

COMPONENT 2: CALCULATOR-ALLOWED MATHEMATICS, HIGHER TIER**GENERAL INSTRUCTIONS for MARKING GCSE Mathematics**

1. The mark scheme should be applied precisely and no departure made from it. Marks should be awarded directly as indicated and no further subdivision made. When a candidate follows a method that does not correspond to the methods explicitly set out in the mark scheme, marks should be awarded in the spirit of the mark scheme. In such cases, further advice should be sought from the Team Leader or Principal Examiner.

2. Marking Abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

CAO = correct answer only

MR = misread

PA = premature approximation

bod = benefit of doubt

oe = or equivalent

si = seen or implied

ISW = ignore subsequent working

F.T. = follow through (✓ indicates correct working following an error and ✗ indicates a further error has been made)

Anything given in brackets in the marking scheme is expected but, not required, to gain credit.

3. Premature Approximation

A candidate who approximates prematurely and then proceeds correctly to a final answer loses 1 mark as directed by the Principal Examiner.

4. Misreads

When the data of a question is misread in such a way as not to alter the aim or difficulty of a question, follow through the working and allot marks for the candidates' answers as on the scheme using the new data.

This is only applicable if a wrong value, is used consistently throughout a solution; if the correct value appears anywhere, the solution is not classed as MR (but may, of course, still earn other marks).

5. Marking codes

- 'M' marks are awarded for any correct method applied to appropriate working, even though a numerical error may be involved. Once earned they cannot be lost.
- 'm' marks are dependant method marks. They are only given if the relevant previous 'M' mark has been earned.
- 'A' marks are given for a numerically correct stage, for a correct result or for an answer lying within a specified range. They are only given if the relevant M/m mark has been earned either explicitly or by inference from the correct answer.
- 'B' marks are independent of method and are usually awarded for an accurate result or statement.
- 'S' marks are awarded for strategy
- 'E' marks are awarded for explanation
- 'U' marks are awarded for units
- 'P' marks are awarded for plotting points
- 'C' marks are awarded for drawing curves

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Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
1. (a) $28416/38400 \times 100$ 74(%) (b) $766 + 766 \times 12/100$ OR 766×1.12	M1 A1 M1 A1 (4)	1.3a 1.3a 1.3a 1.3a (4)AO1 (0)AO2 (0)AO3	Or equivalent full method Or equivalent full method
2. (a) Reason, e.g. 'outside the juice bar', 'mostly younger people use juice bars' (b) Two appropriate criticisms e.g. 'No under 15s', '30 appears in two boxes', 'may object to giving their age'	E1 E2 (3)	2.5b 2.5b (0) AO1 (3) AO2 (0) AO3	
3. $6x - 2 = 4x + 5$ $2x = 7$ $x = 7/2$ (3.5) Length of side of square = $4 \times 3.5 + 5$ or $6 \times 3.5 - 2$ =19(cm)	B1 B1 B1 M1 A1 (5)	2.2 1.3a 1.3a 2.2 1.3a (3) AO1 (2) AO2 (0) AO3	
4.(a) Reasonable straight line of best fit by eye, some points above and below (b) Suitable description of the relationship e.g. 'higher the number of visitors, higher the donations' (c) Indicates Sunday (12, 100) (d) (i) Valid explanation e.g. "By using the line of best fit" or "By using the relationship shown in the graph" (ii) Valid explanation e.g "You can't say for definite how many donations the centre will receive on a particular day"	B1 B1 B1 E1 E1 (5)	1.3a 2.1b 2.3a 2.1a 2.5a (1) AO1 (4) AO2 (0) AO3	Accept 'positive correlation' but not just 'positive'

Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
5. (a) $(x =) \frac{1}{4}$ or 0.25 or equivalent (b) $9x - 4 = 7x + 14$ $2x = 18$ or equivalent $x = 9$	B1 B1 B1 B1 (4)	1.3a 1.3b 1.3b 1.3b (4) AO1 (0) AO2 (0) AO3	Accept embedded answers in (a) and (b) Accept 3/12. Mark final answer FT until 2 nd error
6.(a) $7n - 1$ (b) $a+a+7+a+14+a+21=6$ or equivalent $a = -9$ or lowest number = -9 $-9, -2, 5, 12$	B2 M1 A1 B1 (5)	1.3a 3.1a 1.3a 1.3a (4) AO1 (0) AO2 (1) AO3	B1 for $7n \pm \dots$ Allow change of letter OR sight of at least 3 trials keeping to either difference criterion or sum criterion
7. (Height of tree =) $\tan 56^\circ \times 19 + 1.8(\text{m})$ (Height of tree =) 29.968658..... (m)	M3 A1 (4)	3.1d 1.3b (1) AO1 (0) AO2 (3) AO3	Award M2 for $\tan 56^\circ \times 19$ OR sight of 28.168658.....(m) Award M1 for $\tan 56^\circ = \text{opposite}/19$ Accept rounded or truncated from working Accept rounded or truncated from working F.T from their rounded or truncated 28.168...
8.(a) Midpoints 52, 56, 60 and 64 $52 \times 12 + 56 \times 32 + 60 \times 14 + 64 \times 2$ (=3384) /60 56.4 (cm) (b) Strategy to look back that 32 out of 60 are size 2, e.g. '(table shows) about half customers are size 2 Conclusion to give Salesman is correct	B1 M1 m1 A1 S1 E1 (6)	1.3b 1.3b 1.3b 1.3b 2.5a 2.5a (4) AO1 (2) AO2 (0) AO3	F.T. their midpoints, provided within interval F.T. their sum of products, division by 60

GCSE MATHEMATICS Sample Assessment Materials 158

Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
9.(a) 8 (mm)	B1	2.3a	Or idea of alternative complete method Accept sight of quotient based on misread of the scale for M1 only. Mark final answer.
(b) (i) Method e.g. increase in L / increase in M	M1	1.3a	
e.g. $12/150$ (= 0.08)	A1	1.3a	
(ii) Full explanation, e.g. 'rate of change of length with mass', 'for every 1 g increase 0.08 mm increase'	E1	2.3a	
(c) Plausible explanation, e.g. 'no more data recorded', 'spring snaps', 'broken spring', 'spring now completely straight', etc	E1	2.3a	
(5)	(2) AO1 (3) AO2 (0) AO3		
10. Straight lines parallel to all 4 sides and 3cm away (± 2 mm)	B2	2.3b	B1 for straight lines parallel to 2 sides and 3cm away (± 2 mm), OR straight lines parallel to all 4 sides but not at 3cm B1 for arcs with radius 3cm (± 2 mm) at least 2 vertices but not joined to straight lines, OR arcs at all 4 vertices but not at 3cm or not joined to straight lines
Arcs with radius 3cm (± 2 mm) at all 4 vertices joining the straight lines	B2	2.3b	
(4)	(0) AO1 (4) AO2 (0) AO3		
11. (a) $x + 3x + 16x = 1$ $x = 1/20$ or 0.05 or equivalent ISW	M1 A1	1.1 1.3a	Use of 'total probability = 1' Accept 5% only if specified as a percentage . Accept alternative explanations such as 'It may decrease his chance of winning a prize as more people may be tempted to buy tickets'
(b) (Statement that Stephen is incorrect and) a correct explanation e.g. fraction (proportion) of tickets bought would be the same.	E1	2.5a	
(3)	(2) AO1 (1) AO2 (0) AO3		

Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
12.(a) All three stages of the appropriate calculation $560 \times (4.55 \div 37.8) \times 1.48$ (£)99.76	M3 A2	3.1d 1.3a	M2 for sight of $560 \times 455 \div 37.8$, OR M1 for sight of $560 \div 37.8$, $4.55 \div 37.8$, $37.8 \div 4.55$, or 4.55×1.48 Note: $560 \div 37.8$ (= 14.814814... gallons) $\times 4.55$ (= 67.407... litres) Use of 14.8 gives 67.34, use of 15 gives 68.25
(b) $560 / 10.75$ or $560 / 10 \frac{3}{4}$ 52(-093 mph)	M2 A1	3.1d 1.3a	M1 for $560/10.45$ or $560/675$ or $560/645$ C.A.O
C selected or implied with a reason, e.g. 'C because 52 mph average means travels fast'	E1 (9)	2.1b (3) AO1 (1) AO2 (5) AO3	Only F.T. provided $50 \leq \text{their average speed} \leq 70$
13.(a) $2.3 \times 10^{30} / 2^5$ or equivalent 7.2×10^{28}	M2 A1	3.1c 1.2	M1 for an attempt to divide 2.3×10^{30} by 2 more than once
(b) $r = 0.75^t \times x$	B3 (6)	2.3a (1) AO1 (3) AO2 (2) AO3	B2 for correct expression $0.75^t \times x$ B1 for $0.75x$, $x - 1/4 x$, 0.75^2x , ... SC2 for $r = 0.25^t \times x$ or SC1 for $0.25^t \times x$ or equivalent
14 (a) $45 / 120$ ($\times 100$) $37.5(\%)$ rounded or truncated	M1 A1	1.3b 1.3b	Accept values from 44 to 46 inclusive leading to 36.66.. to 38.33..(%) rounded or truncated.
(b) 70 seconds means $\approx 100 \times 85/120$ OR 80% calls means ($0.8 \times 120 =$) 96 calls	M1	3.1c	(OR $100 \times 84/120 = 70\%$). 70 seconds gives 84 to 86 inclusive so accept 70% to 72%.
70.833..% OR 71% OR ≈ 75 seconds AND interpretation 'No' (target not met stated or implied)	A1	2.1b	<u>Alternative solution to (b):</u> 'You can't tell', with full supported working for reasoning, gains M1 A1. e.g. percentage of calls answered in 70 seconds could be anything between 50% and 91.6666...%
Stating an assumption made e.g. "assumed that the times between 60 and 80 are evenly distributed"	E1 (5)	3.4a (2) AO1 (1) AO2 (2) AO3	Assumption: e.g. 'you don't know how the calls are distributed in the 60-80 group' gains E1.

GCSE MATHEMATICS Sample Assessment Materials 160

Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
15. Use of A : B is 2 : 3 or sight of 2/5 Area circle = $\pi \times 1.5^2$ Area A = $(2/5) \times \pi \times 1.5^2$ $= 2.8(27.. \text{cm}^2)$	B1 B1 M1 A1 (4)	3.1a 1.1 3.2 1.3a (2) AO1 (0) AO2 (2) AO3	
16. $x = \left[-3 \pm \sqrt{(3^2 - (4 \times 2) - 3)} \right] / (2 \times 2)$ $= \left[-3 \pm \sqrt{33} \right] / 4$ 0.69 and -2.19	M1 A1 A1 (3)	1.3a 1.3a 1.3a (3) AO1 (0) AO2 (0) AO3	Allow one slip CAO. Must be correct to 2 decimal places
17. (a) Sight of 305(cm) or 3.05(m) AND 3.95(cm) or 0.0395(m) $\frac{305}{3.95}$ or $\frac{3.05}{0.0395}$ $= 77$	B1 M1 A1	3.1d 3.1d 1.3a	<i>The B1 may be awarded if these values are seen in (a) or in (b) and need not be of the same units.</i> F.T. 'their 305', provided it is > 300 and ≤ 310 AND 'their 3.95', provided it is ≥ 3 and < 4 77.2.... is A0.
(b) (If container has height=) 295(cm) or 2.95(m) AND (each metal plate has thickness=) 4.05(cm) or 0.0405(m) $\frac{295}{4.05}$ or $\frac{2.95}{0.0405}$ $= 72.8...$	B1 M1 A1 (6)	2.4a 2.4a 2.4a (1) AO1 (3) AO2 (2) AO3	<i>The B1 may be awarded if these values are seen in (a) or in (b) and need not be of the same units.</i> F.T. 'their 295', provided it is ≥ 290 and < 300 AND 'their 4.05', provided it is > 4 and ≤ 5 <u>Alternative methods:</u> 73×4.05 M1 $= 295.6(5)$ AND 'this is > 295 ' A1 OR $295/73$ M1 $= 4.04$ AND 'this is less than 4.05' A1

Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
18. (a) $(x =) 35^\circ$ Angles in same segment, (angles in triangle)	B1 E1	2.3a 2.3a	Dependent on B1, unless correct workings seen but with 1 error in their calculation Accept, e.g. 'angles from same chord'
(b) 40° Angle at the centre is twice the angle at circumference	B1 E1	2.3a 2.3a	Dependent on B1, unless correct workings seen but with 1 error in their calculation
(c) Angle $CAB = x$ AND stating alternate segment theorem Stating triangle CAB isosceles AND $(180 - x)/2$	B1 B1 (6)	2.4b 2.4b (0) AO1 (6) AO2 (0) AO3	May be indicated on the diagram
19. Radius of the cylinder = 0.5 cm OR diameter = 1 cm Idea height of cylinder approximately circumference of ring Ring C = $2 \times \pi \times$ value between 8 and 9 inclusive Volume = $\pi \times 0.5^2 \times$ ring C Volume in the range 39.5 to 44.4 (cm ³) inclusive Statement about assumption, e.g. volume of cylinder used to calculate volume of dog toy, use of mid value for radius. Justification e.g. used smaller radius so volume will be greater, or used larger radius so volume will be less, or used 8.5 cm as height of cylinder is clearly between 8 cm and 9 cm.	B1 S1 M1 M1 A1 E1 E1 (7)	3.1d 3.1d 3.1d 1.3a 3.5 3.4a (1) AO1 (0) AO2 (6) AO3	Maybe shown on the diagram Maybe internal, external or somewhere in between. Accept sight of $8 \times \pi$ or $9 \times \pi$ for S1 C.A.O. E.g. 41.95 (cm ³) from use of 8.5 Accept 'circumference of the ring is the same as the length of plastic', 'radius doesn't change as bend around' Do not accept 'radius is 0.5'
20.(a) Sight of $h \propto u^2$ or $h = ku^2$ $5 = k \times 10^2$ $k = 0.05$ $h = 0.05 \times 12^2$ $h = 7.2$ (m) or equivalent	B1 M1 A1 M1 A1	3.1d 3.1d 1.3a 3.1d 1.3a	May be implied in later working F.T. non-linear only in all parts Or equivalent. Ignore incorrect use of \propto . NOTE: working for finding k (first three marks) may be seen in (b) not (a). Award the marks in (a) if this is the case. F.T. 'their k '
(b) $16 / 0.05 = u^2$ (=320) $u = 17.88854...$ (m/s)	M1 A1 (7)	1.3a 1.3a (4) AO1 (0) AO2 (3) AO3	Accept rounded or truncated

Specimen Assessment Materials Calculator-allowed Higher	Mark	Elements linked to AOs	Comments
23. (a) $f(4) = 8$ $gf(4) = 19$ (b) $fg(x) = 2(3 + 2x)$ $fg(x) = 6 + 4x$ $6 + 4x = 14$ $x = 2$	B1 B1 M1 A1 M1 A1 (6)	1.3a 1.3a 3.1b 1.3a 3.1b 1.3a (4) AO1 (0) AO2 (2) AO3	F.T 'their $f(4)$ ' Alternative method: $gf(x) = 3 + 2(2x)$ OR $3 + 4x$ B1 $gf(4) = 19$ B1 Allow F.T. from 'their $6 + 4x$ ', provided it is a linear expression, for M1 only C.A.O. <u>Alternative method:</u> $fg(x) = 2(3 + 2x)$ M1 $2(3 + 2x) = 14$ M1 $3 + 2x = 7$ A1 C.A.O. <i>or equivalent without brackets</i> $x = 2$ A1 C.A.O.

