AQA Qualifications

GCSE

MATHEMATICS

Topic tests – Higher tier - Mark schemes

Version 1.1

Our specification is published on our website (www.aqa.org.uk). We will let centres know in writing about any changes to the specification. We will also publish changes on our website. The definitive version of our specification will always be the one on our website, this may differ from printed versions.

You can get further copies of this Teacher Resource from:
The GCSE Mathematics Department
AQA
Devas Street
Manchester
M15 6EX

Or, you can download a copy from our All About Maths website (http://allaboutmaths.aqa.org.uk/)

Contents

Algebra

Q	Answer	Mark	Comments
1(a)	$5x - 10$ (= 35)	M1	$x - 2 = 7$
	$5x = 45$	M1	$x = 7 + 2$
	9	A1ft	ft for M1M0 or M0M1
1(b)	$9y - 12 = 3y$	M1	or $6y - 9y$ (= $-3y$)
	13 – 1 (= 12)	M1	or 1 – 13 (= –12)
	4	A1 ft	ft for M1M0 or M0M1 with only one rearrangement error
2(a)	$2 < x \leqslant 6$	B1	
2(b)	1, 2, 3, 4, 5, 6	B2	B1 For 5 correct and 1 missing B1 For 6 correct and 1 incorrect B1 For $1 \leqslant x < 7$ B0 For 2 or more errors 1, 2, 3, 4, 5 B1 1, 2, 3, 4, 5, 6, 7 B1 2, 3, 4, 5, 6, 7 B0
3	$y = 3x + 6$	B3	oe B2 $y = 3x \pm c$ or $3x + 6$ B1 Indication that gradient is 6 ÷ 2 or 3 or $y = mx + 6$

Q	Answer	Mark	Comments
4	$(x + 2)(x + 7)$	B2	Either order B1 For $(x + a)(x + b)$ where $a + b = 9$ or $ab = \pm 14$
5	$8x + 4y$ (= 11 + 7y)	M1	$2x + y = \frac{11+7y}{4}$
	$8x = 11 + 7y - 4y$	M1	$8x = 11 + 3y$ $2x = \frac{11+7y}{4} - y$
	$x = \frac{11+3y}{8}$	A1ft	ft M1M0 or M0M1 and only one error in expansion or rearrangement SC2 $\frac{11+3y}{8}$
6	$6x + 12y = 3$ **and** $6x - 10y = 14$ **or** $10x + 20y = 5$ **and** $12x - 20y = 28$	M1	Condone poor arithmetic if one coefficient is balanced
	Either $x = 1.5$ or $y = -0.5$	A1	$\frac{33}{22}, -\frac{11}{22}$
	Substituting their x or y into any of the linear equations and solving for the other variable, or balances again to eliminate and solve the other variable	M1dep	Condone poor arithmetic and rearrangement errors if the intention to solve is clear
	Either $y = -0.5$ or $x = 1.5$	A1	oe SC1 If T&I used and both answers correct

Q	Answer	Mark	Comments
7	**Alternative method 1**		
	$abx^2 + a^2x + b^2x + ab$ or $ab = 10$	M1	
	Identifies 1 and 10 or 2 and 5	M1	
	29 or 101	A1	
	29 and 101	A1	Correct answer gets all 4 marks
	Alternative method 2		
	$(x + 10)(10x + 1)$	M1	$(2x + 5)(5x + 2)$
	$10x^2 + 100x + x + 10$	M1	$10x^2 + 4x + 25x + 10$
	29 or 101	A1	
	29 and 101	A1	Correct answer gets all 4 marks

Number

Q	Answer	Mark	Comments
1(a)	$9 \times \frac{5}{11}$	M1	
	$\frac{45}{11}$	A1	oe fraction
	$4\frac{1}{11}$	B1ft	Correctly changes their improper fraction to a mixed number
1(b)	Yes with correct comparison $\frac{100}{220}$ and $\frac{99}{220}$	B1	oe $0.\dot{4}\dot{5}$ or 0.454(…) or 0.455 and 0.45 45.4…% or 45.5% and 45% $\frac{100}{220} > \frac{99}{220}$ or $\frac{9}{20} < \frac{5}{11}$ oe implies Yes
2	1.1 or 110%	B1	
	517 ÷ 1.1	M1	517 ÷ 110 × 100
	470	A1	

