Version 1.0



Level 2 Certificate in Further Mathematics

Specimen Paper 2 8360/2

Mark Scheme

Mark Schemes

Principal Examiners have prepared these mark schemes for specimen 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.

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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	Any consecutive pair contains an even (and an odd)	M1	$n(n+1)+(n+2)(n+3)$
	Even × odd = even	M1	$n^2+n+n^2+3n+2n+6$ Allow 1 error
	Even + even = even	A1	$2(n^2+3n+3)$ so even
2	$\sqrt{((7-1)^2+(12-4)^2)}$	M1	
	10	A1	
3(a)	4 $\frac{31}{55}$ $\frac{301}{595}$	B2	B1 For two correct oe
3(b)	Reference to $3n+1 \to 3n$ or $6n-5 \to 6n$ when n is large	B1	oe Must include reference to n being large
	$\frac{3n}{6n}$ cancelled to $\frac{1}{2}$	B1	
Alt 3(b)	$\frac{\frac{3n}{n}+\frac{1}{n}}{\frac{6n}{n}-\frac{5}{n}}$	M1	
	$\frac{3}{6}$ since $\frac{1}{n}$ and $\frac{5}{n} \to 0$ as $n \to \infty$	A1	oe
4(a)	56	B1	
4(b)	$x(x+1)=0$	M1	
	0 and –1	A1	
4(c)	$(x+1)^2+x+1-x^2-x$	M1	Allow 1 sign error
	$x^2+x+x+1+x+1-x^2-x$	A1	oe
	$2x+2$ or $2(x+1)$	A1	

Q	Answer	Mark	Comments
5	$4x - 5 = 2x + 3$	M1	
	$4x - 2x = 3 + 5$	M1	Allow one sign error
	$x = 4$	A1ft	
	Substitute their x into one of the equal sides	M1	eg, 4 × 4 – 5 or 2 × 4 = 3 (=11)
	Shows BC is 3 × 4 – 1 = 11 and 11 obtained for either AB or AC	A1	
6	Attempt at common value for y in order to eliminate y eg, 3 × 5 : 2 × 5 and 5 × 2 : 4 × 2	M1	Attempt to find two equations in order to eliminate y eg, $y = \frac{2x}{3}$ and $y = \frac{5z}{4}$
	15 : 10 and 10 : 8	A1	oe eg, $\frac{2x}{3} = \frac{5z}{4}$ or $8x = 15z$
	15 (: 10) : 8	A1	15 : 8

Q	Answer	Mark	Comments
7	$x + 2x + 3x + 4x = 360$	M1	oe
	$10x = 360$ ($x = 36$)	M1	
	Their 36 × 2 and their 36 × 3 or their 36 × 4	M1	
	36 + 144 = 180 or 72 + 108 = 180	M1	oe
	Concludes that *AB* is parallel to *DC* because allied/interior angles add up to 180°	A1	
Alt 7	$x + 4x + 3x + 2x = 360$	M1	oe
	$10x = 360$ ($x = 36$)	M1	
	$5x$ = 180	M1	
	$x + 4x = 5x$, so angle *A* + angle *D* = 180° or $3x + 2x = 5x$, so angle *C* + angle *B* = 180°	M1	oe
	Concludes that *AB* is parallel to *DC* because allied/interior angles add up to 180°	A1	oe
8	Sets denominator to zero or attempts to factorise in the form $(x \pm a)(x \pm b)$ where $ab = 10$	M1	$x^2 - 3x - 10 = 0$
	$(x + 2)(x - 5)$	A1	
	– 2 (and) 5	B1ft	ft From their factors

Q	Answer	Mark	Comments
9(a)	$x^3 + 4x^2 - 2x$	M1	Allow 1 error
	$-5x^2 - 20x + 10$	M1	Allow 1 error
	$x^3 + 4x^2 - 2x - 5x^2 - 20x + 10$	A1	
	$x^3 - x^2 - 22x + 10$	A1ft	
9(b)	$(x + 4)(x - 4) - (x - 4)(3x + 5)$	M1	
	$(x - 4)(\ldots\ldots\ldots\ldots\ldots\ldots)$	M1	
	$(x - 4)(x + 4 - 3x - 5)$	A1	
	$(x - 4)(-2x - 1)$	A1ft	oe eg, $-(x - 4)(2x + 1)$
Alt 9(b)	$(-)(3x^2 - 12x + 5x - 20)$	M1	
	$-2x^2 + 7x + 4$	A1	
	$(x + a)(-2x + b)$ $ab = 4$	M1	
	$(x - 4)(-2x - 1)$	A1 ft	oe eg, $-(x - 4)(2x + 1)$
10(a)	Attempt to work out both areas	M1	ie, $\frac{1}{2}(2x \times 2x)$ and $x(x + 4)$ Allow one error
	Correct expression for both areas	A1	
	$2x^2 > x^2 + 4x$	A1	
10(b)	$x(x - 4) > 0$	M1	Attempts U-shaped sketch of $y = x^2 - 4x$ crossing x-axis at $x = 0$ and $x = 4$
	$(x < 0$ and$)$ $x > 4$	M1	
	5	A1	

