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General Certificate Secondary of Education
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Applications of Mathematics (Pilot)   9370

Unit 2 Higher Tier 93702H

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics 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.
Q	Marks awarded for quality of written communication. (QWC)
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 $\frac{1}{2}$

A2 Higher Tier

Q	Answer	Mark	Comments
1	$150 \times 4 \ (= 600)$	M1	$150 - \dfrac{480}{4} \ (= 30)$
	Their $600 - 480$	M1 Dep	Their 30×4
	120	A1	

Q	Answer	Mark	Comments
2(a)	70	B1	May be on diagram
	$360 - (80 + 65 + \text{their } 70)$	M1	$360 - 215$
	145	A1 ft	ft Their 70
			SC2 Answer 160
			SC2 Answer 152.5
2(b)	$420 \div 6$	M1	oe eg $6x = 420$ or 6 (edges) $\rightarrow 420$
	70	A1	
	$(2 \times)$ their $70 \times$ their 70	M1	Must be $(2 \times) \ x \times x$
	9800	A1 ft	ft $2 \times$ their $70 \times$ their 70
			SC3 Answer with digits 98
			SC2 Answer with digits 49

Q	Answer	Mark	Comments
3(a)	Bearing from A $142° \ (\pm 2°)$	B1	
	Bearing from B $255° \ (\pm 2°)$	B1	
	Intersection of their lines indicated as C	B1 ft	Any unambiguous indication
			ft From B1 B0 or B0 B1
3(b)	Q **and** 8	B2	B1 **24** or **16** or **8** seen
			or
			32 **and** 48 seen
			or
			Q with reason why it is faster
			eg Q as the line is steeper
			SC1 Q **and** $\dfrac{2}{15}$ (or $0.1\dot{3}$)

Q	Answer	Mark	Comments
4(a)(i)	0.72	B1	
4(a)(ii)	$2.8 \times 1.9 -$ their 0.72	M1	oe eg $280 \times 190 -$ their 7200 $5.32 -$ their 0.72
	4.6(0)	A1 ft	ft From their (a)(i) and consistent units Allow M1 A1 ft for 46000 if their (a)(i) is 7200 SC1 Answer with digits 46
4(b)	$2.4 \times 1.9 + \dfrac{1}{2} \times 2.4 \times (2.2 - 1.9)$ $(= 4.92)$ **or** $2 \times \dfrac{1}{2} \times 1.2 \times (1.9 + 2.2)$ $(= 4.92)$ **or** $2.4 \times 2.2 - \dfrac{1}{2} \times 2.4 \times (2.2 - 1.9)$	B2	oe B1 $\dfrac{1}{2} \times 2.4 \times (2.2 - 1.9)$ **or** $\dfrac{1}{2} \times 1.2 \times (1.9 + 2.2)$ oe **or** $4.56 + 0.36$ (no working) **or** $5.28 - 0.36$ (no working)
4(c)	$2 \times$ their 4.6 $(= 9.2)$ **or** 2×4.92 $(= 9.84)$ **or** (their $4.6 + 4.92$) $(\times 2)$ $(= 9.52$ or $19.04)$	M1	
	Their 19.04×2 $(= 38.08)$	M1	Their $19.04 \div 5$ $(= 3.808)$
	Their $38.08 \div 5$	M1	Their 3.808×2
	[7.6, 7.62]	A1 ft	Only ft from their 4.6(0) Accept 8 with correct working seen
Alt 4(c)	$(2 \times)$ 4.92 sections need $(2 \times)$ 1 litre **or** $(2 \times)$ 4.6 sections need $(2 \times)$ 1 litre	M1	
	$(2 \times)$ 4.92 sections need $(2 \times)$ 1 litre **and** $(2 \times)$ 4.6 sections need $(2 \times)$ 1 litre	M1	
	$(2 + 2) \times 2$	M1	oe eg 4×2
	8	A1	