Q	Answer	Mark	Comments
3	**Alternative method 1**		
	$\frac{3}{4} - \frac{1}{8}$ $(= \frac{5}{8})$ oe or $\frac{6}{8}$ seen	M1	
	45 (litres) = their $\frac{5}{8}$	M1	
	45 ÷ their 5 (= 9)	M1	Their 5 cannot be 1 or 2
	72	A1	SC2 60
	Alternative method 2		
	Diagram with $\frac{1}{8}$ and $\frac{6}{8}$ indicated	M1	oe
	45 identified between $\frac{1}{8}$ and $\frac{6}{8}$	M1	
	Each section = 9	M1	
	72	A1	SC2 60
	Alternative method 3		
	$\frac{x}{8} + 45 = \frac{3x}{8}$	M1	oe
	x = 360 = 6x	M1	oe
	360 = 5x	M1	
	72	A1	SC2 60
4(a)	(0).00246	B1	
4(b)	0.2×10^3	M1	180000 (÷) 900 or 200 or $18 \times 10^4 \div 9 \times 10^2$ or $\frac{1.8 \times 10^3}{9}$ or other correct equivalent expression
	$2(.0) \times 10^2$	A1	

Q	Answer	Mark	Comments
5(a)	$\sqrt{2 \times 32}$ or $\sqrt{64}$ or $(\sqrt{2} \times)\, 4\sqrt{2}$ or $2\sqrt{16}$ or $(\sqrt{2} \times)\, \sqrt{2}\, \sqrt{16}$	M1	
	8	A1	
5(b)	$\frac{21\sqrt{7}}{\sqrt{7}\sqrt{7}}$ or $\frac{21\sqrt{7}}{7}$ or $\frac{21\sqrt{7}}{\sqrt{49}}$	M1	
	$3\sqrt{7}$	A1	
5(c)	**Alternative method 1**		
	$(\sqrt{6})^2 + \sqrt{6} \times \sqrt{12} + \sqrt{6} \times \sqrt{12}$ $+ (\sqrt{12})^2$	M1	oe Any expansion with 4 correct terms implied
	$6 + \sqrt{72} + \sqrt{72} + 12$	A1	oe eg $\sqrt{36} + 2\sqrt{72} + \sqrt{144}$
	$18 + 12\sqrt{2}$	A1 ft	ft $18 + 2 \times$ their (a) for $\sqrt{2}$ term
	Alternative method 2		
	$(\sqrt{6})^2\ (1 + \sqrt{2})^2$	M1	
	$6(1 + 2\sqrt{2} + 2)$	A1	
	$18 + 12\sqrt{2}$	A1 ft	

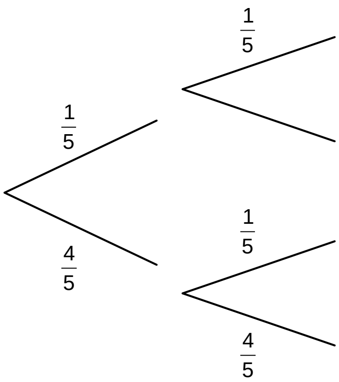
Q	Answer	Mark	Comments
6	$9^{\frac{1}{2}} = 3$ or $(-7)^\circ = 1$	B1	
	$\left(\frac{1}{8}\right)^{-\frac{1}{3}} = 8^{\frac{1}{3}}$ or $\dfrac{1}{\sqrt[3]{\frac{1}{8}}}$ or $\dfrac{1}{\frac{1}{2}}$ or $\sqrt[3]{8}$ or $\left(\frac{1}{2}\right)^{-1}$ or $\left(\frac{1}{8}\right)^{\frac{1}{3}} = \frac{1}{2}$ or $\sqrt[3]{8} = \frac{1}{2}$	M1	oe $-\frac{1}{2}$ implies M1
	$\left(\frac{1}{8}\right)^{\frac{1}{3}} = 2$	A1	
	All three numbers correct evaluated and in correct order $(-7)^\circ$ $\left(\frac{1}{8}\right)^{\frac{1}{3}}$ $9^{\frac{1}{2}}$	A1	

