



**General Certificate of Secondary Education
June 2011**

**Applications of Mathematics (Pilot) 93702H
(Specification 9370)**

**Unit 2: Applications of Mathematics
Written Paper (Higher)**

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 candidates' 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 candidates' 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.

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.

Further copies of this Mark Scheme are available from: aqa.org.uk

Copyright © 2011 AQA and its licensors. All rights reserved.

Copyright

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

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	4 or 8	B1	oe eg, 9 – 1 is acceptable for 8 One missing length found correctly May be seen on diagram
	7 + 7 + their 4 + 2 + 3 + their 8	M1	oe Allow one error or one omission
	31	A1	SC2 Answer 27 or 32
2(a)	70	B1	Condone £0.70 B0 £70 or £0.7 or 0.70 or 0.7
2(b)	Straight line from (0, 4.8) to (5, 9.8) or Plots all 6 correct points (± 2 mm) (0, 4.8) (1, 5.8) (2, 6.8) (3, 7.8) (4, 8.8) and (5, 9.8)	B2	B1 Any line of gradient 1 (or any 6 points that would make a line of gradient 1 if joined) B1 Plots at least 3 correct points (± 2 mm)
2(c)	Valid example eg 1, 4 (toppings cost the) same eg 2, 5 (toppings costs) more	B1 ft	oe ft From their points or line in (b)
3(a)	Draws direction of <i>A</i> correctly ($\pm 2^\circ$)	B1	
	Draws direction of <i>B</i> correctly ($\pm 2^\circ$)	B1	
	States that they will not collide with valid reason. eg 1, No collision as <i>B</i> will pass through the place where their paths meet before <i>A</i> gets there eg 2, <i>A</i> takes longer to get to the crossing point than <i>B</i> so no they will not collide	B1 ft	oe ft If two directions drawn
3(b)	Arc, centre <i>A</i> , radius 10 cm (± 2 mm)	B1	
	Arc, centre <i>B</i> , radius 6 cm (± 2 mm)	B1	
	Point <i>L</i> clearly indicated	B1 ft	Award B0 B0 B1 if no arcs drawn but <i>L</i> indicated in correct position (± 2 mm) ft Two intersecting arcs from centres <i>A</i> and <i>B</i>

Q	Answer	Mark	Comments
4(a)	$125 \div (21 + 14) (= 3.57 \dots)$	M1	$125 \div (3 + 2) (= 25)$
	Their $3.57 \dots \times 21 (= 75)$ or their $3.57 \dots \times 14 (= 50)$	M1	$125 \div \text{their } (3 + 2) \times \text{their } 3$ or $125 \div \text{their } (3 + 2) \times \text{their } 2$
	(small) 75 (large) 50	A1	(small) 50 (large) 75 M1 M1 A0
Alt 4(a)	$\frac{21}{35} (= 0.6)$ or $\frac{14}{35} (= 0.4)$	M1	At least two equivalent ratios for 21 : 14 seen eg, 3 : 2 30 : 20
	Their $0.6 \times 125 (= 75)$ or their $0.4 \times 125 (= 50)$	M1	Equivalent ratios seen including 75 : 50 eg, 30 : 20 60 : 40 75 : 50
	(small) 75 (large) 50	A1	(small) 50 (large) 75 M1 M1 A0
4(b)	$200 \times 21 \times 0.05 (= 210)$ or $200 \times 14 \times 0.09 (= 252)$	M1	oe Allow working in pence
	$200 \times 0.87 (= 174)$	M1	oe Allow working in pence
	Their 210 + their 252 + their 174 (= 636)	M1	Must be the sum of 2 or 3 amounts of money oe Allow working in pence
	Their $636 + 0.85 \times \text{their } 636$ (= their $636 + 540.6(0)$)	M1	oe eg, $1.85 \times \text{their } 636$ Allow working in pence
	1176.60	A1	1176.6 is A0 Allow 1176 or 1177 or 1180
Alt 4(b)	$21 \times 0.05 (= 1.05)$ or $14 \times 0.09 (= 1.26)$	M1	oe Allow working in pence
	Their $1.05 + \text{their } 1.26 + 0.87$ (= 3.18)	M1	Must be the sum of 2 or 3 amounts of money oe Allow working in pence
	$200 \times \text{their } 3.18 (= 636)$	M1	oe Allow working in pence
	Their $636 + 0.85 \times \text{their } 636$ (= their $636 + 540.6(0)$)	M1	oe eg, $1.85 \times \text{their } 636$ Allow working in pence
	1176.60	A1	1176.6 is A0 Allow 1176 or 1177 or 1180

