F

GCSE (9–1)

Mathematics

J560/03: Paper 3 (Foundation tier)

General Certificate of Secondary Education

Mark Scheme for November 2021

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations available in RM Assessor. These must be used whenever appropriate during your marking.

Annotation	Meaning
	Correct
	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
^	Omission sign
BP	Blank page
SEEN	Seen

For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0 or ^) is sufficient, but not required.
For responses that are not awarded either 0 or full marks, you must make it clear how you have arrived at the mark you have awarded and all responses must have enough annotation for a reviewer to decide if the mark awarded is correct without having to mark it independently.

It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

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. 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.
   - **nfww** means **not from wrong working**.
   - **oe** means **or equivalent**.
   - **rot** means **rounded or truncated**.
   - **soi** means **seen or implied**.
   - **dep** means that the marks are **dependent** on the marks indicated. You must check that the candidate has met all the criteria specified for the mark to be awarded.
   - **with correct working** means that full marks **must not** be awarded without some working. The required minimum amount of working will be defined in the guidance column and **SC** marks given for unsupported answers.

3. 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.

4. Unless the command word requires that working is shown and the working required is stated in the mark scheme, 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.

5. 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. 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.

   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 × (*their* '37' + 16), or FT 300 – √(*their* '52 + 72'). Answers to part questions which are being followed through are indicated by e.g. FT 3 × *their* (a).

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 and incorrect answer given**:

   (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 if there is no other method leading to the incorrect answer. 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. A correct step, value or statement that is not part of the method that leads to the given answer should be awarded **M0** and/or **B0**.

   (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 marks for the poorer response 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 marks for the poorer response 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. If a candidate corrects the misread in a later part, do not continue to follow through, but award **A** and **B** marks for the correct answer only.

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.

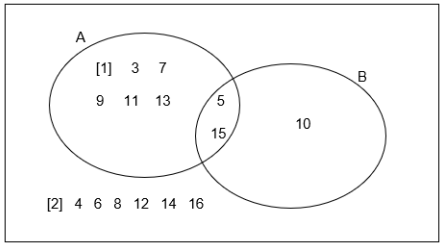
13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

14. If in any case the mark scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Marks	Part marks and guidance	
1	(a)	(i)	10	1		
		(ii)	7	1		
	(b)		RomCom	1		
	(c)		20	2	**M1** for 3 [+] 2 [+] 5 [+] 7 [+] 3 seen	May be on graph
	(d)		4 : 5	3	**B1** for 25 or (45 – *their* 20) **M1** for *their* 20 : *their* 25 OR **M2** for $\frac{4}{9}:\frac{5}{9}$ seen or **M1** for $\frac{20}{45}:\frac{25}{45}$ oe seen If 0 scored, SC1 for answer 5 : 4	*Their* Yr 10 from (c) *Their* 25 is any value from 12 to 44 May be on answer line For M1 ratio must be seen and not implied from a "simplified" version 20 : 25 implies B1 M1 25 : 20 implies B1 oe 0.444[...] : (0.555 to 0.556)
2	(a)		43	1		
	(b)		1024	1		

Question			Answer	Marks	Part marks and guidance	
3			49.50 with correct working	6	**B5** for figs 495 as final answer with at least the M2 mark OR **M1** for [10p =] 0.2 × 150 oe soi 30 **M1** for [20p =] 0.3 × 150 oe soi 45 and **M1** for (150 – *their* 30 – *their* 45) oe soi by 75 and **M2** for (*their* 30 × 10) and (*their* 45 × 20) and (*their* 75 × 50) oe or **M1** for one from (*their* 30 × 10) or (*their* 45 × 20) or (*their* 75 × 50) oe If 0 or 1 scored and no/insufficient working seen **SC2** for figs 495 as final answer	 Ignore money notation Ignore money notation May be 150 ÷ 2 May work in £ Implied by 300, 900, 3750 or £3, £9, £37.5[0] If M1 only and SC2 available award SC2 only

