Pearson

Mark Scheme (Results)

January 2017

International GCSE Mathematics A 4MA0/3H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Types of mark
    - M marks: method marks
    - A marks: accuracy marks
    - B marks: unconditional accuracy marks (independent of M marks)
- Abbreviations
    - cao – correct answer only
    - ft – follow through
    - isw – ignore subsequent working
    - SC - special case
    - oe – or equivalent (and appropriate)
    - dep – dependent
    - indep – independent
    - eeoo – each error or omission

- No working
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- With working
  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
  If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.
  If there is no answer on the answer line then check the working for an obvious answer.
- Ignoring subsequent work
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- Parts of questions
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

International GCSE Maths				
Apart from questions 3, 5d, 17, 18, 20 & 23 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1 (a)	18 ÷ 60 oe **or** 7.3 **or** $7\frac{18}{60}$ **or** $7\frac{3}{10}$ **or** 7 × 60 + 18 (=438)		3	M1 for changing time to a decimal (7.3)
	750 × "7.3" oe **or** $750 \times \frac{"438"}{60}$ oe			M1 for speed × time (allow 750 × 7.18 **or** answer of 5385)
		5475		A1
(b)	for at least one correct operation eg. 750 × 1000, 750 ÷ 60 **or** $\frac{1000}{60\times60}$ (= 0.27....) **or** $\frac{5}{18}$		3	M1 for **one or two** of ×1000, ÷60, ÷60 (can be implied by 750 000 **or** 12.5 **or**12500 **or** 0.2083)
	$\frac{750\times1000}{60\times60}$ oe			M1 complete correct method
		208		A1 accept answers in range 208 – $208.\dot{3}$
	Alternative mark scheme ft from (a)			
	"5475" × 1000 (=5475000) **OR** 7 × 60 + 18 = 438 **and** 438 × 60 (=26280 (sec))		3	M1
	"5475000" ÷ 26280			M1 dep complete correct method
		208		A1 accept answers in range 208 – $208.\dot{3}$
				Total 6 marks

2	3×7 (=21)		2	M1 **or** for 3 numbers with a total of 21 **or** 3 numbers with a median of 5 **or** 3 numbers with a range of 14 **or** $(a + c =) 3 \times 7 - 5$ (=16)
		1, 5, 15		A1 numbers can be in any order
				Total 2 marks

3	$\frac{17}{3} - \frac{19}{5}$		3	M1	for correct improper fractions (subtraction sign not necessary) **OR** two improper fractions with a common denominator with at least one of the fractions correct
	E.g. $\frac{85}{15} - \frac{57}{15}$ **or** $\frac{17\times5-3\times19}{15}$ oe			M1	for correct fractions with a common denominator a multiple of 15 i.e. in form $\frac{85a}{15a} - \frac{57a}{15a}$
		shown		A1	dep on M2 for correct conclusion to $1\frac{13}{15}$ from correct working **with** sight of the result of the subtraction e.g. $\frac{28}{15}$
	Alternative method				
	$(5)\frac{10}{15} - (3)\frac{12}{15}$		3	M1	for two correct fractions with a common denominator a multiple of 15
	$-\frac{2}{15}$			M1	
		shown		A1	dep on M2 for correct conclusion to $1\frac{13}{15}$ from correct working **with** sight of the result of the subtraction e.g. $\frac{28}{15}$ or $2 - \frac{2}{15}$
	Alternative method				
	E.g. $5\frac{10}{15} - 3\frac{12}{15}$		3	M1	for two correct fractions with a common denominator a multiple of 15
	E.g. $4\frac{25}{15} - 3\frac{12}{15}$			M1	for a complete correct method
		shown		A1	dep on M2 for correct conclusion to $1\frac{13}{15}$ from correct working
					Total 3 marks

4	$\pi \times (70 - 2 \times 15)$ **or** $\pi \times 40$ (=125(.6…))		4	M1	oe
	4×15 (=60) **and** 4×70 (=280) **or** 340			M1	independent
	"125.6..." + "60" + "280"			M1	dep on M2
		466		A1	for answer in range 465.6 – 466
					Total 4 marks

