

OCR

Oxford Cambridge and RSA

H

Date – Morning/Afternoon

GCSE (9-1) MATHEMATICS

J560/06 Paper 6 (Higher Tier)

PRACTICE PAPER (SET 3) MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 100

Final

This document consists of 15 pages

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for special cases that are worthy of some credit.
2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

Do not award the marks if the answer was obtained from an incorrect method, i.e. incorrect working is seen and the correct answer clearly follows from it.

3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, e.g. FT $180 \times (\textit{their} '37' + 16)$, or FT $300 - \sqrt{(\textit{their} '5^2 + 7^2')}$. Answers to part questions which are being followed through are indicated by e.g. FT $3 \times \textit{their} (a)$.

For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.
5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.
 - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point e.g. 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
 - **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
 - **nfw** means **not from wrong working**.
 - **oe** means **or equivalent**.
 - **rot** means **rounded or truncated**.
 - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
 - **soi** means **seen or implied**.

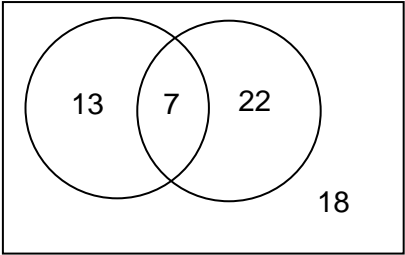
6. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (i.e. **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.
7. In questions with a final answer line following working space:
 - (i) If the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.
 - (ii) If the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - (iii) If the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.
8. In questions with a final answer line:
 - (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
 - (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.
10. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

11. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.
12. Ranges of answers given in the mark scheme are always inclusive.
13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.
14. Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.

Question		Answer	Marks	Part marks and guidance		
1	(a)	2250	1 1 A02.1a		Allow answers in range 2175 to 2325	
	(b)	(i)	12750	3 1 A01.3b 1 A02.1a 1 A03.1a	<p>M2 for $17 \times k$ oe where $725 \leq k \leq 775$</p> <p>Or M1 for 1 [tonne] = [£]750 soi or $17 \times$ <i>their 'k'</i> oe where <i>k</i> is <i>their</i> weight per tonne</p>	<p>Allow answers in range 12 325 to 13 175</p> <p>May be in parts read from the graph, e.g. 4 [tonnes] = [£]3000 1 [tonne] = [£]750 17 [tonnes] = $4 \times 3000 + [1 \times] 750$</p> <p>Attempt at unitary method Accept 725 – 775</p>
		(ii)	The unit cost is the same for all amounts bought	1 1 A03.4b	See Appendix for further examples	
2	(a)	0.45 oe	2 1 A01.3a 1 A02.1a	M1 for $1 - (0.3 + 0.25)$ If 0 scored, SC1 for 0.72		
	(b)	(i)	9	2 1 A01.3a 1 A02.1b	M1 for 0.3×30 oe	
		(ii)	Correct explanation	1 1 A03.4b	e.g. May need to play more times or she may not be very good at this game	
3	(a)	Position correctly shown on map	3 1 A01.3a 1 A02.3a 1 A02.3b	M1 for bearing 130 to 134 drawn at mast Y M1 for bearing 250 to 254 drawn at mast Z	Ignore other constructions for M marks For full marks, position of 'mast X' must be unambiguously marked	

Question			Answer	Marks	Part marks and guidance
	(b)	(i)	1 250 000	2 2 AO1.3a	B1 for [2 :] 2 500 000
		(ii)	122 to 125	2 1 AO1.3a 1 AO2.3a	M1 for $12.5 \times$ <i>their</i> measurement between 9.8 and 10 oe Method may be seen in stages e.g. Measurement = 9.9 $9.9 \div 2 = 4.95$ $4.95 \times 25 = 123.75$
4			11 100 to 11 200	3 3 AO1.3a	B2 for 124 400 000 to 124 450 000 seen Or M1 for $\sqrt{\frac{2 \times 6.67 \times 10^{-11} \times 5.97 \times 10^{24}}{6.4 \times 10^6}}$ oe Or B1 for figs 124... seen
5	(a)		Crompton, Harwood, Astley nfw	4 2 AO1.3b 1 AO3.1c 1 AO3.3	M3 for converting all three into comparable forms Or M2 for converting two into comparable forms Or M1 for correctly manipulating one into an equivalent alternative form Condone C, H, A as abbreviations for school names e.g. Working in decimals: H = 0.428... or 0.43 A = 0.44[4...] C = 0.42 or working in fractions: $H = \frac{1350}{3150}$, $A = \frac{1400}{3150}$, $C = \frac{1323}{3150}$ See Appendix for further examples
	(b)		If Beechfield has more pupils than Kenwood the <i>number</i> of girls may be more than at Kenwood	1 1 AO2.5b	Comments must indicate that the pie charts show proportions, not quantity

