Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE In Mathematics A (4MA1) Higher Tier Paper 2H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme.

  Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - eeoo – each error or omission
- **No working**

  If no working is shown then correct answers normally score full marks

  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**

  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

  If there is no answer on the answer line then check the working for an obvious answer.
- **Ignoring subsequent work**

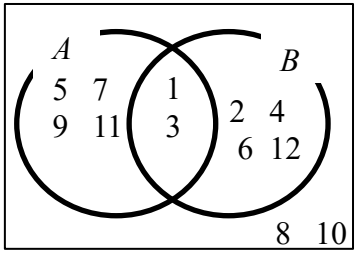
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another

Question	Working	Answer	Mark	Notes		
1	73 ÷ 200 (=0.365) **or** 73 × 100 (= 7300) or 1 cm = 2 m oe "0.365" × 100 **or** "7300" ÷ 200 73 ÷ 2	36.5	3	M1 M1 A1	Allow their incorrectly converted 73 m ÷ 200	M2 for $100 \div \frac{200}{73}$ oe
2		$4n + 3$	2	B2oe	e.g. 7 + 4(n – 1) or 4n + (7 – 4) etc allow $T_n = 4n + 3$ or $x = 4n + 3$ etc If not B2 then award B1 for answer of $4n + k$ $(k \neq 3)$ or $n = 4n + 3$	
3	90 ÷ (2 + 13) (= 6) **or** $\frac{12+x}{90+x} = \frac{1}{3}$ "6" × 2 (=12) **or**"6" × 13 (=78) **or** $3(12 + x) = 90 + x$ ("78" ÷ 2) – "12" **or** $2x = 54$ **or "**78" × 3/2 –"78" – "12"oe	27	4	M1 M1 M1 A1	M2 for $\frac{2}{15} \times 90 (= 12)$ or $\frac{13}{15} \times 90 (= 78)$ dep on a correct method for "78" and "12"	

Question	Working	Answer	Mark	Notes
4		Fully correct Venn diagram	4	B4 fully correct Venn diagram with labels *A* and *B* (If not B4 then B3 for 3 correct regions, B2 for 2 correct regions B1 for 1 correct region)
5	123 – 67 (=56) **or** $2x = 123 – 67$ **or** $2x + y = 67$ **or** $4x + y = 123$ oe (x = length of tile, y = width of tile) e.g. “56” ÷ 2 (=28) 67 – 56 (=11) **or** 67 – 2×”28” (=11) **or** 123 – 4×”28” (=11) (67 – 2×”11”) × (123 – 2×”11”) **(**45 × 101) **or** 123 × 67 – 12 × “28” ×” 11” (8241 – 3696)	4545	5	M1 M1 for method to find length or width M1 for method to find other dimension M1 dep on M2 A1

<table>
<tr><th colspan="2">Question</th><th>Working</th><th>Answer</th><th>Mark</th><th colspan="2">Notes</th></tr>
<tr><td>6</td><td>(a)</td><td>2 × 2 × 2 × 2 × 2 × 3 or 2 × 2 × 2 × 3 × 5
e.g.
<table><tr><td>2</td><td>96</td><td>120</td></tr><tr><td>2</td><td>48</td><td>60</td></tr><tr><td>2</td><td>24</td><td>30</td></tr><tr><td>3</td><td>12</td><td>15</td></tr><tr><td></td><td>4</td><td>5</td></tr></table>
<table><tr><td>6</td><td>96</td><td>120</td></tr><tr><td>4</td><td>16</td><td>20</td></tr><tr><td></td><td>4</td><td>5</td></tr></table></td><td>24</td><td>2</td><td>A1</td><td>or $2^3 \times 3$ oe</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td></td><td>M1</td><td>for $2^m \times 3^n \times 5^p \times 7^q \times 11^r$ with at least two of $m = 4$, $n = 1$, $p = 2$, $q = 2$, $r = 1$ (or omission of one with others fully correct) NB: e.g.2^4 could be 2×2^3
or
prime numbers may be seen in a Venn diagram – if so must be correctly placed</td></tr>
<tr><td></td><td></td><td></td><td>646 800</td><td>2</td><td>A1</td><td>or $2^4 \times 3 \times 5^2 \times 7^2 \times 11$ oe</td></tr>
</table>