5	(a)		$h\,(7 + h)$	1	B1	
	(b)	$4p + 20 + 7p - 14$		2	M1	Any 3 terms correct
			$11p + 6$		A1	cao NB $11p + 6$ followed by, for example, $17p$ scores M1 A0
	(c)	$7 \times (-2)^2 + 5$ **or** $7 \times 4 + 5$ **or** $7\,(-2)^2 + 5$		2	M1	for correct substitution **or** 7×4 **or** 28
			33		A1	
	(d)	$5q - 15\ (= 12 - q)$ **or** $q - 3 = \frac{12}{5} - \frac{q}{5}$		3	M1	
		E.g. $5q + q = 12 + 15$ **or** $6q = 27$			M1	For a correct equation with the q terms collected on one side of the equation and the non q terms on the other side. ft from $5q - 3 = 12 - q$ for this mark only
			4.5		A1	for 4.5 **or** $\frac{9}{2}$ oe dep on at least M1
	(e)	$-7t \geq 31 - 3$ or $7t \leq 3 - 31$ oe		2	M1	$-7t \geq 31 - 3$ **or** $7t \leq 3 - 31$ **or** -4 **or** $t \geq -4$ accept an equation or the wrong inequality sign in the working
			$t \leq -4$		A1	or for $-4 \geq t$
						Total 10 marks

6	$2.5 \times 28 + 7.5 \times 32 + 12.5 \times 20 + 17.5 \times 14 + 22.5 \times 6$ **or** $70 + 240 + 250 + 245 + 135$ **or** 940		4	M2	$f \times d$ for at least 4 products with correct mid-interval values **and** intention to add. If not M2 then award M1 for d used consistently for at least 4 products within interval (including end points) **and** intention to add **or** for at least 4 correct products with correct mid-interval values with no intention to add
	$(2.5 \times 28 + 7.5 \times 32 + 12.5 \times 20 + 17.5 \times 14 + 22.5 \times 6) \div 100$ **or** $(70 + 240 + 250 + 245 + 135) \div 100$ **or** "940" $\div 100$			M1	dep on M1 NB: accept their 100 if addition shown
		9.4		A1	SC: B2 for answer of 9.44 (B1 for 944 in working)
					Total 4 marks

7	$96 \div 3$ (= 32)		3	M1	M2 for $\frac{5}{3} \times 96$
	$9 \times$ '32'(=288) **or** $4 \times$ '32'(=128) **or** $(9 - 4) \times$ '32'			M1 dep	
		160		A1	
					Total 3 marks

8 (a)	(−1, 6) (0, 4) (1, 2) (2, 0) (3, −2) (4, −4) (5, −6)	Correct line between $x = -1$ and $x = 5$	4	B4	For a correct line between $x = -1$ and $x = 5$
				B3	For a correct line through at least 3 of (−1, 6) (0, 4) (1, 2) (2, 0) (3, −2) (4, −4) (5, −6) **OR** for all of (−1, 6) (0, 4) (1, 2) (2, 0) (3, −2) (4, −4) (5, −6) plotted but not joined.
				B2	For at least 2 correct points plotted
				B1	For at least 2 correct points stated (may be in a table) or seen in working **OR** for a line drawn with a negative gradient through (0, 4) **OR** for a line with the correct gradient.
(b)			3	M1	for $y = -4$ drawn; accept full or dashed line NB A shaded rectangle implies a choice of lines so M0
				M1	for $x = 1$ drawn; accept full or dashed line NB A shaded rectangle implies a choice of lines so M0
		For correct region identified		A1ft	for correct region identified. Condone no label if region clear. ft from an incorrect straight line in part (a)
					Total 7 marks

9	$4x^2 + 6x + 6x + 9$ **or** $4x^2 + 12x + 9$		3	M1	for at least 3 terms correct in expansion of first pair of brackets
	$2x^2 - 10x + 3x - 15$ **or** $2x^2 - 7x - 15$			M1	for at least 3 terms correct in expansion of second pair of brackets **or** all 4 terms correct ignoring signs allow $-2x^2 - 7x - 15$
		$2x^2 + 19x + 24$		A1	
	Alternative method				
	$(2x + 3)[(2x + 3) - (x - 5)]$			M1	
	$(2x + 3)(x + 8)$			M1	
		$2x^2 + 19x + 24$		A1	
					Total 3 marks