Question		Answer	Marks	Part marks and guidance
6	(a)	1400	<p>3 1 AO1.3a 1 AO2.3a 1 AO3.1c</p>	<p>M2 for $\frac{24}{60} \times 3500$ oe</p> <p>Or B1 for $\frac{24}{60}$ oe or $\frac{36}{60}$ oe</p> <p>If 0 scored, SC1 for 2100 as final answer</p>
	(b)	Different age groups may not have the same opinion	<p>1 1 AO3.5</p>	
7		$\frac{(x) + (x+1) + (x+2) + (x+3) + (x+4)}{5}$ $= \frac{5x+10}{5}$ <p>= x + 2, which is the median</p>	<p>4 2 AO2.4a 1 AO3.1a 1 AO3.2</p>	<p>M1 for x, x + 1, x + 2, x + 3, x + 4 seen</p> <p>M1 for (x) + (x + 1) + (x + 2) + (x + 3) + (x + 4) M1 for <i>their</i> (5x + 10) ÷ 5</p> <p>If 0 scored, allow SC2 for a numerical example of any 5 consecutive numbers with mean clearly evaluated, and median identified as the same value</p> <p>Or SC1 for a numerical example of any 5 consecutive numbers with mean clearly identified, or median clearly identified, or both identified with no conclusion</p>

Question		Answer	Marks	Part marks and guidance
8	(a)		<p>3 1 A02.1a 2 A02.3b</p>	<p>B1 for 18 correctly placed AND B2 for 13, 7 and 22 correctly placed Or M1 for $60 - (18 + \text{their '13'} + \text{their '22'})$ in overlap</p> <p><i>Their 7 must be ≥ 1</i></p>
	(b)	$\frac{20}{42}$ oe	<p>2FT 1 A02.1b 1 A02.3a</p>	<p>M1 for denominator 42 seen, FT from <i>their '13' + their '7' + their '22'</i></p> <p>FT from <i>their</i> Venn diagram Look for $\frac{10}{21}$ or 0.476[190...] Condone 0.47 to 0.48</p>
9	(a)	k^5	<p>1 1 A01.3a</p>	
	(b)	$12m^{\frac{9}{2}}$	<p>2 2 A01.3a</p>	<p>B1 for $m^{\frac{9}{2}}$ or $m^{4\frac{1}{2}}$ or $m^{4.5}$</p> <p>Allow $12m^{4\frac{1}{2}}$ or $12m^{4.5}$</p>
	(c)	$25p^{17}$	<p>3 3 A01.3b</p>	<p>B2 for p^{17} seen Or B1 for 25 or p^{14} seen</p>
10	(a)	$\frac{1}{2} \times 12 \times k + (30 - 12) \times k = 6k + 18k = 24k$	<p>3 1 A02.1a 1 A02.2 1 A02.3b</p>	<p>M1 for $\frac{1}{2} \times 12 \times k$ AND M1 for $(30 - 12) \times k$ Or M2 for $\frac{1}{2} \times k \times (18 + 30)$</p> <p>Condone missing \times signs</p>

Question		Answer	Marks	Part marks and guidance	
	(b)	17.1	3 2 AO1.3a 1 AO2.1a	M2 for $[k =] \frac{410}{24}$ oe soi by 17.0[83...] Or M1 for $24k = 410$	
	(c) (i)	0.272	3 1 AO1.3b 1 AO2.1a 1 AO3.1c	M2 for $\frac{410 - 13 \times 25}{\frac{1}{2} \times 25^2}$ oe Or M1 for $410 = 13 \times 25 + \frac{1}{2} \times a \times 25^2$	May be done in stages Substitutes numbers correctly into formula (or <i>their</i> attempt at a rearranged formula)
	(ii)	21 nfw	5 1 AO1.3b 3 AO3.1d 1 AO3.3	M1 for $410 = 15t + \frac{1}{2} \times 0.4t^2$ oe AND M2 for $[t =] \frac{-15 \pm \sqrt{15^2 - 4 \times 0.2 \times -410}}{2 \times 0.2}$ Or M1 for $[t =] \frac{-15 \pm \sqrt{15^2 - 4 \times 0.2 \times -410}}{2 \times 0.2}$ with at most 1 sign error AND A1 for [-96.2 to -96.3 or -96 and] 21.2 to 21.3 If no relevant working shown, SC3 for -96 and 21 as final answer Or SC2 for -96.2 to -96.3 and 21.2 to 21.3 as final answer	oe includes $410 = 15t + 0.2t^2$ or $2050 = 75t + t^2$ M2 or M1 are FT from <i>their</i> 3 term quadratic Condone 'short' division line in working if seen correct at least once Would earn M1 only if only "+" or "-" used instead of "±" Maximum 4 marks if unrounded and/or negative solution not rejected