Question			Answer	Marks	Part marks and guidance	
4	(a)		$\frac{90}{360}$ oe fraction	1		Expect $\frac{1}{4}$ but ignore attempts to cancel initially correct fraction but not convert to decimal or percentage Answer 0.25 after $\frac{1}{4}$ seen scores 0
	(b)		Yes oe and [in 2020] they won more matches (or double the number of matches) than [in 2019] oe or The win fraction went up to ½ oe [from ¼ oe] The win fraction got bigger	1		See appendix Must be clear reference to win not "it" Do not allow comparing with unlike (e.g. W and L) only unless clearly indicating that W replaced L as majority" oe ½ or ¼ may be degrees Allow error in 2020 win fraction Must be an implied comparison
5			702	3	**M2** for 600 × 1.17 oe or **M1** for 600 × [0].17 oe soi by 102	May be 600 + *their* 102 from valid attempt at 17% May be Non-Calculator eg [10% =] 60, [5% =] 30, [1% =] 6, [2%] = 12 and sum of *their* 60, 30 and 12 Must have labels or correct processes
6	(a)		60, 120, 60, 120	1		Accept in any order or only on diagram Must be 120 and not 60|60 or 60+60
	(b)		30, 120, 30	2	**M1** for diagram with longer diagonal drawn only	May be on original drawing If diagram redrawn then diagonal must join "other two" vertices
7			3	2	**M1** for 6 ÷ 2 oe	

Question			Answer	Marks	Part marks and guidance	
8			$4t + 2u$ final answer	2	**B1** for $4t$ or $2u$ seen	
9	(a)			3	**B2** for one element misplaced or repeated or missing or **B1** for one correct region	Condone 1 and/or 2 repeated
	(b)		[Venn diagram] 2 and [because] odd numbers cannot be multiples of 2 oe and no contradictions	2	**B1** for choice of diagram 2	Must justify using properties of elements. Accept "Odd numbers cannot be even" and "All multiples of 2 are even"
10			162	4	**B1** for [Area of face =] 9 **B1** for [Total number of faces =] 18 **M1** for *their* number of faces × *their* 9 Alternative **B1** for [area of face=] 9 **B1** for [total surface area of cube=] 54 **M1** for *their* 54 × 4 – 6 × *their* 9 oe Alternative **B1** for [area of face=] 9 **M1** for 24 × *their* 9 soi 216 **M1** for *their* 216 – 6 × *their* 9	e.g. 4+4+3+3+2+2 or 5+4+4+5 May be in stages e.g. 5×9+4×9+ etc Accept other alternative methods

Question			Answer	Marks	Part marks and guidance	
11	(a)		$a + 2b$ cao	1		Do not accept extras
	(b)		$2y < x$ cao	1		Do not accept extras
	(c)		$2x = 5$ cao	1		Do not accept extras
12			$w = \frac{P - 2h}{2}$ oe	2	**M1** for $\frac{P - 2h}{2}$ oe or correct first step eg $P - 2h = 2w$ or $\frac{P}{2} = \frac{2w}{2} + \frac{2h}{2}$ or for next correct step towards isolating w following first error	Note $w = \frac{2h - P}{-2}$ oe is correct May be $\frac{P}{2} = w + h$ e.g. Following $2w = P + 2h$ w = $\frac{P + 2h}{2}$
13			40 with correct working	5	**B1** for 2800 [cm] or [0].6[0] [m] **M1** for $\frac{\text{figs } 28}{\text{figs } 6}$ soi 46.6 to 46.7 or $46\frac{40}{60}$ oe **M1** for *their* 46.6… truncated soi 46 **M1** for figs 28 – *their* 46 × figs 6 If 0 scored with no/ insufficient working **SC2** for answer 40 or **SC1** for answer 0.4	If both seen and one incorrect award B0 Correct working requires all part marks soi At least 4 repeated additions or repeated subtraction May have indication of continuing 46 implies M2 B1 2800 – 2760 implies M3 B1 May be (*their* 46.6... – 46) × 60

Question			Answer	Marks	Part marks and guidance	
14	(a)		5120	1		
	(b)		Topozero, Tana, Mweru, Ladoga, Victoria or 986, 3200, 5120, 18 100, 68 900 oe in standard form	2	**B1** for Topozero as smallest or Victoria as largest or all in correct reverse order	9.86×10^2, 3.20×10^3, 5.12×10^3, 1.81×10^4, 6.89×10^4 condoning superfluous zeros and slip in index
	(c)		1.5×10^4 nfww isw	4	**B3** for 15 000 oe or $1.49[0..] \times 10^4$ or **B2** for 14 900 oe or **M1** for figs 181 – figs 32 If 0 scored **SC1** for *their* value correctly rounded to 2 significant figures	e.g. 15 000 may be 15×10^3 Subtraction may be implied e.g. by figs 15 or figs 149 *Their* unrounded value must be seen
15	(a)		285	2	**M1** for $\frac{760}{(2+3+3)}$ soi 95	
	(b)		24	2	**M1** for $\frac{2}{3} \times 36$ oe	Allow (0.66 or 0.7) $\times$ 36 for M1 only