Q	Answer	Mark	Comments
5	Two correct trials [4.65, 4.75] which bracket 172 and 4.7 as final answer	B4	<p>B3 As B4 response but 4.7 not the final answer or</p> <p>B3 Two correct trials [4.65, 4.8] which bracket 172</p> <p>B2 Two correct trials $4 \leq L < 5$</p> <p>B1 One correct trial $4 \leq L < 5$</p>
6	Correctly converts one dimension to metres	B1	eg, 0.8 seen
	$0.8 \times 0.3 (\times 2) + 0.3 \times 0.2 \times 2$ $+ 0.8 \times 0.2 \times 2 \quad (= 0.68)$	M2	$0.24 (\times 2) + 0.12 + 0.32$ <p>M1 $0.8 \times 0.3 (\times 2)$ or $0.3 \times 0.2 (\times 2)$ or $0.8 \times 0.2 (\times 2)$</p> <p>M2 or M1 May be scored even if incorrect conversion factor has been used</p>
	$4.5 \div \text{their } 0.68 \quad (= 6.6 \dots)$	M1	
	6	A1	
Alt 6	$80 \times 30 (\times 2) + 30 \times 20 \times 2$ $+ 80 \times 20 \times 2 \quad (= 6800)$	M2	$2400 (\times 2) + 1200 + 3200$ <p>M1 $80 \times 30 (\times 2)$ or $30 \times 20 (\times 2)$ or $80 \times 20 (\times 2)$</p>
	Their 6800 correctly converted to square metres (= 0.68)	B1	4.5 square metres correctly converted to square centimetres ie, 45 000
	$4.5 \div \text{their } 0.68 \quad (= 6.6 \dots)$	M1	$45\,000 \div \text{their } 6800 \quad (= 6.6 \dots)$
	6	A1	

Q	Answer	Mark	Comments
7(a)(i)	$x + 4x = 180$ or $5x = 180$	M1	oe Equation
	$(x =) 180 \div 5$	M1	ft If their equation uses x and their obtuse angle
	36	A1 ft	ft If one method mark gained
	Sets up a linear equation and solves their equation correctly	Q1	36 obtained without an algebraic equation seen is M1 M1 A1 Q0 SC1 Angle $4x$ seen in a correct position on the diagram
7(a)(ii)	$4 \times \text{their } 36 (= 144)$ or $180 - \text{their } 36 (= 144)$	M1	May be seen on diagram $\frac{1}{2}y = \text{their } 36$
	$360 - 2 \times \text{their } 144$	M1	$2 \times \text{their } 36$ (if this is first step award M2)
	72	A1 ft	ft Their 36 in part (a)
7(b)	$\pi \times 15 \times 15$ ($= 225\pi$)	M1	oe [706.5, 707]
	$\frac{250}{360} \times \text{their } 225\pi$ ($= \frac{625\pi}{4}$) or $\frac{360 - 250}{360} \times \text{their } 225\pi$ ($= \frac{275\pi}{4}$)	M1	[490.6, 491] [215.8, 216.03] Their 225π can be from any $\pi \times r \times r$ or from $2 \times \pi \times 15 (= 30\pi)$ or $2 \times \pi \times 30 (= 60\pi)$
	Their $\frac{625\pi}{4} \times 3$	M1	
	$\frac{1875\pi}{4}$ or [1471.8, 1473]	A1	
	Uses $\frac{\theta}{360} \times \pi r^2$ and $V = A \times h$ in their solution	Q1	Must be πr^2 not $2\pi r$
8	$\sin 76$	B1	$\cos 14$
	$\sin 76 = \frac{d}{5.5}$ or $5.5 \times \sin 76$	M1	$\cos 14 = \frac{d}{5.5}$ or $5.5 \times \cos 14$
	5.3...	A1	

Q	Answer	Mark	Comments
9(a)	$24 \div 20$ (= 1.2)	M1	$30 \div 24$ (= 1.25) or $20 \div 24$ (= 0.83...)
	$30 \div$ their 1.2	M1	$20 \times$ their 1.25 or $30 \times$ their 0.83...
	25	A1	
Alt 1 9(a)	$20 \div 4$ (= 5)	M1	
	$5 \times$ their 5	M1	oe eg, $20 \div$ their 5
	25	A1	
Alt 2 9(a)	$24 \times \frac{60}{20}$ (= 72)	M1	oe
	$\frac{30}{\text{their } 72} \times 60$	M1	oe
	25	A1	
9(b)	Sight of 1.6(.....) or 4.5(....)	B1	oe eg, 8 km = 5 miles or 0.6(2....) or 0.2(2...)
	$48 \times$ their 1.6 \div their 4.5 (= 17.(...))	M1	oe eg, $48 \div$ their 4.5 \times their 1.6 (= 17.(...))
	Car A and their 17.(...)	A1 ft	Only ft if B0 M1 ft From any conversion factors
Alt 1 9(b)	Sight of 1.6(....) or 4.5(....)	B1	oe eg, 8 km = 5 miles or 0.6(2....) or 0.2(2...)
	$15 \div$ their 1.6 \times their 4.5 (= 42.(...))	M1	oe eg, $15 \times$ their 4.5 \div their 1.6 (= 42.(...))
	Car A and their 42.(...)	A1 ft	Only ft if B0 M1 ft From any conversion factors
Alt 2 9(b)	Sight of 1.6(.....) or 4.5(....)	B1	oe eg, 8 km = 5 miles or 0.6(2....) or or 0.2(2...)
	$48 \times$ their 1.6 (= 76(.8) or 77) and $15 \times$ their 4.5 (= 67(.5) or 68)	M1	$48 \div$ their 4.5 (= 10(.6...) or 10.7 or 11) and $15 \div$ their 1.6 (= 9(.3...) or 9.4)
	Car A and their 76(.8) or 77 and their 67(.5) or 68	A1 ft	Car A and their 10(.6...) or 10.7 or 11 and their 9(.3...) or 9.4 Only ft if B0 M1 ft From any conversion factors

