Version 0.3

General Certificate of Secondary Education
June 2013

Applications of Mathematics (Pilot) 9370

Unit 2 Higher Tier 93702H

Final

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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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.

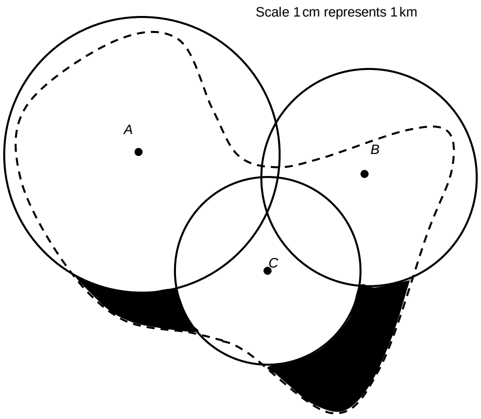
M	Method marks are awarded for a correct method which could lead to a correct answer.
M dep	A method mark dependent on a previous method mark being awarded.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
Q	Marks awarded for quality of written communication.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
25.3 …	Allow answers which begin 25.3 e.g. 25.3, 25.31, 25.378.
Use of brackets	It is not necessary to see the bracketed work to award the marks.

A2 Higher Tier

Q	Answer	Mark	Comments
1	$\frac{20}{40} \times 60$ (= 30) **or** $\frac{20}{40} \times 120$ (= 60) **or** $\frac{20}{40} \times 180$ (= 90)	M1	oe eg 1 60 ÷ 2 eg 2 60 ÷ 40 (= 1.5) **and** their 1.5 × 20
	$\frac{15}{20} \times 60$ (= 45) **or** $\frac{15}{20} \times 120$ (= 90) **or** $\frac{15}{20} \times 180$ (= 135)	M1	oe eg 1 180 ÷ 4 × 3 eg 2 60 ÷ 20 (= 3) **and** their 3 × 15
	their 30 + their 45 **or** their 60 + their 90 **or** their 90 + their 135	M1dep	dep on at least one M1
	(Sugar) 75 (Butter) 150 (Flour) 225	A1	All 3 correct SC2 No working with two correct answers SC1 No working with one correct answer
1	**Alternative**		
	$\frac{20}{40}$ **and** $\frac{15}{20}$	M1	oe eg 0.5 **and** 0.75
	their $\frac{20}{40}$ + their $\frac{15}{20}$ $(=\frac{5}{4})$	M1	oe eg 1.25
	their $\frac{5}{4} \times 60$ (= 75) **or** their $\frac{5}{4} \times 120$ (= 150) **or** their $\frac{5}{4} \times 180$ (= 225)	M1dep	oe eg 1.25 × 60
	(Sugar) 75 (Butter) 150 (Flour) 225	A1	All 3 correct SC2 No working with two correct answers SC1 No working with one correct answer

Q	Answer	Mark	Comments
2(a)	6.4 × 4.5 (+) 4 × 2.3 **or** 4.5 × 2.4 (+) 4 × 6.8	M1	oe eg 28.8 (+) 9.2 **or** 10.8 (+) 27.2
	38	A1	SC1 28.8 **and** 9.2 or 10.8 **and** 27.2 or 5.4 **and** 5.4 **and** 27.2
2(a)	**Alternative**		
	6.4 × 6.8 (–) 2.3 × 2.4	M1	oe eg 43.52 (–) 5.52
	38	A1	SC1 43.52 **and** 5.52
2(b)	π × 1.7 × 1.7	M1	oe
	[9, 9.1] **or** 2.89π	A1	oe SC1 [2.268, 2.3]
2(c)	$\frac{\text{their [9, 9.1]}}{\text{their 38}}$ (× 100)	M1	oe eg their [9, 9.1] ÷ 0.38
	[0.236, 0.24] **or** [23.6, 24]	A1 ft	ft from their areas in (a) and (b)
	[0.236, 0.24] **and** Yes **or** [23.6, 24] **and** Yes	Q1ft	Strand (iii) Must have M1 Correct ft decision based on their decimal or their percentage ft from their areas in (a) and (b)
2(c)	**Alternative 1**		
	0.25 × their 38	M1	oe
	9.5	A1ft	ft from their area in (a)
	9.5 **and** Yes	Q1ft	Strand (iii) Must have M1 Correct ft decision based on their 9.5 and their area in (b) ft from their areas in (a) and (b)
2(c)	**Alternative 2**		
	their [9, 9.1] × 4	M1	
	[36, 36.4]	A1ft	ft from their area in (b)
	[36, 36.4] **and** Yes	Q1ft	Strand (iii) Must have M1 Correct ft decision based on their [36, 36.4] and their area in (a) ft from their areas in (a) and (b)