Question		Working	Answer	Mark	Notes		
7	(a)	8500 × 0.023 (=195.5) **or** 8500 × 1.023 (=8695.5)			M1		M2 for 8500×1.023^3 (M1 for 8500×1.023^n)
		((8500 + "195.5") × 1.023) × 1.023			M1	complete method	
			9100	3	A1	for 9100 – 9100.1 (answer for 600(.1) gains M2A0)	
	(b)	687 700 ÷ 0.92 (=747 500) **or** 687 700 ÷ 1.15 (=598 000) **or** 1.15 × 0.92 (=1.058)			M1	a correct first step	
		687 7000 ÷ (0.92 × 1.15)			M1	Dep on M1 for completely correct method	
			650 000	3	A1		

Question		Working	Answer	Mark	Notes
8	(a)	$0.65 = \frac{3.5}{V}$		M1	
		$(V =) \frac{3.5}{0.65}$		M1	
			5.38	3	A1 for answer in range 5.38 – 5.385 SCB1 for a "correct" equation involving V with digits 65 and 35 where units have been converted eg $V = \frac{3500}{0.65}$
	(b)	630 × 1000 (=630 000) 60 × 60 (=3600) eg 630 ÷ 60 (=10.5) 630 000 ÷ 60 (=10 500) 1000 ÷ 60 (=16.66...) 1000 ÷ (60 × 60) (=0.277...) 1 ÷ (60 × 60) (= 0.000277...)		M1	for converting 630 km to m **or** 1 hour to seconds **or** for correct operation(s) using at least 2 of the numbers 630, 1000, 60, 60
		$\frac{630 \times 1000}{60 \times 60}$ oe		M1	Fully correct method (M2 for 630 ÷ 3.6)
			175	3	A1

Question	Working	Answer	Mark	Notes	
9	e.g. $4x + 5y = 4$ $4x - 2y = 18$ with the operation of subtraction $4x + 5y = 4$ $10x - 5y = 45$ With the operation of adding $y = 2x - 9$ and $4x + 5(2x - 9) = 4$			M1 M1	for correct method to eliminate one variable – multiplying one or both equations so the coefficient of x or y is the same in both with the intention to add or subtract to eliminate one variable(condone one arithmetic error) or isolating x or y in one equation and substituting into the other equation (dep) for substitution of found variable into one equation or correct method to eliminate second variable
		$x = 3.5$ oe, $y = -2$	3	A1	Dep on M1
10	$3 \div 2$ (=1.5) or eg $\frac{4-1}{2(-0)}$ or $c = 1$ $y =$ "1.5"$x + c$ **or** $y = mx + 1$ or eg $y - 4 = m(x - 2)$			M1 M1	for correct method to find gradient – may see this on grid. For $c = 1$, could be $(L =) mx + 1$ oe or for $1.5x + c$ for use of $y = mx + c$ with either m or c or for $(L =) 1.5x + 1$
		$y = 1.5x + 1$ oe	3	A1	oe eg $y - 4 = \frac{3}{2}(x - 2)$

Question	Working	Answer	Mark	Notes
11	**Basic comparisons from information:** eg The median is greater for Science/less for Maths The IQR (or range) is higher for Science/less for Maths The median is 2.5 marks higher for Science The IQR (or range) is 7 marks more for Science **Comparisons in context:** eg On the whole students have higher marks in Science The spread of results is greater for Science Results are more consistent for Maths	Two comparisons one for IQR and one for median	2	B2 For 2 comparisons in context **or** 1 basic comparison and 1 comparison in context (B1 for 1 or 2 basic statements or for 1 statement in context) NB; any numbers used must be correct for the award of the mark

Question		Working	Answer	Mark	Notes	
12	(a)		1	1	B1	
	(b)		$27x^6y^{15}$	2	B2	If not B2 then B1 for any two correct terms in a product
	(c)	$2(e^2 - 9)$ **or** $(2e - 6)(e + 3)$ **or** $(e - 3)(2e + 6)$			M1	
			$2(e - 3)(e + 3)$	2	A1	
	(d)	$m^2 = \frac{6a + r}{5r}$			M1	
		$m^2 \times 5r = 6a + r$			M1	
		$5rm^2 - r = 6a$			M1	
			$r = \frac{6a}{5m^2 - 1}$	4	A1	or for $r = \frac{-6a}{1 - 5m^2}$ oe NB: to award A1 we must see $r = \frac{6a}{5m^2 - 1}$ in working if $\frac{6a}{5m^2 - 1}$ alone is given as answer