Probability and statistics

Q	Answer	Mark	Comments
1(a)	4 + 3 + 5 + 2 or 20 – 5 – 1	M1	oe
	14	A1	
1(b)	4 + 5 or 9	M1	$\frac{4}{20} \times 100$ or 20 or $\frac{5}{20} \times 100$ or 25
	$\frac{4+5}{20} \times 100$	M1dep	oe their 20 + their 25
	45	A1	
1(c)	3 out of 12 or 2 out of 8 or $\frac{3}{12}$ or $\frac{2}{8}$	M1	oe 3 : 12 or 2 : 8
	3 out of 12 **and** 2 out of 8 or $\frac{3}{12}$ **and** $\frac{2}{8}$ or $\frac{1}{4}$ or 25% or 0.25	A1	oe 3 : 12 and 2 : 8 All answers must be correct
	States the same	Q1ft	Strand (iii) Must see a correct comparison from their relative frequencies dependent on M1 SC1 For $\frac{3}{20}$ **and** $\frac{2}{20}$ and states boys larger oe

Q	Answer	Mark	Comments
2(a)	No response section or No mention of websites or No mention of buying music	B1	oe
2(b)	Suitable question	B1	eg Where do you buy music?
	Suitable response section	B1	eg bookshops, websites, don't buy music Must include both shops and websites
2(c)	Reason involving time or location	B1	eg only Monday, only one morning, only customers asked, only in the shop
2(d)	Complete description including correction of time and location	B2	B1 Description correcting one problem Accept increased sample size as one of time/location

Q	Answer	Mark	Comments
3	Fully correct labelled pie chart Spain 180° Portugal 90° Turkey 30° Other 60° Tolerance ± 2°	B4	B3 Two or three correct sectors and four sectors labelled correctly B3 Fully correct but incomplete or no labels B2 All angles calculated B2 Two or three sectors correct but incomplete or no labels B1 At least one angle calculated in table B1 One sector drawn an labelled correctly

Q	Answer	Mark	Comments
4		B2	oe B2 At least one correct pair of probabilities or all top probabilities = $\frac{1}{5}$ or all bottom probabilities = $\frac{4}{5}$
	$\frac{1}{5} \times \frac{4}{5}$ or $\frac{4}{25}$	M1	oe May be at the end of tree diagram
	$\frac{8}{25}$ or 0.32	A1 ft	oe ft their tree diagram
5	5×58 (= 290) + 64 (= 354)	M1	(64 – 58) ÷ 6 (= 1)
	Their 354 ÷ 6	M1dep	58 + their 1 NB $\frac{58 \times 5}{6} + \frac{64}{6}$ is M2
	59	A1	

Problem solving

Q	Answer	Mark	Comments
1	**Alternative method 1**		
	32 – 15 (= 17)	M1	Check diagram
	y coordinate = 19	A1	
	36 – 17 – 10 (= 9)	M1	oe eg 26 – 17
	x coordinate = 23	A1	(19, 23) is A1 max
	Alternative method 2		
	Graph drawn with A at (15, 10) and B at (32, 36)	M1	
	Any rectangles drawn from A and B matching the diagram.	M1	
	x coordinate = 23	A1	
	y coordinate = 19	A1	