10	$0.82x = 25.83$ **or** $82\% = 25.83$		3	M1	or for use of 0.82 in a calculation
	$\frac{25.83}{0.82}$ **or** $\frac{25.83}{82} \times 100$			M1	
		31.5(0)		A1	
					Total 3 marks

11	(a)	4, 16, 42, 84, 96, 100	4, 16, 42, 84, 96, 100	1	B1	cao
	(b)	(20, 4) (40, 16) (60, 42) (80, 84) (100, 96) (120, 100)		2	M1	(ft from sensible table i.e. clear attempt at addition) for at least 4 points plotted correctly at end of interval **or** for all 6 points plotted consistently within each interval in the **freq table** at the correct height
			correct cf graph		A1	accept curve or line segments accept curve that is not joined to (0,0)
	(c)		46 - 48	1	B1	ft from a cumulative frequency graph
	(d)	E.g. reading from graph at $t = 70$		2	M1	for evidence of using graph at $t = 70$ ft from a cumulative frequency graph provided method is shown
			36 – 38		A1	100 – '63' ft from a cf graph ft from a cumulative frequency graph provided method is shown
						Total 6 marks

12	(a)(i)	2×48	96	1	B1	
	(ii)		The angle at the centre is double the angle at the circumference	1	B1	NB : accept twice, double, origin (O) accept 'angle at circumference is half the angle at the centre' oe
	(b) (i)	$180 - 48$	132	1	B1	
	(ii)		The opposite angles in a cyclic quadrilateral total 180°	1	B1	accept supplementary angles accept The angle at the centre is double the angle at the circumference **with** angles at a point sum to 360^o
						Total 4 marks

13	0.0275×4000 (=110)		3	M1	for interest for first year **or** 330 **or** answer of 4330	M2 for $1.0275^3 \times 4000$ oe
	E.g. $0.0275 \times (4000 +$ "110") (=113.025) **and** $0.0275 \times (4000 +$ "110" + "113.025")			M1	for a complete method	
		4339.16		A1	Accept answer in range 4339 – 4340 NB: Answer in range 339 – 340 gets M2A0	
						Total 3 marks

14	(a)	$T = k\sqrt{x}$		3	M1	or for $T = \sqrt{mx}$ k may be numeric (but not 1)
		$400 = k\sqrt{625}$ **or** $k = 16$ **or** $400 = \sqrt{m625}$ **or** $m = 256$			M1	implies the first M1
			$T = 16\sqrt{x}$		A1	accept $T = \sqrt{256x}$ Award 3 marks if $T = k\sqrt{x}$ but k is evaluated correctly in part (a) or (b). SC: B2 for correct formula for x in terms of T
	(b)		120	1	B1	ft for a correct answer from a substitution into an equation (or expression) in the form ($T =$) $k\sqrt{x}$ except for $k = 1$
						Total 4 marks

15	$(x^2 =)\ 17^2 + 14^2 - 2 \times 17 \times 14 \times \cos(123°)$		4	M1	
	E.g. $(x^2 =)\ 744(.248.....)$ **or** $(x^2 =)\ 17^2 + 14^2 - -259(.2\ldots)$			M1	for correct order of operations
	$(x =)27.28.....$			A1	for missing side in range 27.2 – 27.3
		58.3		B1ft	dep on M1 ft for "27.28" + 31
	Alternative scheme				
	(height =) $14 \times \sin(180 - 123)$ (=11.7…)			M1	
	$14 \times \cos(180 - 123)$ (=7.6…)			M1	
	$\sqrt{"11.7"^2 + "(17 + 7.6)"^2}$ (=27.28)			A1	
		58.3		B1ft	dep on M1 ft for "27.28" + 31
					Total 4 marks