Question		Answer	Marks	Part marks and guidance
11	(a)	$24x + 64$ or $8(3x + 8)$	2 2 A01.3a	M1 for $3x + 6$ seen
	(b)	-2	3 1 A01.3a 2 A03.1a	M1 for $3'x' + 6 = 8('x' + 2)$ oe M1 for $5'x' = -10$
12		$5 + 5 + 2.5 + 2.5 + 2 \times \frac{50}{360} \times 2 \times \pi \times 2.5$ $= 19.36[\dots] = 19.4$ [m]	4 2 A01.3b 1 A02.2 1 A02.3a	B1 for 50 or 100 seen AND M2 for $[2 \times \frac{\text{their } 50}{360} \times 2 \times \pi \times 2.5]$ Or M1 for $2 \times \pi \times 2.5$
13		26.3 to 26.4	6 2 A01.3a 3 A03.1b 1 A03.2	M5 for $\frac{[2 \times \frac{1}{2}] \times r \times r \times \sin 124}{\pi r^2} [\times 100]$ OR M1 for $180 - 56$ oe AND M2 for $[2 \times \frac{1}{2}] \times r \times r \times \sin \text{their}'124'$ Or M1 for $\frac{1}{2} \times r \times r \times \sin \text{their}'124'$ AND M1 for $\text{their triangle area} \div \pi r^2 [\times 100]$

Question		Answer	Marks	Part marks and guidance	
14	(a)	"Sides =" 33, 56, 65 $33^2 + 56^2 = 4225$ $\sqrt{4225} = 65$	3 1 AO1.3a 1 AO2.4a 1 AO3.1a	B1 for 56 and 65 seen M1 for $33^2 + 56^2$	<u>Alternative method</u> M1 for $(x + 23)^2 + x^2 = (2x - 1)^2$ M1 for $x^2 - 25x - 264 = 0$ or equivalent quadratic = 0 A1 for $x = 33$ [and $x \neq -8$]
	(b)	$2x - 1 = x + 23$ $x = 24$ $2x - 1 = x$ $x = 1$ which does not give a triangle $x = x + 23$ which has no solution	M1 B1 M1 A1 M1 A1 1 AO1.3a 3 AO3.1a 2 AO3.4b		Could be in any order $x = 1$ must be rejected Needs to be explained
15		322.26	4 3 AO1.3b 1 AO3.3	B3 for 2722.26 to 2722.263 OR M2 for 2400×1.032^4 OR M1 for 2476.8[0] or 1.032 soi M1 for <i>their</i> 2476.8×1.032 and <i>their</i> 2556.05 to 2556.06×1.032 and <i>their</i> 2637.85 to 2637.86×1.032	Steps towards first year calculated Further 3 years calculated

Question		Answer	Marks	Part marks and guidance	
16	(a)	$8^{\frac{5}{15}} = 8^{\frac{1}{3}} = \sqrt[3]{8} = 2$	2 2 AO2.2	M1 for $8^{\frac{5}{15}}$ or $8^{\frac{1}{3}}$	
	(b)	$3^{\frac{1}{2}}$	3 1 AO1.3b 1 AO2.2 1 AO3.1b	B2 for $3^{\frac{4}{8}}$ or equivalent fractional power Or M1 for 3^4 or $(3^3 \times 3)^{\frac{1}{8}}$ or $27^{\frac{1}{8}} \times 3^{\frac{1}{8}}$	
17		BP = PC (P midpoint of BC) Angle MBP = angle NPC (corresponding angles) Angle BPM = angle PCN (corresponding angles) Triangles [MBP and NPC] congruent by ASA.	4 1 AO1.1 3 AO2.4b	B3 for three facts with conclusion Or B2 for three facts with missing or unclear conclusion or for two facts with conclusion Or B1 for one fact	
18	(a)	4 440 000 or 4 441 000 to 4 441 100	2 2 AO1.3a	M1 for $30\,000 \times 2.3^6$ Allow 4 400 000 provided correct working seen	