Question			Answer	Marks	Part marks and guidance	
16	(a)		Triangle at (-8, 6), (-8, 2), (0, 6)	2	**B1** for reflection in $x = k$ or in $y = 0$	Mark intention, condone freehand
	(b)		Enlargement $\frac{1}{4}$ or 0.25 (0, -6)	3	**B1** for each element	Marks spoilt if extra transformations Condone omission of brackets Accept centre as a vector $\begin{pmatrix} 0 \\ -6 \end{pmatrix}$
17	(a)		0.14, 0.09, (0.19), 0.2[0], 0.13, 0.25	2	**B1** for three or four correct relative frequencies in the correct place	Accept fractions
	(b)	(i)	[Unbiased dice] would have each [rf =] 0.16-0.17 or [Unbiased dice] would have each [f =] 50 or comment about very unequal [relative] frequencies and implied comparison	1		Accept "about 0.16" Accept "about 50" Not enough to say one number was rolled the most. Must say 6 [and 4] or some numbers are much higher or 2 or 5 or some numbers are much lower
		(ii)	need larger sample oe	1		
18	(a)		3.39 and 3.44 only	2	**B1** for one only or for two correct and one extra	
	(b)	(i)	10 cm [between 3.35 and 3.45] oe or [If to nearest cm it should be between] 3.395 and 3.405	1		Mention of 10 cm (range or difference) oe
		(ii)	3.405	1		

19	**(a)**		4 with correct working	**3**	**M1** for 210 – *n* where 40 ≤ *n* ≤ 50 soi by 160 to 170 **M1** for (*their* number of characters) ÷ 40 Alternative **M2** for two from [4 letters] 210 ÷ 5 [5 letters] 210 ÷ 6 [6 letters] 210 ÷ 7 or **M1** for one from [4 letters] 210 ÷ 5 [5 letters] 210 ÷ 6 [6 letters] 210 ÷ 7 Alternative (trials): **M2** for two from 3 × 40 + [40 to 50] 4 × 40 + [40 to 50] 5 × 40 + [40 to 50] or **M1** for one from 3 × 40 + [40 to 50] or 4 × 40 + [40 to 50] or 5 × 40 + [40 to 50] OR **M1** for 210 ÷ 40 **A1** for final answer of 5 If 0 scored and no/insufficient working **SC1** for answer 4	Correct working requires at least M1 *n* represents an estimate of the number of spaces and/or punctuation, digits, symbols etc] Allow 40 × 5 = 200 for M1 Answer “4 to 5” or 5 with no working score 0

Question			Answer	Marks	Part marks and guidance	
	(b)		72 [seconds]	B1		
			$\frac{40}{60} \times$ *their* 72 oe or $\frac{52}{\textit{their}\ 72} \times 60$ oe	M1		
			OR			
			1.2 oe	B1		oe may be $1\frac{12}{60}$ oe
			40 × *their* 1.2 oe or 52 ÷ *their* 1.2	M1		*their* 1.2 is not 1.12
			AND			
			48 or 43.[3…] and short/shorter word length oe	A1		Ignore non-contradictory statements but, “He may type faster” is incorrect and, if included, scores A0

Question			Answer	Marks	Part marks and guidance	
20			60 with correct working	**5**		For full marks, correct working requires Pythagoras or trig leading to 12
					B3 for 12 as third side with correct working or **M2** for $\sqrt{13^2 - 5^2}$ oe or **M1** for $13^2 = 5^2 + [DC^2]$	For B3 "correct working" requires evidence of M2 or M1 or mention of 5:12:13 triangle
					OR	
					M1 for $\angle BDC = \sin^{-1}\left(\frac{5}{13}\right)$ oe or $\angle CBD = \cos^{-1}\left(\frac{5}{13}\right)$ oe	22.6... or 67.3 to 67.4 oe may be in ΔABD
					M1 for 13 cos *their* $\angle BDC$ or 13 sin *their* $\angle CBD$	
					AND	
					M1 for $5 \times$ *their* DC (or AB)	*Their* DC (or AB) not = 13.
					If 0 or 1 scored with no/insufficient working **SC2** for answer 60 or If 0 scored with no/insufficient working **SC1** for 12 as third side	If M1 scored and SC2 available, award SC2 only May be on diagram