16	(a)	$\sqrt[3]{\frac{264}{891}}$ **or** $\sqrt[3]{\frac{891}{264}}$ **or** $\frac{2}{3}$ or **or** $\frac{3}{2}$ oe **or** 2 : 3 **or** $\sqrt[3]{264} : \sqrt[3]{891}$ (= 6.415 : 9.622)		2	M1	correct linear scale factor **or** correct ratio (numbers may be in either order)
			12		A1	cao
	(b)	$459 \times \left(\frac{2}{3}\right)^2$ oe or $459 \div \left(\frac{3}{2}\right)^2$ oe **or** $459 \times 41(.153\ldots) \div 92(.594\ldots)$		2	M1	correct method to find the surface area of A
			204		A1	cao
						Total 4 marks

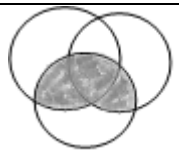
17	$\frac{-8 \pm \sqrt{524}}{10}$ **or** $\frac{-8 \pm \sqrt{8^2 - -460}}{2\times5}$ oe **or** $\frac{-8 \pm 2\sqrt{131}}{10}$ NB: denominator must be 2×5 or 10 **and** there must be evidence for correct order of operations in the numerator		3	M2	If not M2 then M1 for $\frac{-8 \pm \sqrt{8^2 - 4\times5\times-23}}{2\times5}$ condone one sign error in substitution; allow partial correct evaluation
		1.49, −3.09		A1	for answers in range 1.489 to 1.489105 **and** −3.089 to −3.0891045 Award M2 A1 for answers in range 1.489 to 1.489105 **and** −3.089 to −3.0891045 with sufficient correct working that would gain at least M1
	Alternative scheme				
	$5[(x+\frac{4}{5})^2 - \frac{16}{25}]$ oe		3	M1	for completing the square
	$-\frac{4}{5} \pm \sqrt{\frac{23}{5} + \frac{16}{25}}$ oe			M1	
		1.49, −3.09		A1	for answers in range 1.489 to 1.489105 **and** −3.089 to −3.0891045
					Total 3 marks

18	$\left(\frac{dy}{dx} =\right) 20x + 9$			M1	for differentiating $10x^2$ or $9x$ correctly
	$20x + 9 = 0$			M1	equating their $\frac{dy}{dx}$ (of the form $ax + b$) to zero, dep on previous M1
	$x = -0.45$ oe			A1	dep on at least M1 for $x = -0.45$ oe
		$(-0.45, 2.975)$ oe	4	A1ft	dep on M2 accept fractions $\left(-\frac{9}{20}, 2\frac{39}{40}\right)$ or $\left(-\frac{9}{20}, \frac{119}{40}\right)$
	Alternative scheme (completing the square)				
	$(x + \frac{9}{20})^2 + \ldots..$			M1	
	$(x + \frac{9}{20})^2 - \left(\frac{9}{20}\right)^2 + \frac{5}{10} = 0$			M1	
	$x = -0.45$ oe			A1	dep on at least M1 for $x = -0.45$ oe
		$(-0.45, 2.975)$ oe	4	A1ft	dep on M2 accept fractions $\left(-\frac{9}{20}, 2\frac{39}{40}\right)$ or $\left(-\frac{9}{20}, \frac{119}{40}\right)$

M2 for $\frac{-9}{2\times 10}$ (from $\frac{-b}{2a}$)

19	$k^2 = \frac{5m+2e}{3e}$ **or** $k\sqrt{3e} = \sqrt{5m+2e}$		4	M1	Squaring both sides **or** clearing fraction
	$3ek^2 = 5m + 2e$			M1	Clearing fraction **and** squaring both sides
	$3ek^2 - 2e = 5m$ or $-5m = 2e - 3ek^2$ $e(3k^2 - 2) = 5m$ or $-5m = e(2 - 3k^2)$			M1	Isolating terms in e in a correct equation
		$e = \frac{5m}{3k^2-2}$		A1	for $e = \frac{5m}{3k^2-2}$ **or** $e = \frac{-5m}{2-3k^2}$ oe
					Total 4 marks

