explanation
9(b)	$50^2 + 65^2 - 2 \times 50 \times 65$ (×) cos 75 (= [5042.676, 5043])	M1	oe eg 2500 + 4225 – 6500cos75
	$\sqrt{50^2 + 65^2 - 2 \times 50 \times 65 \times \cos 75}$	M1	$[\sqrt{5042.676}, \sqrt{5043}]$
	[71, 71.012]	A1	Accept 70 with correct method seen
10	$b = 4(a - 2)$	B1	oe
	$b = 3a + k$	B1	oe
	Their $4(a - 2)$ = their $3a + k$	M1	
	$a = k + 8$	A1 ft	ft From B0 B1 M1 or B1 B0 M1
11(a)	48	B1	
11(b)	$7^2 + 24^2$ (= 625) **or** 7^2 + their 48^2 (= 2353)	M1	
	$\sqrt{7^2 + 24^2}$ **or** $\sqrt{7^2 + \text{their } 48^2}$	M1	$\sqrt{625}$ (= 25) **or** $\sqrt{2353}$ (= [48.5, 48.51])
	$\sqrt{7^2 + \text{their } 48^2} - \sqrt{7^2 + 24^2}$	M1	[48.5, 48.51] – 25
	[23.5, 23.51]	A1 ft	ft Their 48 and M3
12	q is odd (because f(0) = q)	B1	
	f(1) = 1 + p + q	M1	
	1 + q is even **and** even + odd = odd	A1	oe eg, odd + odd + odd = odd

Q	Answer	Mark	Comments
13	$x^4 - x$	B2	B1 For x^4 **or** x
	$4x^3$ **or** 1	M1	ft Their x^4 **or** their x
	$4x^3 - 1$	A1 ft	Only ft from B0 M1
14	2 : 3 **or** 3 : 2 **or** $\frac{2}{5}$ **or** $\frac{3}{5}$	B1	oe ratio
	$\frac{\text{their 2}}{\text{their 2} + \text{their 3}} \times (11 - 1)$ **or** $\frac{\text{their 2}}{\text{their 2} + \text{their 3}} \times (18 - 3)$	M1	
	(5, 9)	A2 ft	A1ft for each Only ft from B0 M1
15(a)	$(2x - 7)(x + 2)$	B2	B1 $x(2x - 7) + 2(2x - 7)$ or $(2x + a)(x + b)$ where $ab = \pm 14$ or $a + 2b = \pm 3$
15(b)	$\frac{7}{2}$ **or** -2	M1	oe ft Their factors in (a)
	Their $\frac{7}{2} + 5$ **or** their $-2 + 5$	M1	oe
	$\frac{17}{2}$ **and** 3	A1 ft	oe SC1 $x = y - 5$
Alt 1 **15(b)**	$2(y^2 - 5y - 5y + 25) - 3(y - 5) - 14$ $(= 2y^2 - 23y + 51)$	M1	Allow one sign error in expansion
	$(2y - 17)(y - 3)$	A1	
	$\frac{17}{2}$ **and** 3	A1	oe
Alt 2 **15(b)**	Sub $y - 5$ into $(2x - 7)(x + 2)$ ie, $(2(y - 5) - 7)((y - 5) + 2)$	M1	ft Their factors in (a)
	$(2y - 17)(y - 3)$	A1	
	$\frac{17}{2}$ **and** 3	A1	

Q	Answer	Mark	Comments
16(a)	x^4	B1	
16(b)	$(x^2 + 1)\ (x + 1)\ (x - 1)$	B2	B1 $(x^2 + 1)(x^2 - 1)$ **or** B1 Shows f(1) = 0 or f(–1) = 0
17(a)	Square with vertices (0, 0) (3, 0) (3, 3) and (0, 3)	B2	B1 At least one of (3, 0) (3, 3) (0, 3) $\begin{pmatrix}3\\0\end{pmatrix}$ $\begin{pmatrix}3\\3\end{pmatrix}$ $\begin{pmatrix}0\\3\end{pmatrix}$
17(b)	$\begin{pmatrix}0 & 1\\-1 & 0\end{pmatrix}$	B2	B1 $\begin{pmatrix}1\\0\end{pmatrix} \rightarrow \begin{pmatrix}0\\-1\end{pmatrix}$ **or** $\begin{pmatrix}0\\1\end{pmatrix} \rightarrow \begin{pmatrix}1\\0\end{pmatrix}$ SC1 $\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$
18	$\frac{(3x + 7)(2x + 3) + (x + 1)(4x - 11)}{(x + 1)(2x + 3)}\ (= 5)$	M1	
	$6x^2 + 14x + 9x + 21$ **or** $4x^2 + 4x - 11x - 11$ **or** $(5)(2x^2 + 2x + 3x + 3)$	M1	oe 4 terms with any 3 correct
	$6x^2 + 14x + 9x + 21$ **or** $4x^2 + 4x - 11x - 11$ **or** $(5)(2x^2 + 2x + 3x + 3)$	A1	oe All 4 terms correct
	Their $6x^2 + 14x + 9x + 21$ + their $4x^2 + 4x - 11x - 11$ = 5 their $(2x^2 + 2x + 3x + 3)$	M1	
	$-\frac{5}{9}$	A1	