Q	Answer	Mark	Comments
2	**Alternative method 1**		
	Any side chosen for square and squared, eg $10^2 = 100$	M2	M2 Is for both squares and circle areas attempted with correct numerical values (eg if 10 chosen for side of square, then 5 must be used as radius of circle, or if 4 chosen as radius then 8 is used as side of square) M1 If both square and circle area attempted with one incorrect numerical value (eg if 10 chosen as side of square, then 10 used as radius of circle, or if 4 chosen as radius then 4 used as side of square)
	Works out 75% of their square and a correct calculation of the circle area, **or** works out what percentage the circle area is of the square area	A1	This can be awarded even if only M1 awarded Allow π used if a clear comparison, eg $\pi \times 25 > 3 \times 25$
	A method mark gained and correct conclusion based on 75% of their square with their circle	Q1	Strand (ii) Do not award if their circle area > square area eg $78.5 > 25$
	Alternative method 2		
	$2r$ length of side of square giving $4r^2$ as area	M1	
	r as radius of circle giving πr^2 as area of circle		
	75% of their square ($= 3r^2$) and correct expression for area of circle with their chosen radius	A1	
	A method mark gained and correct conclusion based on 75% of their square with circle eg $\pi > 3$	Q1	Strand (ii) Do not award if their circle area > square area eg $\pi r^2 > r$

Q	Answer	Mark	Comments
3	**Alternative method 1**		
	$3x - (x - 5)$	M1	Condone omission of brackets
	$2x + 5 = 17$	M1	
	6	A1	SC2 11
	Alternative method 2		
	$2^{3x} = 2^{17} \times 2^{x-5}$	M1	
	$3x = 12 + x$	M1	
	6	A1	SC2 11
	Alternative method 3		
	Substitutes a value for x and evaluates correctly as a power of 2	M1	
	Substitutes a different value for x and evaluates correctly as a power of 2 which is closer to 17	M1	
	6	A1	SC2 11

4	$2 \times \pi \times 7$ or [43.9, 44]	M1	oe 14π
	$2 \times \pi \times 7 \div 4$ or [10.9, 11] or $2 \times \pi \times 7 \times 3$ or [131.9, 33]	M1dep	oe $\frac{7\pi}{2}$ oe 42π
	$2 \times \pi \times 7 \div 4 \times 3$ or [32.9, 132]	M1dep	oe $\frac{21\pi}{2}$
	[46.9, 47]	A1	$10.5\pi + 14$ oe SC2 For [23.4, 23.5] or [30.4, 30.5] SC1 For [16.4, 16.5]

Q	Answer	Mark	Comments
5	4 and 40000 and 200	B2	B1 For any correct value of $n \times 10$^n, where $n > 1$ 200, 3000, 40000, 500000, 6000000 etc
6	**Alternative method 1**		
	$\dfrac{n(n-1)+n(n+1)}{2}$	B1	This mark is for combining fractions **or** if fractions dealt with separately, for combining n^2 terms correctly $\dfrac{n^2-n+n^2+n}{4}$ is B0 as incorrect combining of fractions
	$\dfrac{n^2-n+n^2+n}{2} = \dfrac{2n^2}{2}$	B1	This is for eliminating $-n$ and n either by showing by crossing or writing on same line and writing next line without them $\dfrac{n^2}{2} - \dfrac{n}{2} + \dfrac{n^2}{2} + \dfrac{n}{2} = \dfrac{n^2}{2} + \dfrac{n^2}{2}$
	$\dfrac{2n^2}{2} = n^2$	B1	This mark is for cancelling 2 top and bottom $\dfrac{n^2}{2} + \dfrac{n^2}{2} = n^2$
	Alternative method 2		
	$\dfrac{n^2}{2}((n-1)+(n+1))$	B1	This mark is for factorising out a common factor $\dfrac{n}{4}(n-1+n+1)$ is B0
	$\dfrac{n}{2}(2n)$	B1	This mark is for combining terms inside bracket correctly
	n^2	B1	$1n^2$ is OK

<table>
<tr><th>Q</th><th colspan="2">Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="4">7</td><td colspan="2">1.5 or $\frac{2}{3}$ seen

or $\frac{1}{2}$ seen as a scale factor</td><td>M1</td><td>oe
12 : 8
8 : 12
$\tan C = \frac{8}{11}$ or 36°
$\frac{12}{EC} = \frac{8}{11}$ or $\frac{EC}{12} = \frac{11}{8}$ or $\frac{11 \times 12}{8}$</td></tr>
<tr><td>11×1.5 or