Question			Answer	Marks	Part marks and guidance	
21	(a)		2 cao	1		
	(b)	(i)	$y = 2x + 3$	1		Allow, "The first one" oe for $y = 2x + 3$
		(ii)	Comment: Rejecting 4 [as gradient] and/or indicating $2 > \frac{1}{2}$	1		See appendix
	(c)		$2 \times 45 - 1$ soi 89 or $(90 + 1) \div 2$ soi 45.5 oe Below	M1 A1		

Question			Answer	Marks	Part marks and guidance	
22	(a)		$x \times x$ or $4(2x + 5)$ seen $x^2 = 8x + 20$ or $x^2 = 4(2x + 5)$ Correctly rearranging to $x^2 – 8x – 20 = 0$ without error	M1 M1 A1	**Dep**endent on first M1 and not from rearrangement of original equation	Allow [area of] square = x^2 or [area of] rectangle = $8x + 20$ x^2 and /or $8x + 20$ may be written with correct shape(s)
	(b)		$^{-}2$ 10 nfww	3	**B2** for one correct solution nfww OR **M2** for $(x + 2)(x – 10) = 0$ or **M1** for $(x + a)(x + b)$ where $ab = –20$ or $a + b = {}^{-}8$ OR **M2** for two correct trials using $^{-}4 \leq x \leq 0$ and two correct trials using $8 \leq x \leq 12$ or **M1** for two correct trials using $^{-}4 \leq x \leq 0$ or two correct trials using $8 \leq x \leq 12$ If 0 scored **SC1** for answers 2 and –10	e.g. one trial is when $x = 2$, $2^2 – 8 \times 2 – 20 = –32$ Accept as trial $x = 2$ and $–32$ x -4 16 32 -20 28 -3 9 24 -20 13 -2 4 16 -20 0 -1 1 8 -20 -11 0 0 0 -20 -20 8 64 -64 -20 -20 9 81 -72 -20 -11 10 100 -80 -20 0 11 121 -88 -20 13 12 144 -96 -20 28
	(c)		Length [of square] cannot be negative	1	Dependent on negative answer in (b)	Do not accept x cannot be negative
	(d)	(i)	100	1	**FT (***their* positive root from **(b)** $)^2$	If two positive roots seen in (b) accept either or both used in (i) and in (ii) BUT, if one answer right and one wrong in any part, 0 marks
	(d)	(ii)	25	1	**FT (***their* positive root from **(b)** $) \times 2 + 5$	

Question			Answer	Marks	Part marks and guidance	
23			5 : 6 nfww	**4**		Accept for all part marks *n* replaced by a consistent integer
					B3 for 5*kn* : 6*kn* *k* > 0 or equivalent correct unsimplified ratio seen	e.g. 2.5*n* : 3*n* or 5*n* : 6*n* or 10 : 12 etc
					OR	
					M1 for two ratios with a common number of mints implied by … : 10*k* **and** 10*k* : … seen, *k* > 0 with one correct ratio or 2.5*n* : 5 seen	May be seen as two separate ratios Eg 5*n* : 10 and 10 : 6*n* or 10 : 20 and 20 : 12 etc
					A1 for 5*kn* : 10*k* : 6*kn*	For **M1** the examples just require the common 10 or the common 20 etc