Q	Answer	Mark	Comments
19	Correct shape that has min and max points in correct quadrants and one intersection with x-axis shown	B3	B2 Correct shape that has min and max points in correct quadrants but incomplete (eg intersection with x-axis not shown) B1 Correct shape
20	First differences attempted 3 7 11 15	M1	Allow one error
	Second difference of $4 \div 2$ (= 2)	A1	$2n^2$
	Subtracts their $2n^2$ from terms of sequence (– 3 – 6 – 9)	M1	
	$2n^2 - 3n$	A1	
Alt 20	3 equations in 3 variables obtained eg, $a + b + c = -1$ $4a + 2b + c = 2$ $9a + 3b + c = 9$	M1	Allow one error in coefficients
	Eliminates one variable to obtain 2 equations in two variables eg, $3a + b = 3$ $5a + b = 7$	M1	
	Eliminates one variable eg, $2a = 4$	M1	
	$2n^2 - 3n$	A1	

Q	Answer	Mark	Comments
21	A (0, 1) **or** $AC = 6$	B1	
	Gradient BC is $-\frac{1}{2}$	B1	oe eg, equation BC $y = -\frac{1}{2}x + 7$
	$2x + 1 =$ their $-\frac{1}{2}x + 7$	M1	oe eg, $\frac{2x + 1 - 7}{x} =$ their $-\frac{1}{2}$
	$2\frac{1}{2}x = 6$ $(x = 2.4)$	M1	oe eg, $5x = 12$ ft From their $-\frac{1}{2}x + 7$ or their $-\frac{1}{2}$
	$\frac{1}{2}$ × their 6 × their 2.4	M1	
	7.2	A1 ft	ft From B1 B0 M3 or B0 B1 M3
Alt 21	Gradient BC is $-\frac{1}{2}$	B1	oe eg Equation BC $y = -\frac{1}{2}x + 7$
	$\frac{2x+1-7}{x} =$ their $-\frac{1}{2}$	M1	oe eg $2x + 1 =$ their $-\frac{1}{2}x + 7$
	$5x = 12$ $(x = 2.4)$	M1	oe eg $2\frac{1}{2}x = 6$ ft From their $-\frac{1}{2}$ or their $-\frac{1}{2}x + 7$
	$y = 5.8$	A1	
	$\frac{1}{2} \times \sqrt{(\text{their } 5.8 - 7)^2 + \text{their } 2.4^2}$ $\times \sqrt{(\text{their } 5.8 - 1)^2 + \text{their } 2.4^2}$	M1	
	7.2	A1 ft	ft From B0 M2 A1 M1 or B1 M2 A0 M1

Q	Answer	Mark	Comments
22	$2x^2y + 3xy^2$ **or** $5x^2y - 2xy^2$	B1	
	$10x^3y$ (–) $4x^2y^2$ (+) $15x^2y^2$ (–) $6xy^3$	M1	4 terms with 3 correct ft Their $2x^2y + 3xy^2$ or $5x^2y - 2xy^2$
	$10x^3y - 4x^2y^2 + 15x^2y^2 - 6xy^3$	A1 ft	Fully correct ft Their $2x^2y + 3xy^2$ or $5x^2y - 2xy^2$
	$10x^3y + 11x^2y^2 - 6xy^3$	B1 ft	Only ft if their 4 terms above require simplification
Alt 22	$10x^2$ (–) $4xy$ (+) $15xy$ (–) $6y^2$	M1	4 terms with 3 correct
	$10x^2 - 4xy + 15xy - 6y^2$	A1	Fully correct
	$10x^2 + 11xy - 6y^2$	B1 ft	Only ft if their 4 terms above require simplification
	$10x^3y + 11x^2y^2 - 6xy^3$	B1 ft	ft xy(their $10x^2 + 11xy - 6y^2$)
23	$(3x)^3 + 3(3x)^2$	M1	$27x^3$ or $27x^2$ seen
	$27x^3$ (+) $27x^2$	M1	
	$27x^2(x + 1)$ **or** $k = 27$	A1	
Alt 23	$x^2(x + 3)$ **and** $(3x)^2(3x + 3)$	M1	
	$9x^2(3x + 3)$	M1	
	$27x^2(x + 1)$ **or** $k = 27$	A1	
24(a)	$s(5s - 2)$	B1	
24(b)	$\sin x$ ($5\sin x - 2$)	M1	ft Their factorisation in (a)
	$\sin x = 0$ **and** $\sin x = \frac{2}{5}$	M1	
	0° 180° 360° 23.6° 156.4°	A2 ft	ft From their factorisation in (a) and M2 A2 For exactly 5 correct solutions A1 For 5 correct with other incorrect solutions A1 For any two correct solutions seen

Q	Answer	Mark	Comments
25	Any 2 factors of 150 except 1 and 150	M1	2, 75 **or** 3, 50 **or** 5, 30 **or** 6, 25 **or** 10, 15
	$c = 5$ **and** $d = 6$	A1	
	x^2 (+) $5x$ (+) $5x$ (+) 25	M1	ft Their c 4 terms with at least 3 correct
	$(x^2 + 10x + 25)(x + 6) = x^3$ (+) $10x^2$ (+) $25x$ (+) $6x^2$ (+) $60x$ (+) 150	M1	ft their c and their d Allow one error or one omission
	$x^3 + 10x^2 + 25x + 6x^2 + 60x + 150$	A1 ft	Fully correct for their c and their d
	$a = 16$ **and** $b = 85$	A1 ft	ft Their expansion
Alt 25	$x^3 + dx^2 + 2cx^2 + 2cdx + c^2x + c^2d$	M1	Allow up to two errors or omissions
	Their $c^2d = 150$	M1	
	$c = 5$ **and** $d = 6$	A1	
	Their $d + 2c = a$ **or** their $2cd + c^2 = b$	M1	
	$a = 16$	A1 ft	ft Their $d + 2c$ and their c and their d
	$b = 85$	A1 ft	ft Their $2cd + c^2$ and their c and their d