Version 1.0

Level 2 Certificate in Further Mathematics

Practice Paper Set 3

Paper 1 8360/1

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.aqa.org.uk

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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 1 - Non-Calculator

Q	Answer	Mark	Comments
1	$\left(\frac{1}{2}\right)^2 + \left(\frac{2}{3}\right)^2$	M1	or $\frac{1}{4} + \frac{4}{9}$
	$\frac{9 + 4 \times 4}{36}$	M1	or $\frac{9}{36} + \frac{16}{36}$
	$\sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{2}{3}\right)^2}$ or $\sqrt{\left(\frac{9}{36}\right) + \left(\frac{16}{36}\right)}$ or $\sqrt{\left(\frac{25}{36}\right)}$	M1 Dep	Dep on 1st M1 Use of 3, 4, 5 Δ, with $\frac{1}{2} = \frac{3}{6}$ and $\frac{2}{3} = \frac{4}{6}$ scores M3
	$\frac{5}{6}$	A1	
2	$15x - 10 - 3x + 3h$	M1	Allow one error or $4kx + 8$ (no errors)
	$12x = 4kx$ and $-10 + 3h = 8$	M1	ft Their expansion if 1st M1 earned
	$h = 6$ or $k = 3$	A1 ft	
	$h = 6$ and $k = 3$	A1	
3	$4(y - 2) + 5(2y + 1)$	M1	
	$4y - 8 + 10y + 5$ or $14y - 3$	M1 Dep	Allow one expansion or sign error when collecting terms
	Their $14y - 3 = 60$	M1	oe
	$\frac{63}{14}$ or $\frac{9}{2}$ or $4\frac{1}{2}$	A1	

Q	Answer	Mark	Comments
4	Angle at circumference = x	M1	
	$x + x + 42 = 180$	M1 Dep	
	$(x =)$ 69	A1	
Alt 1 4	Angle at circumference $= 180 – (x + 42)$	M1	
	$2(180 – (x + 42)) = 2x$ or $180 – (x + 42) = x$	M1 Dep	
	$(x =)$ 69	A1	
Alt 2 4	Reflex angle at centre = $2x + 84$	M1	
	$2x + 84 + 2x = 360$	M1 Dep	
	$(x =)$ 69	A1	
Alt 3 4	Reflex angle at centre = $360 – 2x$	M1	
	$360 – 2x = 2(x + 42)$	M1 Dep	
	$(x =)$ 69	A1	

5	$5a^6b^4$	B2	B1 For two out of three components correct

6	$\begin{pmatrix} a & b \\ -a & 2b \end{pmatrix} \begin{pmatrix} 5 \\ 4 \end{pmatrix} = \begin{pmatrix} 1 \\ 17 \end{pmatrix}$	M1	$5a + 4b = 1$ or $–5a + 8b = 17$ earns this mark
	$5a + 4b = 1$ and $–5a + 8b = 17$	M1	
	$12b = 18$	M1	or $15a = –15$ oe ….for correct elimination from their equations
	$a = –1$ or $b = 1\frac{1}{2}$	A1 ft	ft From their equations for their first answer
	$a = –1$ and $b = 1\frac{1}{2}$	A1	

Q	Answer	Mark	Comments
7(a)	$f(x) \leq 4$	B1	Allow $y \leq 4$
7(b)	2.6 or 2.7 or 2.8		
	–0.8 or –0.7 or –0.6	B1	
7(c)	$x < -1$ (and) $x > 3$	B2	B1 One inequality correct **or** $x \leq -1$ (or) $x \geq 3$
8	$\sqrt{x} = 6$ or $x = 6^2$ or $x = 36$	M1	
	$\frac{1}{y^3} = 64$ or $y^3 = \frac{1}{64}$	M1	
	$y = \frac{1}{4}$	A1	
	144	A1ft	ft Their x ÷ their y if $y \neq$ integer
9(a)	$3x$	B1	
9(b)	$180 - x$ or $180 -$ their $3x$	M1	
	$\frac{180 - x}{180 - \text{their } 3x} = \frac{7}{6}$	M1	oe
	$6(180 - x) = 7(180 -$ their $3x)$	M1	oe
	$x = 12$	A1ft	
	$\frac{360}{12}$ (= 30)	A1	oe eg, $30 \times 12 = 360$ Verify, rather than proof, scores max 3/5