APPENDIX

Exemplar responses for Q4b

Response		Mark
Yes They lost fewer matches [in 2020]		**1**
Yes The sector for win is bigger[in 2020]	Implied comparison by "biggER"	**1**
Yes Win is a half and it was a quarter oe	Comparison of like with like	**1**
Yes the fraction/number/ of wins doubled		**1**
Yes in 2020 they won more than 2019 and lost less	Ignore the last three words	**1**
Yes the win rate increased by another ¼	BOD if "another" missing. Indicates improvement	**1**
They improved because they won $\frac{2}{3}$ when they won $\frac{1}{3}$ before	BOD means double following $\frac{1}{3}$ seen in (a)	**1**
Yes they have won much more than last at least 170°	Condone the "at least 170°"	**1**
Yes In 2019 they lost the most and in 2020 they won the most	Unlike but indicates majority has changed	**1**
Yes They got an extra half of wins than in 2019	BOD "extra half". Implies improvement	**1**
Yes The win section is larger than draw which is ¼, which is what they won before	Implies "Win larger than ¼ and "before" implies 2019	**1**
Yes In 2020 the team won 50% of their matches which is ¼ more than 2019	BOD the ¼ more. Implies improvement	**1**
Yes The pie chart in 2020 shows the team won ½	No comparison stated	**0**
Yes it went from ¼ to ½	Do not condone "it" for "win"	**0**
Yes It's $\frac{1}{4}$ [in 2019] and now [in 2020] it's $\frac{1}{2}$	Unclear what "its" refers to. Must be clearly WIN	**0**
Yes They won half instead of lost half	No marks as don't compare like with like (They could still have won half in 2019)	**0**
Yes The fraction has gone up to a half	Not clearly about wins	**0**
Yes ½ of the matches won and only ¼ lost	No marks as don't compare like with like	**0**

Exemplar responses for Q9b

Response	Mark
2 because odds and multiples of 2 are different	**2**
2 L and M have nothing in common Both marks earned	**2**
2 There won't be any numbers to fit both 1 mark for 2 and BOD the reason implying nothing in common	**2**
2 No numbers in each set share the same values therefore they are split and separate in set 2 1 mark for 2 and BOD the "values" for "properties". Set 2 means "Diagram 2"	**2**
2 None of the numbers are in the same group 1 mark for 2	**1**
2 because odds are different 1 mark for "2" reason insufficient as doesn't say different to what	**1**
2 both of them are equal as it has no middle 1 mark for "2" reason incorrect	**1**
1 anything	**0**

Exemplar responses for Q17b(i)

Response	Mark
The frequency of 2 is much lower than for the rest of the numbers OK as MUCH lower (and for 2)	**1**
6 has a much larger number than the all the other numbers Allow for "much" [and mention of the other numbers]	**1**
Frequency of rolling the numbers are very high compared to others such as 27 – 75 big difference BOD 27 and 75 implying 2 and 6 and a BIG difference	**1**
It lands on a certain number most of the time Does not say which number and most is not enough	**0**
It has a higher chance of landing on the same number Does not say much higher or which number	**0**
It may be biased as the frequency of a number changes all the time Only different not very different	**0**
Because 6 was rolled 75 times Does not compare to other numbers or mention expected frequency	**0**
One number was rolled the most Not enough as most could just be one more	**0**
6 seemed to be landed on more than any other Does not mention MUCH oe	**0**
Dice landed on 6, 75 times Doesn't compare using MUCH oe	**0**
The number 6 was most frequent and 2 was least frequent Doesn't mention MUCH oe	**0**
It's bound to land on every number almost the same number of times And so... nothing said to answer the question	**0**
Number is considerably higher than all the others Doesn't say "Some numbers" or identify 6	**0**
Some numbers have a higher frequency that others Doesn't mention MUCH oe	**0**

Exemplar responses for Q17b(ii)

Response		Mark
It has not been thrown enough times	Indicates needs more trials	1
It depends on how you throw the dice		0
The larger/smaller numbers may just be anomalies	Does not indicate needs more trials	0
It could land on any number at any time, there is no specific way to get a certain number	Does not indicate needs more trials	0

Exemplar responses for Q21b(ii)

Response		Mark
The number before *x* is bigger in the first one	Compares the numbers for gradient	1
The 4 is not the gradient, it is the y intercept. The gradient is ½	OK, Rejects gradient	1
Because it is only half whereas y = 2x + 3 is the steepest	BOD ½ for gradient and implied comparison with 2	1
The number added is the [*y*] intercept and not the gradient	OK, rejects constant	1
It has the smallest gradient which is ½	BOD implied comparison of gradients	1
You halve the *x* making it closer to *x*	inconclusive statement and doesn't compare numbers	0
It's actually the least steep	True but no reason given	0
Because ½ isn't the highest number	Doesn't compare the gradients ½ and 2. There are lots of "numbers"	0

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