Q	Answer	Mark	Comments
3(a)	$4x + 7 = 21$	M1	oe eg $2x + 1 + x + x + 6 = 21$
	$4x = 21 - 7$	M1	oe eg $2x + x + x = 21 - 1 - 6$ ft their equation of form $ax + b = c$ $a \neq 0$ $b \neq 0$
	3.5 **or** $3\frac{1}{2}$ **or** $\frac{7}{2}$	A1ft	oe ft from M0 M1 or M1 M0
	Sets up and solves their linear equation	Q1	Strand (iii) Allow one error in the solution of their equation
3(a)	**Alternative**		
	21 – 7 (= 14)	M1	
	their 14 ÷ 4	M1	
	3.5 **or** $3\frac{1}{2}$ **or** $\frac{7}{2}$	A1ft	oe ft from M0 M1 or M1 M0
		Q0	
3(b)	9.5	B1ft	ft their x in (a) if $x > 0$

Q	Answer	Mark	Comments
4	Completely correct ie Circle radius 4.5 cm centre *A* Circle radius 3.5 cm centre *B* Circle radius 3 cm centre *C* Shades both correct regions  	B4	All radii ± 2 mm Full circles do not have to be drawn but arcs inside the town must be seen B3 3 circles correct **and** only 1 correct region shaded (no incorrect regions) **or** 3 circles correct **and** both correct regions shaded **and** one extra region shaded **or** 2 circles correct **and** 1 incorrect **and** correct ft regions shaded B2 3 circles correct with no or incorrect shading **or** 2 circles correct **and** 1 incorrect **and** correct ft regions shaded **and** one extra region shaded **or** 1 circle correct **and** 2 incorrect **and** correct ft regions shaded **or** 2 circles correct **and** none incorrect **and** correct ft regions shaded B1 3 incorrect circles **and** correct ft regions shaded **or** At least 1 circle correct

Q	Answer	Mark	Comments
5(a)	At least 6 squares drawn on gold grid **and** 6 large triangles **and** 24 small triangles drawn on silver grid **and** answer 6	B4	B3 At least 4 large triangles **and** at least 16 small triangles drawn on silver grid B2 At least 2 large triangles **and** at least 8 small triangles drawn on silver grid B1 At least 1 large triangle **and** at least 4 small triangles drawn on silver grid **or** At least 1 square drawn on gold grid SC2 Answer 6 **and** at least 6 squares drawn on gold grid **and** 6 three by two rectangles drawn on silver grid SC2 Answer 6 **and** at least 6 squares drawn on gold grid **and** one three by two rectangle drawn on silver grid with 4 small and 1 large triangle shown SC1 Answer 6 with no valid diagrams
5(b)	4 (gold) **or** 6 (silver)	B1	
	their 4 × 14 (+) their 6 × 2.5(0)	M1	56 (+) 15 At least one of their 4 and their 6 must be > 1
	71	A1	