Q	Answer	Mark	Comments
5(a)	$5 \div 2 \ (= 2.5)$ **or** $7.6 \div 2 \ (= 3.8)$	M1	oe
	$\pi \times$ their $2.5 \times$ their 2.5×87.5 **or** $\pi \times$ their $3.8 \times$ their 3.8×48	M1	oe
	[1715, 1718.3]	A1	$[546.875\pi, 547\pi]$
	[2174, 2179.2]	A1	$[693\pi, 693.12\pi]$ SC2 [6868, 6873.125] **and** [8705, 8711.1322] SC1 [6868, 6873.125] **or** [8705, 8711.1322]
	Their [1715, 1718.3] **and** Their [2174, 2179.2] **and** Tube A	Q1 ft	Strand (iii) - Correct ft conclusion based on their two volumes from using the correct formula twice
5(b)	$3 \times 7.6 + 4 \times 0.5 \ \ (= 24.8)$ **or** $3 \times 7.6 + 3 \times 0.5 \ \ (= 24.3)$ **or** $3 \times 7.6 + 2 \times 0.5 \ \ (= 23.8)$	M1	$22.8 + 2$ **or** $22.8 + 1.5$ **or** $22.8 + 1$
	$7.6 + 2 \times 0.5 \ \ (= 8.6)$	M1	
	Their $24.8 \times$ their 8.6×50	M1	Their length $\times$ their width $\times 50$
	10 664	A1 ft	ft From M1 M0 M1 or M0 M1 M1

Q	Answer	Mark	Comments
6	$8000 \times \dfrac{3}{4} \times \dfrac{3}{4} \times \dfrac{3}{4}$	M2	oe eg three consecutive reductions by $\dfrac{1}{4}$ M1 $8000 \times \dfrac{3}{4} \ \ (= 6000)$ **or** $8000 - \dfrac{1}{4} \times 8000 \ \ (= 6000)$
	3375	A1	SC1 Answer 125 SC1 Answer 2000

Q	Answer	Mark	Comments
7(a)	Arc drawn inside rectangle, centre *X*, radius [3.8 cm, 4.2 cm]	B2	B1 Arc drawn inside rectangle, centre *X*, radius outside allowed range **or** At least 4 points marked within the allowed tolerance **or** Arc with at least half within the tolerance
7(b)	Correct (shortest) measurement ($\pm$ 2 mm) taken from *Y* to their arc drawn in (a) [8 cm, 8.4 cm] if (a) correct	M1	
	[16, 16.8]	A1 ft	ft Their [8 , 8.4] × 2 SC1 Arc drawn, centre *Y*, that touches ($\pm$ 2 mm) their arc drawn in (a)
Alt 1 7(b)	Measures length and width correctly ($\pm$ 2 mm) and uses Pythagoras and subtracts 4 ie $\sqrt{[9.8, 10.2]^2 + [6.8, 7.2]^2} - 4$ $(= [7.9, 8.5])$	M1	Measures length and width correctly (±2 mm), applies scale, uses Pythagoras and subtracts 8 ie $\sqrt{[19.6, 20.4]^2 + [13.6, 14.4]^2} - 8$
	[15.8, 17]	A1	Do not ft for this method
Alt 2 7(b)	Measures XY correctly ($\pm$ 2 mm) and subtracts 4 ie [12, 12.4] − 4 $(= [8, 8.4])$	M1	Measures XY correctly ($\pm$ 2 mm), applies scale and subtracts 8 ie [24, 24.8] − 8
	[16, 16.8]	A1	Do not ft for this method

Q	Answer	Mark	Comments
8(a)	$7^2 - 4.2^2$ $(= 31.36)$	M1	
	$\sqrt{\text{their } 31.36}$	M1 Dep	6^2
	5.6	A1	36 **and** 31.36
Alt 8(a)	$15^2 - 13.9^2$ $(= 31.79)$	M1	
	$\sqrt{\text{their } 31.79}$	M1 Dep	6^2
	[5.6, 5.64]	A1	36 **and** 31.79
8(b)	$\cos(x) = \dfrac{13.9}{15}$	M1	$\cos(x) = \dfrac{15^2 + 13.9^2 - \text{their } 5.6^2}{2 \times 15 \times 13.9}$
	$\cos^{-1} \dfrac{13.9}{15}$	M1	If M1 seen, an answer of [0.38, 0.4] or [24.3, 24.6] implies the second M1
	[21.9, 22.1]	A1	
Alt 1 8(b)	$\sin(x) = \dfrac{\text{their } 5.6}{15}$	M1	Allow $\sin(x) = \dfrac{\text{their } 5.6}{15} \times \sin 90$
	$\sin^{-1}\left(\dfrac{\text{their } 5.6}{15}\right)$	M1	Allow $\sin^{-1}\left(\dfrac{\text{their } 5.6}{15} \times \sin 90\right)$ If M1 seen, an answer of [0.38, 0.4] or [24.3, 24.6] implies the second M1
	[21.9, 22.1]	A1	
Alt 2 8(b)	$\tan(x) = \dfrac{\text{their } 5.6}{13.9}$	M1	
	$\tan^{-1}\left(\dfrac{\text{their } 5.6}{13.9}\right)$	M1	If M1 seen, an answer of [0.38, 0.4] or [24.3, 24.6] implies the second M1
	[21.9, 22.1]	A1	
Alt 3 8(b)	$\cos(x) = \dfrac{15^2 + (4.2 + 13.9)^2 - 7^2}{2 \times 15 \times (4.2 + 13.9)}$	M1	$(= [0.927, 0.93])$ Allow $543 \cos(x) = 503.61$
	$\cos^{-1} \dfrac{15^2 + (4.2 + 13.9)^2 - 7^2}{2 \times 15 \times (4.2 + 13.9)}$	M1	If M1 seen, an answer of [0.38, 0.4] or [24.3, 24.6] implies the second M1
	[21.9, 22.1]	A1	