20	3.5 **or** 2.5 **or** 5.25 **or** 5.35 **or** 8.365 **or** 8.375		3	M1	accept $3.4\dot{9}$ **or** 3.499… **or** $5.34\dot{9}$ or 5.3499... **or** $8.374\dot{9}$ **or** 8.37499..
	3.5(8.375 – 5.25) **or** 3.5 × 8.375 – 3.5 × 5.25			M1	or for $UB_1 \times (UB_2 - LB)$ oe where $3 < UB_1 \leq 3.5$ **and** $8.37 < UB_2 \leq 8.375$ **and** $5.25 \leq LB < 5.3$
		$\frac{175}{16}$ or 10.9375		A1	dep on M2 – correct working must be seen
					Total 3 marks

21	(a)		12	1	B1
	(b)		7	1	B1
	(c)	Correct region shaded		1	B1 Must be unambiguous
					Total 3 marks

22	$\frac{75}{360}\times\pi\times d\ (2r) = 7.2$		4	M1	for a correct equation linking the angle and arc length NB: 0.208(3…) may be used in place of $\frac{75}{360}$ **or** 4.8 in place of $\frac{360}{75}$
	$\frac{7.2\times360}{75\times\pi}$ oe **or** $\frac{7.2\times360}{75\times2\times\pi}$ oe **or** $d = 11(.0\ldots)$ **or** $r = 5.5(0\ldots)$			M1	for a complete method to find the radius or diameter.
	$\frac{75}{360}\times\pi\times\left(\frac{"11"}{2}\right)^2$ **or** $\frac{75}{360}\times\pi\times"5.5"^2$ **or** $\frac{75}{360}\times95(.04...)$			M1	dep on previous M1
		19.8		A1	for answer in range 19.8 – 19.82
					Total 4 marks

23		$x^2 + (8-2x)^2 = 52$		6	M1 for elimination of one variable $\left(\frac{8-y}{2}\right)^2 + y^2 = 52$
		$x^2 + 4x^2 - 16x - 16x + 64 = 52$			M1 (indep) for a correct expansion of $(8-2x)^2$ **or** $\left(\frac{8-y}{2}\right)^2$ $\left(\frac{64-8y-8y+y^2}{4}\right) + y^2 = 52$
		$5x^2 - 32x + 12 \ (= 0)$			A1 for correct simplified 3 term quadratic equation in any form (may not be equated to zero) $5y^2 - 16y - 144 \ (= 0)$
		$(5x-2)(x-6) \ (=0)$ **or** $\frac{--32 \pm \sqrt{(-32)^2 - 4\times5\times12}}{2\times5}$ (may be partially evaluated, condone lack of brackets around negative numbers)			M1 $(5y-36)(y+4) \ (=0)$ **or** $\frac{--16 \pm \sqrt{(-16)^2 - 4\times5\times-144}}{2\times5}$ (may be partially evaluated, condone lack of brackets around negative numbers) NB: can ft for this mark only provided M1 awarded and a 3 term quadratic
		$x = \frac{2}{5}$ or $x = 6$			A1 for **both** x values (or **both** y values) $y = \frac{36}{5}$ or $y = -4$
			$x = \frac{2}{5}$ oe, $y = \frac{36}{5}$ oe $x = 6$, $y = -4$		A1 for both solutions with x and y values correctly paired
					Total 6 marks

24	$\frac{6}{9}\times\frac{7}{10}\times\frac{7}{10}\left(=\frac{49}{150}\right)$ oe **or** $\frac{3}{9}\times\frac{4}{10}\times\frac{4}{10}\left(=\frac{4}{75}\right)$ oe **OR** $\frac{6}{9}\times\frac{7}{10}\times a$ **and** $\frac{3}{9}\times\frac{4}{10}\times b$ a and b must both be a single fraction where $0 < a, b < 1$ and $a \neq \frac{7}{10}$, $b \neq \frac{4}{10}$		3	M1
	$\frac{6}{9}\times\frac{7}{10}\times\frac{7}{10}$ oe **and** $\frac{3}{9}\times\frac{4}{10}\times\frac{4}{10}$ oe			M1 Both products correct (addition not needed)
		$\frac{19}{50}$		A1 oe E.g. $\frac{342}{900}$
				Total 3 marks

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