<table>
<tr><th>Q</th><th colspan="2">Answer</th><th>Mark</th><th colspan="2">Comments</th></tr>
<tr><td rowspan="4">6</td><td colspan="2">Intention to divide 1.2 m by 3 mm
eg1 1.2 ÷ 3 (= 0.4)
eg2 120 ÷ 0.03 (= 4000)</td><td>M1</td><td colspan="2">Allow inconsistent units and/or incorrect unit conversions</td></tr>
<tr><td colspan="2">1200 ÷ 3 or
120 ÷ 0.3 or
1.2 ÷ 0.003 or
400</td><td>M1</td><td colspan="2">Consistent dimensions with no incorrect unit conversions
This mark implies M1 M1</td></tr>
<tr><td colspan="2">800</td><td>A1</td><td colspan="2"></td></tr>
<tr><td colspan="2">800 and Yes</td><td>Q1ft</td><td colspan="2">ft their 800 and correct ft decision if M2 gained
Strand (ii)
SC4 375 and 400 and Yes</td></tr>
<tr><td rowspan="5">6</td><td colspan="2">Alternative</td><td></td><td colspan="2"></td></tr>
<tr><td>750 × 3 (= 2250)</td><td>750 ÷ 2 (= 375)</td><td>M1</td><td>750 × 0.003 (= 2.25)
or
750 × 0.3 (= 225)</td><td>750 ÷ 2 (= 375)</td></tr>
<tr><td>their 2250 ÷ 2
(= 1125)</td><td>their 375 × 3
(= 1125)</td><td>M1</td><td>their 2.25 ÷ 2
or
their 225 ÷ 2 (= 112.5)</td><td>their 375 × 0.003
or
their 375 × 0.3 (=112.5)</td></tr>
<tr><td colspan="2">1125 and 1200
or
112.5 and 120
or
1.125</td><td>A1</td><td colspan="2"></td></tr>
<tr><td colspan="2">1125 and 1200 and Yes
or
112.5 and 120 and Yes
or
1.125 and Yes</td><td>Q1ft</td><td colspan="2">ft their value(s) and correct ft decision if M2 gained
Pairs of values must be in the same unit
Strand (ii)
SC4 375 and 400 and Yes</td></tr>
</table>

Q	Answer	Mark	Comments
7(a)	200 ÷ 10 (= 20) **or** 20 × 10 = 200 **or** 200 ÷ 20 = 10	B1	
7(b)	(Becky) (25 50 75) 100 …… **and** (Chris) (20 40 60 80) 100 …...	B1	100 (or multiple of 100) as a common multiple
	4 × 200	M1	ft 4 from their lowest common multiple 4 must be from Becky's multiples
	800	A1ft	ft B0 M1 SC1 1000 SC1 Any multiple of 800
7(b)	**Alternative 1**		
	(Becky) (8 16 24 32) 40 …… **and** (Chris) (10 20 30) 40 …...	B1	40 (or multiple of 40) as a common multiple
	4 × 200	M1	ft 4 from their lowest common multiple 4 must be from Chris's multiples
	800	A1ft	ft B0 M1 SC1 1000 SC1 Any multiple of 800
7(b)	**Alternative 2**		
	200 ÷ 2 (= 100)	M1	2 is the difference in speeds
	their 100 × 8	M1	
	800	A1	SC1 1000 SC1 Any multiple of 800

Q	Answer	Mark	Comments
8(a)	3	B1	
8(b)	Correct attempt at full area eg1 $\frac{1}{2} \times 5 \times 5 + 5 \times$ their $3 + \frac{1}{2} \times 4 \times 5$ $(= 12.5 + 15 + 10)$ eg2 $\frac{1}{2} \times (12 +$ their $3) \times 5$ $(= \frac{1}{2} \times 15 \times 5)$	M2	ft their 3 from (a) for M2 and M1 M1 Correct attempt at a relevant area eg 1 $\frac{1}{2} \times 5 \times 5$ $(= 12.5)$ eg 2 $5 \times$ their 3 $(= 15)$ eg 3 $\frac{1}{2} \times 4 \times 5$ $(= 10)$ eg 4 Counting squares
	37.5	A1ft	oe ft from M2 and their 3 from (a)
8(c)	1	B1	
8(d)	acceleration	B1	