Q	Answer	Mark	Comments
9	$\frac{1}{2} \times \pi \times 4^2$ (= [25.1, 25.14]) **or** $\frac{1}{2} \times \pi \times 3.5^2$ (= [19.2, 19.245])	M1	Working out one **uncut** area 8π **or** 6.125π
	$\frac{1}{2} \times \pi \times 4^2 + \frac{1}{2} \times \pi \times 3.5^2$	M1	Working out total **uncut** area This mark implies the first M1
	[44.3, 44.4]	A1	14.125π
	$(\frac{1}{2} \times) \pi \times 5^2$ **or** fully correct attempt to work out total **cut** area	M1	
	[78.5, 78.6] or [39.25, 39.3] **or** [34.1, 34.2]	A1	25π or 12.5π **or** 10.875π
Alt 9	$\pi \times 5^2 - \pi \times 4^2$ (= [28.26, 28.3]) **or** $\frac{1}{2} \times \pi \times 4^2 - \frac{1}{2} \times \pi \times 3.5^2$ (= [5.8875, 5.9])	M1	Working out one **cut** area Allow for one (or half of) annulus **cut** area eg 1 $\pi \times 5^2 - \pi \times 4.5^2$ (= [14.9, 15]) eg 2 $\pi \times 4.5^2 - \pi \times 4^2$ (= [13.3, 13.4]) 9π **or** 1.875π **or** 4.75π **or** 4.25π
	$(\pi \times 5^2 - \pi \times 4^2) +$ $(\frac{1}{2} \times \pi \times 4^2 - \frac{1}{2} \times \pi \ 3.5^2)$	M1	oe Working out total **cut** area This mark implies the first M1
	[34.1, 34.2]	A1	10.875π
	$(\frac{1}{2} \times) \pi \times 5^2$ **or** fully correct attempt to work out total **uncut** area	M1	
	[78.5, 78.6] or [39.25, 39.3] **or** [44.3, 44.4]	A1	25π or 12.5π **or** 14.125π

Q	Answer	Mark	Comments
10(a)	($A =$) 12	B1	
	($B =$) 28	B1 ft	ft 16 + their 12 SC1 (10, 12) **and** (13, 28) SC1 12 and 28 transposed
10(b)	3250 ÷ 250	M1	oe eg 3.25 ÷ 0.25(0)
	13	A1	Allow M1 A1 for clear indication that it takes 3 seconds to fill the upper part of the container
	11.5	A1 ft	ft $\dfrac{\text{their } 13 - 10}{2} + 10$
Alt 10(b)	10 sec → 2.5 litres **and** 3.25 − 2.5 = 0.75 **and** 0.75 ÷ 2 ÷ 0.25	M1	oe eg works in ml
	1.5	A1	Allow M1 A1 for clear indication that it takes 3 seconds to fill the upper part of the container
	11.5	A1ft	ft 10 + their 1.5

Q	Answer	Mark	Comments
11(a)	30 with valid reason eg 1 30 because (in 10 minutes) P will be at the highest point eg 2 30 (10 minutes) 180° or half a turn eg 3 30 because 5 is a quarter of 20 and a quarter turn is 90°	B2	B1 30 without valid reason **or** Reason indicates they understand the context but answer not 30 eg 1 in 10 minutes P will be at the highest point eg 2 10 minutes 180°
11(b)(i)	Fully correct curve with two more sections ie Maximum points at (30, 30) **and** (50, 30) **and** passing through (25,15) (35, 15) (40, 0) (45, 15) (55, 15) (60, 0) All points $\pm \frac{1}{2}$ square	B3	B2 Two curved sections with maximum points at (30, 30) **and** (50, 30) **and** passing through at least four of (25,15) (35, 15) (40, 0) (45, 15) (55, 15) (60, 0) **or** Fully correct curve for either $20 \le t \le 40$ or $40 \le t \le 60$ B1 At least 3 of (25, 15) (30, 30) (35, 15) (40, 0) (45, 15) (50, 30) (55, 15) and (60, 0) seen on graph or in working (eg, in a table)
11(b)(ii)	[5, 6]	B2	B1 Two values seen with at least one being [7, 7.5] or [12.5, 13] **or** Line $h = 25$ drawn on first section of curve up to second point of intersection **or** 2 points marked on first section of curve (or t axis) where $h = 25$ SC1 [15, 18]