Q	Answer	Mark	Comments
11	(numerator) a^2	B1	
	(denominator) a^{12}	B1	
	a^{-10}	B1ft	ft If numerator and denominator seen as powers of a
12	$n^2 - 4n + 4 + 8n - n^2$	M1	Allow one error or omission
	$4n + 4$	A1	
	$4(n + 1)$	A1	$(4n + 4) \div 4 = n + 1$
13	Attempt to eliminate one variable eg, $(2x)^2 = x + 3$	M1	$y^2 = \frac{y}{2} + 3$
	$4x^2 - x - 3 = 0$	A1	$2y^2 - y - 6 = 0$
	Attempt at solution eg, $(4x + 3)(x - 1)$	M1	$(2y + 3)(y - 2)$ Allow correct use of formula
	$x = -\frac{3}{4}$ (and) $x = 1$	A1	$y = 2$ (and) $y = -1\frac{1}{2}$
	$y = -1\frac{1}{2}$ (and) $y = 2$	A1	$x = 1$ (and) $x = -\frac{3}{4}$
14(a)	$x^2 + y^2 = 9$	B1	
14(b)	$2^2 + 2^2 (= 8)$	M1	
	Inside and valid justification	A1	eg, inside and $8 < 9$, inside and $2.8\ldots < 3$
14(c)	$(x - 2)^2 + (y - 4)^2 =$ their 9	B2 ft	$(x + 2)^2 + (y + 4)^2 =$ their 9 B1 ft Their part (a)

Q	Answer	Mark	Comments
15	$\cos A = \frac{6.8^2 + 5.7^2 - 10.2^2}{2 \times 6.8 \times 5.7}$	M1	$\cos B = \frac{10.2^2 + 5.7^2 - 6.8^2}{2 \times 10.2 \times 5.7}$ or $\cos C = \frac{10.2^2 + 6.8^2 - 5.7^2}{2 \times 10.2 \times 6.8}$
	$-0.32649(\ldots)$ or -0.3265	A1	$0.77648(\ldots)$ or 0.7765 or $0.8491(\ldots)$
	$109(.05\ldots)^\circ$ or 109.06° or 109.1°	A1	$39(.05\ldots)$ or 39.1 or $31.88(\ldots)$ or 31.9 or 32
	$\frac{1}{2} \times 6.8 \times 5.7 \times \sin$ their 109	M1	$\frac{1}{2} \times 10.2 \times 5.7 \times \sin$ their 39 or $\frac{1}{2} \times 10.2 \times 6.8 \times \sin$ their 32
	18.3	A1 ft	
16	Gradient = 4	B1	
	Gradient of perpendicular $= -\frac{1}{4}$	B1ft	
	Midpoint = (4, 3)	B1	
	$y - 3 = -\frac{1}{4}(x - 4)$	M1	oe
	$y = -\frac{1}{4}x + 4$	A1	oe

Q	Answer	Mark	Comments
17(a)	$(AC^2 =)\ 12^2 + 10^2$ or $(AX^2 =)\ 6^2 + 5^2$	M1	$(VM^2 =)\ 14^2 - 5^2$ or $(VN^2 =)\ 14^2 - 6^2$
	$(AX =)\ \frac{\sqrt{244}}{2}$ $(\sqrt{61})$	A1	oe $(VM =)\ \sqrt{171}$ or $(VN =)\ \sqrt{160}$
	$(VX^2 =)\ 14^2 -$ their AX^2	M1	$(VX^2 =)$ their $VM^2 - 6^2$ or $(VX^2 =)$ their $VN^2 - 5^2$
	11.6(2)	A1	
17(b)	$\sin VCX = \frac{\text{their } VX}{14}$	M1	$\cos VCX = \frac{\text{their } \sqrt{61}}{14}$ or $\tan VCX = \frac{\text{their } VX}{\text{their } \sqrt{61}}$
	56.1°	A1	
17(c)	Use of right-angled triangle VMX where M is the mid-point of BC	M1	So that MV and MX are both at right angles to BC, thus defining the angle
	$\tan VMX = \frac{\text{their } VX}{6}$	M1	$\cos VMX = \frac{6}{\sqrt{14^2 - 5^2}}$ or $\sin VMX = \frac{\text{their } VX}{\sqrt{14^2 - 5^2}}$
	62.7°	A1	
18	$\cos x = (\pm)\ 0.894427$	M1	
	26.6, 153.4, 206.6, 333.4	A2	A1 For 2 or 3 answers
19	$2x^5 + 5x^4$	M1	
	$10x^4 + 20x^3$	A2 ft	ft Their two terms differentiated
	$10(2)^4 + 20(2)^3$	M1	$x = 2$ in their terms from differentiating
	320	A1 ft	ft If M2 awarded

Q	Answer	Mark	Comments
20(a)	(5,1)	B2	B1 For (5, *k*) or (*c*, 1) or $\begin{pmatrix}5\\1\end{pmatrix}$
20(b)	(3,1) or $\begin{pmatrix}3\\1\end{pmatrix}$	B1	
	2	B1ft	ft Their two points
21	f(2) = 8 – 16 – 22 + 30	M1	
	$x - 2$ is a factor	A1	
	$(x - 2)(x^2 \ldots\ldots - 15)$	M1	
	$(x - 2)(x^2 - 2x - 15)$	A1	
	$(x - 2)\ (x + a)\ (x + b)\ \ ab = -15$	M1	
	$(x - 2)(x - 5)\ (x + 3)$	A1	
22	$(x - 1)(x - 3)$	M1	
	A (1, 0) and *B* (3, 0) or *AB* = 2	A1	oe
	Attempts to differentiate, evidenced by at least one term correct	M1	$\frac{dy}{dx} = 2x - 4$
	Evidence of substituting $x = 5$ to find the gradient of the tangent	M1	When $x = 5$, $\frac{dy}{dx} = 2 \times 5 - 4\ (= 6)$
	Attempt to work out equation of tangent	M1	Tangent is $y - 8 =$ their $6(x - 5)$ oe eg, $y = 6x - 22$
	Substitutes $y = 0$ into their equation in an attempt to obtain $x = \frac{11}{3}$	M1	oe
	$3 \times (\frac{11}{3} - 3) = 2$	A1	oe