or $11 \times \frac{1}{2}$</td><td>$\frac{1}{2} \times 11 \times 8 \times 1.5^2$</td><td>M1dep</td><td>oe
$CE = \frac{12}{\tan(\text{their } 36)}$</td></tr>
<tr><td>16.5 or 5.5</td><td>99</td><td>A1</td><td>16.5(…) or 5.5(…)</td></tr>
<tr><td>$\frac{1}{2}(8 + 12) \times$ their 5.5
or
$\frac{1}{2}(8 + 12) \times$ their ED</td><td>their 99 – $\frac{1}{2} \times$
11×8</td><td>M1</td><td>$\frac{1}{2} \times$ their $16.5 \times 12 - \frac{1}{2} \times 11 \times 8$

their $ED \times 8 + \frac{1}{2} \times$ their $ED \times 4$</td></tr>
</table>

Real life

Q	Answer	Mark	Comments
1(a)	25	B1	
1(b)	Any correct conversion between miles and km seen eg 5 miles = 8 km or 1 mile = 1.6 km or 1 km = $\frac{5}{8}$ mile	M1	$75 \times \frac{5}{8}$
	Slower as limit is 8 km	A1	Slower as $46.875 < 50$
2	**Alternative method 1**		
	1257	B1	Driving school A total
	0.15×23 ($\times 47$) or 3.45 or 162.15	M1	
	(23 – their 3.45) $\times$ 47 or 23 $\times$ 47 – their 162.15	M1	
	918.(85) or 919 or 20.(36…)	A1	Total for B or Price per lesson for A
	(Driving school) B	Q1 ft	Strand (iii) ft conclusion based on two values if M1 awarded
	Alternative method 2		
	1257	B1	Driving school A total
	47×23 or 1081	M1	
	Their 1081 $\times$ 0.85	M1	
	918.(85) or 919	A1	Driving school B total
	(Driving school) B	Q1 ft	Strand (iii) ft conclusion based on two values if M1 awarded

Q	Answer	Mark	Comments

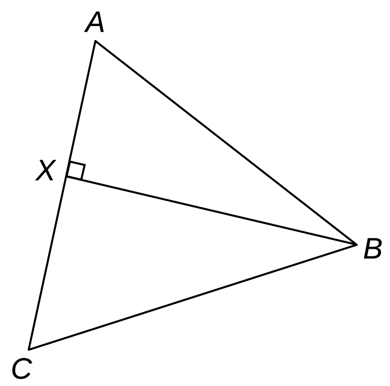
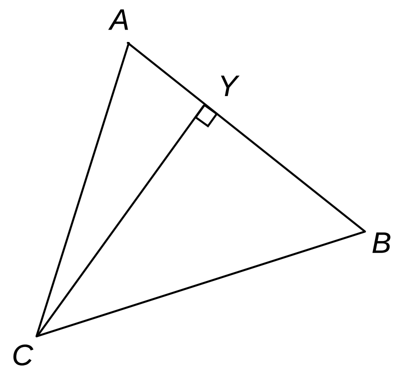
3(a)	**Alternative method 1**		
	Midpoints seen or implied 5, 15, 25, 35, 45	B1	
	Their $\sum fx$ $5 \times 5 + 15 \times 22 + 25 \times 28 + 35 \times 21 + 45 \times 4$ or $25 + 330 + 700 + 735 + 180$ or 1970	M1	This mark is for the sum of their midpoints × frequencies but condone one error $5 \times 5 = 25$ $15 \times 22 = 330$ $25 \times 28 = 700$ $35 \times 21 = 735$ $45 \times 4 = 180$
	Their $\sum fx \div 80$	M1 dep	Their $1970 \div 80$
	24.6(…)	A1	Accept 25 with working shown
3(b)	**Alternative method 1**		
	$5 + 22 + 28$ or 55	M1	$21 + 4$ or 25
	$\frac{5+22+28}{80} \times 100$	M1	$\frac{21+4}{80} \times 100$
	68(…)(%) or 69 and No	A1	31.(…)(%) and No
	Alternative method 2		
	$5 + 22 + 28$ or 55	M1	$21 + 4$ or 25
	$\frac{70}{80} \times 100$ or 56	M1	$\frac{30}{100} \times 80$ or 24
	55 and 56 and No or 56 is in the 30 - 40 group so No	A1	24 and 25 and No

