Version 1.0

Level 2 Certificate in Further Mathematics

Practice Paper Set 4

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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqamaths.aqa.org.uk

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.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
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.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
3.14 …	Allow answers which begin 3.14 eg 31.4, 3142, 3.149
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Paper 2 - Calculator

Q	Answer	Mark	Comments
1	positive odd	B1	Exactly two boxes selected in each
	negative even	B1	
	positive odd	B1	
2(a)	$P^2 = QR - 1$	M1	
	$P^2 + 1 = QR$	M1	Correct step after their first step
	$\frac{P^2+1}{R} = Q$	A1	
2(b)	$\frac{12^2+1}{5}$	M1	$145 = 5Q$
	29	A1	
3	$7x + 8x = 180$	M1	oe eg $7x = 180 - 8x$
	$x = 12$	A1	$7x = 84$ **and** $8x = 96$ May be seen on diagram
	$2 \times$ their $12 + 60$	M1	84 if correct May be seen on diagram
	$2x + 60 = 84$ **and** angle $PQR = 84$ **and** Yes	A1ft	ft from M1 A0 M1 oe eg $2x + 60 = 84$ **and** angle $SRQ = 96$ **and** angle $PQC = 96$ **and** Yes Angles may be seen on diagram

Q	Answer	Mark	Comments
4(a)	(0, 0) **and** (–6, 8)	B1	Seen or implied
	$(-6)^2 + 8^2$	M1	oe eg $6^2 + 8^2$ or 100 or $\sqrt{100}$
	10	A1	
4(b)	Do not overlap **and** complete reason Example 1: Do not overlap **and** $4 + 5 < 10$ Example 2: Do not overlap **and** diagram drawn showing 4, 5 and 10 in appropriate places Example 3: Do not overlap **and** there will be a gap of 1	B2ft	ft their distance in (a) B1ft Do not overlap **and** partial reason Example 1 Do not overlap **and** 9 Example 2 Do not overlap **and** diagram drawn showing two of 4, 5 and 10 B1 4 **and** 5 seen
5(a)	n^{-4}	B2	B1 $(n^2)^5 = n^{10}$ seen or implied eg $\frac{1}{n^4}$
5(b)	$c^2 + 1$	B2	B1 for each correct term Do not accept $c^2 + c^0$ for B2 Accept c^0 as an alternative to 1 for B1
5(c)	$(\frac{1}{2})^4$	M1	oe
	$\frac{1}{16}$ **or** 0.0625	A1	
6(a)	$30 \times 20 - 4 \times x \times x$	M1	oe eg $2x(30 - 2x) + 2x(20 - 2x)$ + $(30 - 2x)(20 - 2x)$
	$600 - 4x^2$	A1	oe eg $4(150 - x^2)$
6(b)	$(30 - 2x)$ **or** $(20 - 2x)$	B1	Seen or implied
	$x(30 - 2x)(20 - 2x)$	M1	ft their three dimensions but all must be in terms of x
	$x(600 - 60x - 40x + 4x^2)$	M1dep	ft their three dimensions but must involve product of two linear expressions
	$600x - 100x^2 + 4x^3$	A1	

Q	Answer	Mark	Comments
7(a)	$\frac{ST}{\sin 54} = \frac{40}{\sin(180-54-25)}$	M1	$\frac{ST}{\sin 54} = \frac{40}{\sin 101}$
	$(ST =) \frac{40}{\sin 101} \times \sin 54$	M1 dep	Must use 101 Allow M2 if this is the first line of working
	32.966(…..)	A1	Only award if correct working for both M marks are seen
7(b)	$\sin 25 = \frac{w}{32.97}$	M1	$\cos 65 = \frac{w}{32.97}$
	$32.97 \times \sin 25$	M1 dep	Allow $32.97 \times \cos 65$
	[13.9, 13.934]	A1	Allow 14 if correct method seen SC2 [12.6, 12.62] SC1 [–4.4, –4.3636]
8	$(AX^2 =) 3^2 + 3^2$ (= 18)	M1	oe eg $(AX =) \sqrt{18}$ or [4.2, 4.243]
	$10^2 -$ their 18 (= 82)	M1	
	$\sqrt{10^2 - \text{their } 18}$	M1 dep	
	[9.055, 9.1] or $\sqrt{82}$	A1	
9(a)	$-2 \leqslant x \leqslant 4$	B2	B1 $-2 < x \leqslant 4$ **or** $-2 \leqslant x < 4$ **or** $-2 < x < 4$ SC1 Fully correct response in words
9(b)	$-3 \leqslant g(x) \leqslant 5$	B2	B1 $-3 < g(x) \leqslant 5$ **or** $-3 \leqslant g(x) < 5$ **or** $-3 < g(x) < 5$ SC1 Fully correct response in words
9(c)	–1.2	B1	
	3	B1	
9(d)	–4	B2	B1 4 **or** $-\frac{8}{2}$ oe