Q	Answer	Mark	Comments
10	Straight line from (0, –3) to (3, 3)	B1	
	Straight line from (3, 3) to (5, 3)	B1ft	Horizontal line of length 2 from $x = 3$ to $x = 5$ ft From their first line
	Straight line from (5, 3) to (8, 0)	B1ft	Line of gradient –1 from $x = 5$ to $x = 8$ ft From their second line
11	Sketch of right-angled triangle with $\sqrt{5}$ on 'opposite' and 3 on hypotenuse	M1	Use of $\cos^2\theta + \sin^2\theta = 1$
	Adjacent = $\sqrt{(3^2 - (\sqrt{5})^2)}$	M1	$\cos^2\theta = 1 - \left(\frac{\sqrt{5}}{3}\right)^2$
	Adjacent = 2	A1	$\cos^2\theta = \frac{4}{9}$
	$-\frac{2}{3}$	A1	
12(a)	$(-3)^3 + 6(-3)^2 + (-3)a - 12 = 0$ or $-27 + 54 - 3a - 12 = 0$	M1	
	$3a = 15$	A1	
12(b)	$x^3 + 6x^2 + 5x - 12$ $\equiv (x + 3)(x^2 + kx - 4)$	M1	Sight of quadratic with x^2 and – 4 as the first and last terms
	$(x + 4)$	A1	
	$(x - 1)$	A1	
Alt 1 12(b)	Substitutes another value into the expression and tests for '= 0'	M1	
	$(x + 4)$	A1	
	$(x - 1)$	A1	
Alt 1 12(b)	Long division of polynomials getting as far as $x^2 + 3x$ …	M1	
	$(x + 4)$	A1	
	$(x - 1)$	A1	

Q	Answer	Mark	Comments
13	Multiplying 1st and 2nd brackets first		
	$\sqrt{5}\sqrt{5} + 3\sqrt{5} - 2\sqrt{5} - 3 \times 2$	M1	or better
	$\sqrt{5} - 1$	A1	
	$\sqrt{5}\sqrt{5} - \sqrt{5} + \sqrt{5} - 1$	M1	or better this is $(\sqrt{5} - 1)(\sqrt{5} + 1)$
	4	A1	
Alt 1 13	Multiplying 2nd and 3rd brackets first		
	$\sqrt{5}\sqrt{5} - 2\sqrt{5} + \sqrt{5} - 2 \times 1$	M1	or better
	$3 - \sqrt{5}$	A1	
	$3\sqrt{5} + 3 \times 3 - \sqrt{5}\sqrt{5} - 3\sqrt{5}$	M1	or better this is $(\sqrt{5} + 3)(3 - \sqrt{5})$
	4	A1	
Alt 2 13	Multiplying 1st and 3rd brackets first		
	$\sqrt{5}\sqrt{5} + 3\sqrt{5} + \sqrt{5} + 3 \times 1$	M1	or better
	$8 + 4\sqrt{5}$	A1	
	$8\sqrt{5} - 8 \times 2 + 4\sqrt{5}\sqrt{5} - 8\sqrt{5}$	M1	or better this is $(\sqrt{5} - 2)(8 + 4\sqrt{5})$
	4	A1	

14(a)	Centre must lie on the perpendicular bisector of *QR*	B1	oe eg, perpendicular bisector of chord *QR* passes through centre of circle
14(b)	(Gradient *PQ* = –1) Perpendicular gradient = 1 and gradient of $y = x$ is 1	M1	Gradient fact
	Mid-point of *PQ* = (2, 2) and $y = x$ passes through (2, 2)	A1	Reference to point (2, 2)
14(c)	Coordinates of centre = (7, 7)	B1	
	$(\text{Radius})^2 = 7^2 + 3^2$	M1	ft Their centre
	$(\text{Radius})^2 = 58$	A1	or Radius = $\sqrt{58}$
	$(x - 7)^2 + (y - 7)^2 = 58$	A1	ft Their centre and radius

Q	Answer	Mark	Comments	
15	$x^2 + 2bx + b^2$	M1	$2(x^2 - 2x(+ 2.5))$	$2(x^2 - 2x)$
	$-4 = 2ab$	M1	$2((x - 1)^2 - 1 (+ 2.5))$	$2((x - 1)^2 - 1)$
	$5 = ab^2 + c$	M1	$2(x - 1)^2 + 3$	$2(x - 1)^2 - 2 (+ 5)$
	$a = 2$, $b = -1$ and $c = 3$	A1	$a = 2$, $b = -1$ and $c = 3$ SC1 For $a = 2$ if b and c not found	

Q	Answer	Mark	Comments
16	$\frac{dy}{dx} = 12x^2 + 12x + 3$	M1	Allow one error
	Their $12x^2 + 12x + 3 = 0$	M1	oe ft Their $\frac{dy}{dx}$ if only one error ... must be quadratic
	$(3)(2x + 1)^2 = 0$	M1	Attempt at solving their quadratic
	$x = -\frac{1}{2}$	A1	
	When $x < -\frac{1}{2}$ (eg, –1) $\frac{dy}{dx} > 0$ When $x > -\frac{1}{2}$ (eg, 0) $\frac{dy}{dx} > 0$	M1	ft Their value of x and their $\frac{dy}{dx}$ if first M earned Must test gradient either side of their stationary value
	Point of inflexion at $(-\frac{1}{2}, 4\frac{1}{2})$	A1 ft	ft their $-\frac{1}{2}$