Q	Answer	Mark	Comments
4	$80^2 - 64^2$ (= 2304) **or** $AB^2 + 64^2 = 80^2$	M1	$\cos(C) = \frac{64}{80}$
	$\sqrt{\text{their } 2304}$ (= 48)	M1	$\cos^{-1}\frac{64}{80}$ (= [36.8, 36 9])
	$\frac{1}{2} \times 64 \times$ their 48 (= 1536)	M1	$\frac{1}{2} \times 64 \times 80 \times \sin$ their [36.8, 36 9] (= 1536)
	Their 1536 ÷ 4047 × 6400	M1	oe
	[2426, 2433.5]	A1	Allow 2430 with correct working seen
	2400	B1ft	ft value seen > 3sf rounded correctly to 2sf A1 Is implied by 2400 if no incorrect working seen

5	3.5 × 36000 (= 126000)	M1	Answer of 138600 implies this M1 (126000 + 10%)
	Their 126000 = 90%	M1	Implied by division by 90
	Their 126000 ÷ 90 (× 100) or 1400	M1	
	140000	A1	

Shape

Q	Answer	Mark	Comments
1(a)	25^2 and 43^2 or 625 and 1849 or 2474	M1	
	$\sqrt{25^2 + 43^2}$ or $\sqrt{625 + 1849}$ or $\sqrt{2474}$	M1	
	49.7…	A1	Accept 50 with correct working
1(b)	tan chosen	M1	
	$\tan y = \frac{15}{33}$	M1	oe $\tan y = 0.4545…$
	24.4…	A1	Accept 24 with correct working
2	$2 \times \pi \times 12$ or [75.3, 75.4]	M1	oe 24π
	$\frac{135}{360} \times 2 \times \pi \times 12 \quad (+ 24)$ or [28.2, 28.3]	M1dep	oe $9\pi \quad (+ 24)$
	[52.2, 52.3]	A1	Do not award if $\pi = 3$ used

Q	Answer	Mark	Comments
3	**Alternative method 1**		
	(x^2 =) $6^2 + 8^2 - 2 \times 6 \times 8 \times \cos 75$	M1	oe
	[75.1, 75.2]	A1	
	[8.66, 8.7]	A1	
	Alternative method 2		
	$XB = 7.727\ldots$ **and** $XC = 3.929$	M1	
	$\sqrt{(7.727^2 + 3.929^2}$	M1	
	[8.66, 8.7]	A1	
	Alternative method 3		
	$CY = 5.795\ldots$ or 5.796 or 5.8 **and** $BY = 6.447\ldots$	M1	
	$\sqrt{(5.796^2 + 6.447^2}$	M1	
	[8.66, 8.7]	A1	

Q	Answer	Mark	Comments
4(a)	150	B1	
4(b)	360 – 150 or 210 or 360 – their 150	M1	oe OCA = 18 seen or implied or 180 – 18 – 75 or 87
	360 – 18 – 75 – 210 or 360 – 18 – 75 – their 210	M1dep	oe OCB = 75 – 18 or 57 seen or implied 180 – 93 – 30 or 87 – 30
	57	A1	
5	15.7 × 4 or 62.8	M1	
	Their 62.8 = π × diameter	M1dep	oe Their 62.8 = 2 × π × radius
	their 62.8 ÷ π	M1dep	Their 62.8 ÷ 2π radius = [9.95, 10]
	[19.9, 20]	A1	SC2 For [4.9, 5]
6	w + 40 = 72	M1	May be on diagram
	(w =) 32 seen	A1	
	2w = 64 or 2w = 2 × their 32 or third angle = 72	M1	or 2w + t + 72 = 180 oe
	180 – 72 – 64 or 180 – 72 – their 32 × 2	M1	oe 108 – 64
	44	A1	

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.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
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.
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.
3.14 …	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Acknowledgement of copyright holders and publishers

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright holders have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements in future papers if notified.