Q	Answer	Mark	Comments
10	Enlargement	B1	
	Scale factor –2	B1	
	Centre (0,0)	B1	
11(a)	$(n + 1)^2 + (n + 1)$ $(– (n^2 + n))$	M1	
	$n^2 + 2n + 1 + n + 1 – n^2 – n$ $(= 2n + 2)$	A1	oe Example 1: $n^2 + 3n + 2 + n + 1 – n^2 – n$ $(= 2n + 2)$ Example 2: $n^2 + n + n + 1 + n + 1 – n^2 – n$ $(= 2n + 2)$ Must be clearly shown and have brackets removed $= 2n + 2$ is not needed but if simplification shown it must be correct
11(b)	$2n + 2 = 32$	M1	
	$n = 15$	A1	
	their 15^2 + their 15 **or** $(\text{their } 15 + 1)^2 + \text{their } 15 + 1$	M1	
	240 **and** 272	A1	

Q	Answer	Mark	Comments
12(a)	$35 + 4x^2 = 36$	B1	
	$4x^2 = 1$ **or** $(2x + 1)(2x - 1)$ **or** $\frac{0 \pm \sqrt{0^2 - 4 \times 4 \times -1}}{2 \times 4}$	M1	Simplifies their quadratic to $ax^2 = b$ **or** correctly factorises their quadratic **or** substitutes correctly for their quadratic
	$\frac{1}{2}$ **and** $-\frac{1}{2}$	A1ft	ft from B0 M1 Must have 2 solutions
12(b)	$27 = 8x^3$	M1	oe eg $\frac{27}{8} = x^3$ Must have x^3
	$3 = 2x$	M1 dep	$\sqrt[3]{\frac{27}{8}}$
	$\frac{3}{2}$	A1	oe Solutions $\frac{3}{2}$ and $-\frac{3}{2}$ is A0

Q	Answer	Mark	Comments
13	$\angle SQR = 2x$	M1	Working may be seen on the diagram throughout
	$\angle QRS$ or $\angle QSR = \frac{180 - \text{their } 2x}{2}$	M1	$90 - x$
	$7x$ + their $(90 - x) = 180$ **or** $2x$ + their $(90 - x) = 7x$	M1	oe eg $6x = 90$
	15	A1	
	Alternative method 1		
	$\angle QRS = 180 - 7x$	M1	Working may be seen on the diagram throughout
	$\angle QSR$ = their $(180 - 7x)$	M1	
	$2x$ + their$(180 - 7x) = 7x$	M1	oe eg $12x = 180$
	15	A1	
	Alternative method 2		
	$\angle QRS = 180 - 7x$	M1	Working may be seen on the diagram throughout
	$\angle SQR = 180 - 2 \times$ their $(180 - 7x)$	M1	oe eg $\angle SQR = 14x - 180$
	$2x$ = their $(14x - 180)$	M1	oe eg $12x = 180$
	15	A1	
	Alternative method 3		
	$\angle QSR = 5x$	M1	Working may be seen on the diagram throughout
	$\angle SRQ$ = their $5x$	M1	
	$7x$ + their $5x = 180$	M1	oe eg $12x = 180$
	15	A1	
	Alternative method 4		
	$\angle QSR = 5x$	M1	Working may be seen on the diagram throughout
	$\angle SRQ$ = their $5x$	M1	
	$\angle SQR = 2x$ **and** their $5x$ + their $5x + 2x = 180$	M1	oe eg $12x = 180$
	15	A1	

Q	Answer	Mark	Comments
14	$\sin^{-1} -\frac{1.36}{2}$ (= [–42.844, –42.8])	M1	oe eg $\sin^{-1} -0.68$
	[222.8, 222.844]	A1	
	[317.156, 317.2]	A1ft	ft 540 – their [222.8, 222.844]
	Alternative method		
	$\sin^{-1} -\frac{1.36}{2}$ (= [–42.844, –42.8])	M1	oe eg $\sin^{-1} -0.68$
	[317.156, 317.2]	A1	
	[222.8, 222.844]	A1ft	ft 540 – their [317.156, 317.2]
15	$2 + 8x - 2x^2 = 5$	M1	
	(0 =) $2x^2 - 8x + 3$	A1	$-3 + 8x - 2x^2$ (= 0)
	$\frac{--8 \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$	M1	oe eg $\frac{8 \pm \sqrt{64 - 24}}{4}$ ft their 3-term quadratic
	[3.58, 3.6] **and** [0.4, 0.42]	A1	oe eg $\frac{8 + \sqrt{40}}{4}$ **and** $\frac{8 - \sqrt{40}}{4}$
	[3.16, 3.2]	A1ft	oe eg $\frac{\sqrt{40}}{2}$ or $\sqrt{10}$ ft their 3-term quadratic solutions
	Alternative method		
	$2 + 8x - 2x^2 = 5$	M1	
	$x^2 - 4x = -\frac{3}{2}$	A1	oe
	$(x - 2)^2 - 4 = -\frac{3}{2}$	M1	oe eg $(x - 2)^2 = \frac{5}{2}$ ft their 3-term quadratic
	[3.58, 3.6] **and** [0.4, 0.42]	A1	oe eg $\sqrt{\frac{5}{2}} + 2$ **and** $-\sqrt{\frac{5}{2}} + 2$
	[3.16, 3.2]	A1ft	oe eg $2\sqrt{\frac{5}{2}}$ or $\sqrt{10}$ ft their 3-term quadratic solutions