Question	Working	Answer	Mark	Notes
13	$4 \times 5 + 13 \times 6 + 16 \times 7 + 8x + 6 \times 9$ $(20 + 78 + 112 + 8x + 54)$ **or** $264 + 8x$ $(4 + 13 + 16 + 6 + x) \times 7$ $(=7(39 + x) = 273 + 7x)$ **or** $(4 + 13 + 16 + 6) \times 7 (=273)$ oe **or** $\frac{"264+8x"}{"39+x"}$ $\frac{"264+8x"}{"39+x"} = 7$ oe eg "$264 + 8x$" = "$(39 + x)$" $\times 7$ **or** "273" – "264"	9	4	M1 at least 3 products correct with intention to add M1 for use of mean M1 A1

Question		Working	Answer	Mark	Notes	
14	(a)		0.65 0.35, 0.65 0.35, 0.65	2	B2oe	for all correct If not B2 then award B1 for 0.65 in any of the 3 possible positions NB all values may be given as fractions
	(b)	0.35×0.35 **or** 0.35×0.65 **or** 0.65×0.35 **or** 0.65×0.65			M1	ft from (a)
		$0.35 \times 0.35 + 0.35 \times 0.65 + 0.65 \times 0.35$ **or** $1 - 0.65 \times 0.65$			M1	ft from (a)
			0.5775	3	A1	oe e.g. $\frac{231}{400}$, 0.58 or 58% or better

Question	Working	Answer	Mark	Notes
15 (a)	e.g. $\frac{1}{2}\times(x+5+3x-2)\times(2x-3)$ or $0.5(4x + 3)(2x – 3)$ oe			M1 correct algebraic expression for area
	eg. $\frac{1}{2}\times(8x^2-12x+6x-9)=133$ or $8x^2 - 12x + 6x – 9 = 266$	shown	3	M1 for correct equation with brackets expanded A1 for completion to given equation dep on M2
(b)	$\frac{--6\pm\sqrt{36--8800}}{2\times8}$ **or** $\frac{6\pm\sqrt{36+8800}}{16}$ **or** $\frac{6\pm\sqrt{8836}}{16}$ **or** $(4x - 25)(2x + 11)$ (=0)			M2 If not M2 then award M1 for $\frac{--6\pm\sqrt{(-6)^2-4\times8\times-275}}{2\times8}$ Condone one sign error in substitution; allow evaluation of individual terms e.g. 36 in place of $(-6)^2$ [allow -6^2 or 6^2 in place of $(-6)^2$, throughout allow + rather than ±] **or** $(4x \pm 25)(2x \pm 11)$ (=0) (if student gains M1 and shows both answers the 2nd M1 can be awarded) ft from an incorrect 3 term quadratic equation
		6.25 oe	3	A1 dep on M1 **and** 6.25 oe alone given as final answer

Question		Working	Answer	Mark	Notes
16		e.g. $\sqrt[3]{\frac{960}{405}}\left(=\frac{4}{3}\right)$ (=1.3...)or $\sqrt[3]{\frac{405}{960}}\left(=\frac{3}{4}\right)$(=0.75) $\left(\frac{3}{4}\right)^2\times 928$ **or** $928\div\left(\frac{4}{3}\right)^2$ oe	522	3	M1 for a correct linear scale factor M1 for a complete method A1
17	(a)		−11	1	B1
	(b)		0.5 oe	1	B1
	(c)	g(−1.5) = 1 ÷ (1 – 2 × −1.5) (=0.25) **or** fg(x) = $4-3\times\left(\frac{1}{1-2x}\right)$ oe	3.25 oe	2	M1 g(−1.5) must be the correct calculation alone. A1
18		7.5 **or** 8.5 **or** 4.65 **or** 4.55 25 **or** 15 $\frac{4.55}{25-7.5}$	0.26 oe	4	M1 M1 M1 for $\frac{LB_1}{UB-LB_2}$ with $4.55 \le LB_1 < 4.6$ **and** $20 < UB \le 25$ **and** $7.5 \le LB_2 < 8$ A1 for 0.26 from correct working