Question	Answer	Marks	Part marks and guidance																												
(b)	26 or 25.9[9...]	<p>3 1 AO1.3a 2 AO3.1a</p>	<p>M2 for $(\sqrt[3]{2} - 1) \times 100$ oe</p> <p>Or B1 for $\sqrt[3]{2}$ or 1.2599...</p> <p>Or M1 for $\left(\frac{100+k}{100}\right)^3 = 2$ oe</p> <p><u>Alternative method using trial and improvement</u></p> <p>M2 for working towards calculating overall percentage increase over 3 years for both 25% and 26% e.g. As a minimum: $1.25^3 = 1.95[3\dots]$ and $1.26^3 = 2.000[\dots]$</p> <p>Or M1 for working towards calculating a percentage increase over 3 years where k is between 20 and 30 e.g. $1.25^3 = 1.95[3\dots]$</p> <p>Allow method marks for working in decimals, percentages or from <i>their</i> initial population</p> <table border="1" data-bbox="1599 890 2074 1168"> <thead> <tr> <th>k</th> <th>After 3 years</th> <th>k</th> <th>After 3 years</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>72.8</td> <td>26</td> <td>100.03...</td> </tr> <tr> <td>21</td> <td>77.15...</td> <td>27</td> <td>104.83...</td> </tr> <tr> <td>22</td> <td>81.58...</td> <td>28</td> <td>109.71...</td> </tr> <tr> <td>23</td> <td>86.08...</td> <td>29</td> <td>114.66...</td> </tr> <tr> <td>24</td> <td>90.66...</td> <td>30</td> <td>119.7</td> </tr> <tr> <td>25</td> <td>95.31...</td> <td></td> <td></td> </tr> </tbody> </table>	k	After 3 years	k	After 3 years	20	72.8	26	100.03...	21	77.15...	27	104.83...	22	81.58...	28	109.71...	23	86.08...	29	114.66...	24	90.66...	30	119.7	25	95.31...		
k	After 3 years	k	After 3 years																												
20	72.8	26	100.03...																												
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24	90.66...	30	119.7																												
25	95.31...																														

APPENDIX

Exemplar responses for Q1(b)(ii)

Response	Mark
There are no discounts for buying more	1
There is enough aluminium	0

Exemplar responses for Q5(a)

Working in fractions:

	1 mark	1 mark	Still only 1 mark	2 marks	2 marks	2 marks	3 marks
$H = \frac{3}{7}$				$\frac{27}{63}$		$\frac{150}{350}$	$\frac{1350}{3150}$
A	$\frac{4}{9}$		$\frac{4}{9}$	$\frac{28}{63}$	$\frac{200}{450}$		$\frac{1400}{3150}$
C		$\frac{21}{50}$	$\frac{21}{50}$		$\frac{189}{450}$	$\frac{147}{350}$	$\frac{1323}{3150}$

Working in ratios:

	1 mark	1 mark	Still only 1 mark	2 marks	2 marks	2 marks	2 marks	2 marks	2 marks	3 marks	3 marks
H	3 : 4		3 : 4	12 : 16	21 : 28		15 : 20	87 : 116		84 : 112	435 : 580
$A = 4 : 5$				12 : 15		84 : 105	16 : 20		116 : 145	84 : 105	464 : 580
C		21 : 29	21 : 29		21 : 29	84 : 116		84 : 116	105 : 145	84 : 116	420 : 580

Assessment Objectives (AO) Grid

Question	AO1	AO2	AO3	Total
1(a)	0	1	0	1
1(b)(i)	1	1	1	3
1(b)(ii)	0	0	1	1
2(a)	1	1	0	2
2(b)(i)	1	1	0	2
2(b)(ii)	0	0	1	1
3(a)	1	2	0	3
3(b)(i)	2	0	0	2
3(b)(ii)	1	1	0	2
4	3	0	0	3
5(a)	2	0	2	4
5(b)	0	1	0	1
6(a)	1	1	1	3
6(b)	0	0	1	1
7	0	2	2	4
8(a)	0	3	0	3
8(b)	0	2	0	2
9(a)	1	0	0	1
9(b)	2	0	0	2
9(c)	3	0	0	3
10(a)	0	3	0	3
10(b)	2	1	0	3
10(c)(i)	1	1	1	3
10(c)(ii)	1	0	4	5
11(a)	2	0	0	2
11(b)	1	0	2	3
12	2	2	0	4
13	2	0	4	6
14(a)	1	1	1	3
14(b)	1	0	5	6
15	3	0	1	4
16(a)	0	2	0	2
16(b)	1	1	1	3
17	1	3	0	4
18(a)	2	0	0	2
18(b)	1	0	2	3
Totals	40	30	30	100