Q	Answer	Mark	Comments
16	$\sin^2 x + \cos^2 x$ **or** $-\cos x \sin x + \sin x \cos x$	M1	oe eg $\cos x \cos x + \sin x \sin x$ One correct element Does not have to be seen in a matrix
	$\begin{pmatrix} \sin^2 x + \cos^2 x & -\cos x \sin x + \sin x \cos x \\ -\cos x \sin x + \sin x \cos x & \sin^2 x + \cos^2 x \end{pmatrix}$	M1	oe All 4 correct elements in correct positions in a matrix
	$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$	A1	oe eg $\mathbf{I}$ or identity (matrix)
17	Any two of: $a + 5b = 5$ **or** $2a + 8b = 6$ **or** $3a + 12b = 9$ **or** $4a + 17b = 14$	B2	B1 Any one of: $a + 5b = 5$ **or** $2a + 8b = 6$ **or** $3a + 12b = 9$ **or** $4a + 17b = 14$
	Makes their pair of equations have a common coefficient and subtraction attempt eg $2a + 10b = 10$ $2a + 8b = 6$ **and** $2b = 4$	M1	Allow up to two errors
	$b = 2$	A1	
	$a = -5$	A1	
	Alternative method		
	(First differences) $a + 3b$ $a + 4b$ $a + 5b$	M1	At least 2 correct
	(Second differences) b b	A1	
	$b = 2$	A1	
	Any one of: $a + 5b = 5$ **or** $2a + 8b = 6$ **or** $3a + 12b = 9$ **or** $4a + 17b = 14$	B1	
	$a = -5$	B1ft	ft their b

Q	Answer	Mark	Comments
18	$3m(8 - 3m)$ **or** $m(24 - 9m)$	M1	
	$(8 + 3m)(8 - 3m)$	M1	
	$\frac{3m}{8+3m}$	A1	Further incorrect work is A0
19	$\cos(x) = \frac{8}{12}$	M1	
	$\cos^{-1}\frac{8}{12}$	M1 dep	
	[48.1896851, 48.2]	A1	Allow 48 if correct method seen SC2 [53.5, 53.5441] SC1 [0.84, 0.8411]
20(a)	$(-1, 0)$	B1	
20(b)	$(y =)\ 2 + 2x - x - x^2$	M1	$2 + x - x^2$
	$(\frac{dy}{dx} =)\ 1 - 2x$	M1 dep	oe ft their expansion
	(At $x = 0$, $\frac{dy}{dx} =$) 1	M1	ft their $\frac{dy}{dx}$
	grad normal = –1	A1ft	ft their $\frac{dy}{dx}$ Must have gained M3
	$y =$ (their grad normal) $x + 2$	M1	$y = -x + 2$ if correct
	$y = -x + 2$ **and** $x = 2$ $y = 0$	A1	oe eg $y + x = 2$ **and** $2 + 0 = 2$
21	$a^2b(3a^2 - 2ab - 5b^2)$ **or** $ab(3a^3 - 2a^2b - 5ab^2)$ **or** $a^2(3a^2b - 2ab^2 - 5b^3)$	M1	
	$a^2b(3a - 5b)(a + b)$	A1	

Q	Answer	Mark	Comments
22(a)	$y = 10$	B1	
22(b)	$x = 2$	B1	
22(c)	Increasing	B1	
22(d)	$(\frac{dy}{dx} =) \ 3px^2 - 6x + 8$	M1	At least 2 terms correct
	$3p \times (2)^2 - 6 \times 2 + 8 = 0$	M1	oe Substitutes $x = 2$ in their $\frac{dy}{dx}$ which must be a quadratic **and** equates to zero
	$(p =) \ \frac{1}{3}$	A1	
	$\frac{1}{3} \times (2)^3 - 3 \times (2)^2 + 8 \times 2 + r = 10$	M1	oe Substitutes $x = 2$ in their $px^3 - 3x^2 + 8x + r$ **and** equates to 10
	$(r =) \ \frac{10}{3}$	A1ft	ft their p if M3 gained