9	$\frac{46}{\tan 55}$ **or** 46 (×) tan 35 **or** $\frac{46}{\sin 55}$ (×) sin 35	M2	oe eg Uses sin 55 to calculate AB **and** uses Pythagoras to calculate AD M1 $\tan 55 = \frac{46}{AD}$ **or** $\tan 35 = \frac{AD}{46}$ **or** $\frac{AD}{\sin 35} = \frac{46}{\sin 55}$
	46 (×) cos 38 **or** 46 (×) sin 52 **or** $\frac{46}{\sin 90}$ (×) sin 52	M2	oe eg Uses sine rule to calculate BC **and** uses cosine rule to calculate DC M1 $\cos 38 = \frac{DC}{46}$ **or** $\sin 52 = \frac{DC}{46}$ **or** $\frac{DC}{\sin 52} = \frac{46}{\sin 90}$
	[32, 32.21] **or** [36, 36.25]	A1	
	[68.4, 68.5]	A1ft	ft their [32.2, 32.21] + their [36.2, 36.25] if both values used are to 1 dp or better Only ft if at least M2 M0 or M0 M2 gained SC5 [77.3, 77.33342] SC5 [42.9, 42.92]

Q	Answer	Mark	Comments
10	$60^2 + 80^2$ (= 10 000) **or** $80^2 + 120^2$ (= 20 800) **or** $60^2 + 120^2$ (= 18 000)	M1	100 (may be seen on diagram) **or** [144.2, 144.2221] **or** [134.1, 134.2]
	$\sqrt{60^2 + 80^2 + 120^2}$ (= $\sqrt{3600 + 6400 + 14\,400}$)	M1dep	oe eg 1 $\sqrt{100^2 + 120^2}$ eg 2 $\sqrt{10\,000 + 120^2}$ eg 3 $\sqrt{24\,400}$ or $20\sqrt{61}$ This mark implies M1 M1
	[156, 156.205]	A1	

Q	Answer	Mark	Comments
11(a)	Any 'point' from graph seen eg 1 (20, 6) eg 2 b = 20 **and** h = 6 eg 3 $\frac{1}{2} \times 25 \times 4$	M1	Allow readings from graph rounded or truncated to nearest integer Point may be seen in a table of values
	$\frac{1}{2} \times 20 \times 6$ **or** $\frac{1}{2} \times 15 \times 8$ **or** $\frac{1}{2} \times 10 \times 12$ **or** $\frac{1}{2} \times 5 \times 24$ **or** $\frac{1}{2} \times 3 \times 40$ **or** $\frac{1}{2} \times 3 \times 40$	A1	Must use numbers from the given graph SC2 $\frac{1}{2}$ (×) base (×) height stated **and** any correct multiplication that has answer 60 or 120 but does not show $\frac{1}{2}$ in the calculation eg 1 $\frac{1}{2}$ × base × height **and** 10 × 6 eg 2 $bh \div 2$ **and** 3 × 40
11(b)	Curve passing through (30, 4) **and** (40, 3) (±$\frac{1}{2}$ square)	B2	B1 At least one of (30, 4) and (40, 3) plotted (±$\frac{1}{2}$ square) or seen in working eg 1 $\frac{1}{2} \times 30 \times 4$ eg 2 $\frac{1}{2} \times 40 \times 3$
11(c)(i)	Straight line from (0, 0) to (40, 20)	B1	
11(c)(ii)	(Base) [15, 16] **and** (Height) [7, 8]	B2ft	B1ft (Base) [15, 16] **or** (Height) [7, 8] ft their line in (c) for B2 or B1 Values rounded or truncated to nearest integer SC1 Answers transposed