Q	Answer	Mark	Comments
10	$40 \div 25$ (= 1.6)	M1	$25 \div 40$ (= 0.625)
	$15 \times$ their 1.6	M1 Dep	$15 \div$ their 0.625
	24	A1	
	4.5	B1 ft	oe ft $\frac{\text{their } 24 - 15}{2}$
Alt 10	$25 \div 15$ (= 1.66... or 1.7)	M1	$15 \div 25$ (= 0.6)
	$40 \div$ their 1.66....	M1 Dep	$40 \times$ their 0.6
	24	A1	
	4.5	B1 ft	oe ft $\frac{\text{their } 24 - 15}{2}$
11	$\frac{2}{3} \times \pi \times 3^3$ (= 18π)	M1	[56.5, 56.6] Allow $\frac{4}{3} \times \pi \times 3^3$ (= 36π = [113, 113.112])
	$\pi (\times 1^2) \times 2$ (= 2π)	M1	[6.28, 6.3]
	Their 18π — their 2π	M1	Must subtract two volumes
	16π or [50.2, 50.3]	A1	SC2 136π or [427, 427.312]

Q	Answer	Mark	Comments
12	$10 \times 4 (+) \frac{1}{2} \times 2 \times 4$	M1	oe eg, $\frac{1}{2} \times (10 + 12) \times 4$
	44	A1	
	$4 \times 5 (+) \frac{1}{2} \times 8 \times 5$	M1	oe eg, $\frac{1}{2} \times (12 + 4) \times 5$
	40	A1	
	<p>Gives a valid reason</p> <p>eg 1, Amy won as she travelled a greater distance</p> <p>eg 2, (Amy) $44 \div 12 = 3.7$ (Sue) $40 \div 12 = 3.3$ Amy won as she travelled at a faster (average) speed</p>	B1 ft	<p>oe Must include reference to distances unless average speeds are calculated and reference to speeds made</p> <p>ft Their two areas</p> <p>SC2 Amy 48 and Sue 60 and valid reason (eg Sue travelled further)</p> <p>SC2 Any two correct partial areas calculated (one for each person) and valid reason given on ft</p> <p>(eg, $10 \times 4 = 40$ and $4 \times 5 = 20$ and Amy travelled further)</p> <p>SC1 At least one correct partial area calculation (eg 4×5)</p>
13(a)	1.5 to 1.6 inclusive	B1	Allow fractions eg, $1\frac{1}{2}$
13(b)	3.3 to 3.4 inclusive	B1	Allow fractions eg, $3\frac{3}{10}$
13(c)	$2.5 (-) 0.5$	M1	Two points indicated on graph where $h = 3$ eg, horizontal line drawn at $y = 3$
	2	A1	
13(d)(i)	Tangent drawn at $t = 1$	B1	
	<p>Attempt at $\frac{y_2 - y_1}{x_2 - x_1}$ from any tangent drawn</p>	M1	Allow M1 if tangent drawn at incorrect t value
	[0.8, 1.6]	A1	No tangent drawn B0 M0 A0
13(d)(ii)	Speed or velocity	B1	Rate of change of height B0 Average speed

Q	Answer	Mark	Comments
14(a)	tan used	B1	
	$\tan x = \frac{40}{400}$	M1	oe eg, $\tan x = 0.1$
	5.7	A1	Allow 6 with correct working
14(b)	$700^2 + 400^2$ (= 650 000)	M1	
	$\sqrt{\text{their } 650\,000}$	M1 dep	
	806 (.2)	A1	
	$\tan(y) = \frac{40}{\text{their } 806(.2 \dots)}$	M1	Their 5.7 ... $\div 2$ (= 2.85 or 2.86) and evaluates tan their 2.85 and evaluates $\frac{40}{\text{their } 806(.2 \dots)}$
	2.8	A1	Obtains 0.049... or 0.05 for both evaluations
Alt 14(b)	$40^2 + 400^2$ (= 161 600) and their $161\,600 + 700^2$ (= 651 600)	M1	
	$\sqrt{\text{their } 651600}$	M1 dep	
	807(.2....)	A1	
	$\sin(y) = \frac{40}{\text{their } 807(.2 \dots)}$	M1	Their 5.7 $\div 2$ (= 2.85 or 2.86) and evaluates sin their 2.85 and evaluates $\frac{40}{\text{their } 807(.2 \dots)}$
	2.8	A1	Obtains 0.049... or 0.05 for both evaluations