Q	Answer	Mark	Comments
12(a)	$35 \div 25$ $(= 1.4)$	M1	oe $25 \div 35$ $(= 0.7(1\ldots))$
	Their 1.4×16	M1 Dep	$16 \div$ their $0.7(1\ldots)$
	22.4	A1	
Alt 12(a)	$16 \div 25$ $(= 0.64)$	M1	oe $25 \div 16$ $(= 1.56(25)$ or $1.6)$
	Their 0.64×35	M1 Dep	$35 \div$ their $1.56(25)$
	22.4	A1	
12(b)	$(35 \div 25)^3$ $(= 2.744)$	M1	$(25 \div 35)^3$ $(= 0.3644\ldots)$ oe
	Their 2.744×15	M1 Dep	$15 \div$ their $0.3644\ldots$
	[41, 41.2] **and** No	A1	
Alt 1 12(b)	$(35 \div 25)^3$ $(= 2.744)$	M1	$(25 \div 35)^3$ $(= 0.3644\ldots)$ oe
	$42 \div$ their 2.744	M1 Dep	$42 \times$ their $0.3644\ldots$
	[15.3, 15.31] **and** No	A1	
Alt 2 12(b)	$(35 \div 25)^3$ $(= 2.744)$	M1	$(25 \div 35)^3$ $(= 0.3644...)$ oe
	$42 \div 15$ $(= 2.8)$	M1 Dep	$15 \div 42$ $(= 0.3571...)$
	2.7(44) **and** 2.8 **and** No	A1	0.36(44...) **and** 0.35(71…) **and** No
Alt 3 12(b)	$25 \times 16 \times x$ $(= 400x)$ **and** $35 \times$ their $22.4 \times 1.4x$ $(= 1097.6x)$ **and** their $400x \div 15$ $(= [26.6x, 26.7x])$ **and** their $1097.6x \div 42$ $(= [26.1x, 26.13\ldots x])$	M2	oe
	[26.6x, 26.7x] **and** [26.1x, 26.13…x] **and** No	A1	

Q	Answer	Mark	Comments
13(a)	2	B1	Allow [1.9, 2.1]
13(b)	Area calculated [236, 250] **and** divided by 16 **and** answer [14.75, 15.625] (division by 16 implied by answer [14.75, 15.625])	B6	B5 Area calculated [236, 250] **and** divided by 16 B4 Area calculated [236, 250] **or** Area calculated [200, 235] **and** divided by 16 (division by 16 implied by answer [12.5, 14.7]) **or** Area calculated [251, 260] **and** divided by 16 (division by 16 implied by answer [15.7, 16.3]) B3 Area calculated [200, 235] **or** [251, 260] B2 Any two correct areas under the graph **or** counts squares and obtains [55, 65] squares of area 4 or [12, 16] squares of area 16 B1 Any one correct area under the curve **or** attempt seen to divide area under the graph into rectangles / triangles / trapeziums **or** attempt seen to count squares
Alt 13(b)	Calculates average speeds over **equal** two second time intervals **and** divides by 8 **and** obtains answer 15.55 or 15.6 **or** Calculates average speeds over **equal** four second time intervals **and** divides by 4 **and** obtains answer 15.3	B6	B5 Calculates average speeds over **equal** two second time intervals **and** divides by 8 **or** Calculates average speeds over **equal** four second time intervals **and** divides by 4 B4 Calculates average speeds over **equal** eight second time intervals **and** divides by 2 **and** obtains answer 14 B3 Calculates average speeds over **equal** eight second time intervals **and** divides by 2 B2 Average speed for first 4 seconds is 20 **and** any one other correct average speed over 4 seconds B1 Average speed for first 4 seconds is 20

Q	Answer	Mark	Comments
13(c)(i)	Attempts to draw tangent at $t = 8$	B1	
	Attempt to find slope or gradient of their tangent	M1	Must use vertical change ÷ horizontal change **and** use both scales consistently or use one correct value
	$[-0.5, -1]$	Q1	Strand (i) Positive answer is Q0
13(c)(ii)	Deceleration or acceleration	B1	Rate of change of speed