Q	Answer		Mark	Comments
12(a)	$6 \times 4 \times 2$ (= 48)		M1	
	$\frac{4}{3}$ (×) π (×) 1.5^3 (=[14.1, 14.14])		M1	oe eg 4.5π Condone $\frac{4}{3}$ (×) π (×) 3^3 (= [113, 113.112])
	their 48 + their [14.1, 14.14]		M1	Must be adding two volumes Their [14.1, 14.14] must be from $\frac{4}{3}$ (×) π (×) 1.5^3
	[62.13, 62.14]		A1	Value > 3 sf must be seen for total volume or volume of sphere Only allow 62.1 if volume of sphere is given as [14.13, 14.14]
12(b)	540 ÷ 11.3		M1	
	[47, 48]		A1	
	No		A1ft	ft their 62.1 Working for M1 must be seen or implied
12(b)	**Alternative**			
	their 62.1 × 11.3	540 ÷ their 62.1	M1	
	[700, 702.15]	[8.6, 8.7]	A1ft	ft their 62.1
	No		A1ft	ft their 62.1 Working for M1 must be seen or implied

13(a)	[70, 71]	B1	
13(b)	[4.4, 4.6]	B1	oe [4min 24s, 4min 36s] or [264s, 276s]
13(c)	Tangent drawn at T = [3.8, 4.2]	B1	Do not allow if line crosses curve
	Attempt at gradient of their tangent eg $\frac{138-131}{4-1}$	M1	Either numerator or denominator must be correct for their tangent
	[1.5, 3.5]	A1	SC1 Line drawn from (4,138) that passes through vertical axis between (0,115) and (0,135) **and** attempt at gradient of this line with numerator or denominator correct

Q	Answer	Mark	Comments
14	$\frac{360-60}{360} \times 2 \times \pi \times 15$ (= [78.5, 78.6])	M1	oe eg 1 $\frac{5}{6} \times 30\pi$ eg 2 25π eg 3 $2 \times \pi \times 15 - \frac{1}{6} \times 2 \times \pi \times 15$ eg 4 $0.83 \times 30\pi$
	their [78.5, 78.6] + 2×15	M1dep	oe
	[108.5, 109] **or** $25\pi + 30$	A1	SC2 Answer [78.5, 78.6] **or** 25π SC1 Answer [45.7, 45.71] **or** $5\pi + 30$
15(a)	π (×) 2 (×) 2 (×) 10 **or** π (×) 2^2 (×) 10	B1	
15(b)	π (×) 2 (×) 2 (×) h (= $4\pi h$) **or** π (×) 5 (×) 5 (×) h (= $25\pi h$)	M1	oe eg π (×) 25 (×) h
	their $4\pi h$ + their $25\pi h$ = 40π	M1dep	Must add two volumes
	$29\pi h = 40\pi$	A1	Must be $ah = b$ oe eg 1 [91, 91.12] h = [125.6, 125.7] eg 2 $29h = 40$
	[1.379, 1.38] **or** $\frac{40}{29}$	A1ft	ft from M1 M1 A0 Accept 1.4 with correct method seen
15(b)	**Alternative**		
	40 ÷ (4 + 25)	M2	oe eg $40\pi \div (4\pi + 25\pi)$
	[1.379, 1.38] **or** $\frac{40}{29}$	A2	

Q	Answer	Mark	Comments
16	80 ÷ 16 (= 5) **or** 16 × 5	M1	16 ÷ 80 (= 0.2) **or** 80 × 0.2
	196 × their 5^2 **or** $\frac{x}{196} = (\frac{80}{16})^2$	M1dep	196 ÷ their 0.2^2 **or** $\frac{196}{x} = (\frac{16}{80})^2$
	4900	A1	
16	**Alternative 1**		
	80 ÷ 16 (= 5) **or** 16 × 5	M1	16 ÷ 80 (= 0.2) **or** 80 × 0.2
	5000 ÷ their 5^2 **or** $\frac{5000}{x} = (\frac{80}{16})^2$	M1dep	5000 × their 0.2^2 **or** $\frac{x}{5000} = (\frac{16}{80})^2$
	200	A1	
16	**Alternative 2**		
	80 ÷ 16 (= 5) **or** 16 × 5	M1	16 ÷ 80 (= 0.2) **or** 80 × 0.2
	their 5^2 **and** 5000 ÷ 196	M1dep	their 0.2^2 **and** 196 ÷ 5000
	25 **and** [25.5, 25.5102041]	A1	0.04 **and** 0.039(2)