Question	Working	Answer	Mark	Notes
19	At least 2 of: 2.5 × 2 (=5) **or** 4 × 3 (=12) **or** 3.4 × 5 (=17) **or** 2.2 × 5 (=11) **or** (1 ×) 15 **or** (1 ×) 10 (=10) **or** e.g. at least 2 of 100, 240, 340, 220, 300 or 200			M1 for working with area of at least 2 bars could be using freq density × mins **or** use of counting squares or blocks
	2.5 × 2 + 4 × 3 + 3.4 × 5 + 2.2 × 5 + (1 ×) 15 **or** 5 + 12 + 17 + 11 + 15 (=60) **or** e.g. 100 + 240 + 340 + 220 + 300 (=1200)			M1 for method to find total number of people (allow one error) **or** total number of squares/blocks for method used (allow one error)
		$\frac{1}{6}$ oe	3	A1 for $\frac{1}{6}$ **or** $16.\dot{6}\%$ **or** $0.\dot{1}6$ or 1 in 6 (percentage or decimal rounded or truncated to 3 or more sig figs)

Question	Working	Answer	Mark	Notes
20	angle $CDB = x$ or angle $CAB = x$ angle $CBA = 180 - 2x$ angle $CDA = 180 - (180 - 2x) = 2x$			M1 M1 M1
				B1 dep on M1 for any one appropriate circle theorem reason
		proof with reasons	5	A1 for complete proof with full reasons alternate segment theorem, angles in a triangle sum to 180^o, isosceles triangle, opposite angles of a cyclic quadrilateral sum to 180^o
	Alternative method			
	angle $CDB = x$ or angle $CAB = x$ angle $ACB = x$ angle $ACQ = 2x$ and angle $CDA = 2x$			M1 M1 M1
				B1 dep on M1 for any one appropriate circle theorem reason
		proof with reasons	5	A1 for complete proof with full reasons alternate segment theorem, isosceles triangle
	Alternative method			
	angle $OCB = 90 - x$ angle $BOC = 180 - 2(90 - x)$ $(=2x)$ angle $AOB = 2x$ and angle $CDA = 2x$			M1 M1 M1
				B1 dep for any one appropriate circle theorem reason
		proof with reasons	5	A1 for complete proof with full reasons angle between tangent and radius is 90^o oe, angles in a triangle sum to 180^o, isosceles triangle, angle at centre is twice angle at circumference oe

Q20 contd	Alternative method where students assume $CDA = 2x$ and must work to show that $BCQ = x$			
	eg angle ABC = $180 - 2x$ Angle CAB = angle ACB = $[180 - (180 - 2x)] \div 2 = x$ $BCQ = CAB = x$			M1 M1 M1 B1 Dep on M1 for any one appropriate circle theorem reason A1 For complete proof with reasons e.g. opposite angles of cyclic quadrilateral sum to 180° angles in triangle sum to 180° isosceles triangle alternate segment theorem
21	$y = \frac{6}{4}x(+33)$ **or** (gradient =) $\frac{6}{4}$ oe $m \times \frac{6}{4} = -1$ **or** (gradient of **M** =) $-\frac{2}{3}$ oe $\frac{k-6}{-4-5} = "-\frac{2}{3}"$	12	4	M1 M1 M1 or complete method to find equation of line ($3y = -2x + 28$) dep and then substitution of $x = -4$ A1

Question	Working	Answer	Mark	Notes	
22	$\frac{\pi r^2}{\pi r^2 + \pi rl} = \frac{3}{8}$ **or** $\pi r^2 : \pi r^2 + \pi rl = 3:8$ **or**			M1	
	$\pi r^2 : \pi rl = 3:5$ **or** $\pi r^2 = 3$ **and** $\pi rl = 5$				
	$8\pi r^2 = 3(\pi r^2 + \pi rl)$ **or** $5\pi r^2 = 3\pi rl$ **or**			M1	
	$[r = \sqrt{\frac{3}{\pi}}\ (= 0.9772...)$ **and** $l = \frac{5}{\pi r}]$				
	$\frac{r}{l} = \frac{3}{5}$ oe **or** $l = \frac{5}{\pi\sqrt{\frac{3}{\pi}}}\ (= 1.62...)$			M1	
	e.g. $\sin\left(\frac{AVB}{2}\right) = \frac{3}{5}$ oe eg $\sin\left(\frac{AVB}{2}\right) = \frac{\sqrt{3/\pi}}{\pi\sqrt{3/\pi}}$			M1	$\sin^{-1}(\frac{3}{5}) = 36.86....$
	$2 \times \sin^{-1}\left(\frac{3}{5}\right)$ oe			M1	
		73.7	6	A1	awrt

Question	Working	Answer	Mark	Notes
23	e.g. $\overrightarrow{AB} = \overrightarrow{AD} + \overrightarrow{DB}$ or $\begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -1 \\ 7 \end{pmatrix}$			M1 for a correct vector equation for $\overrightarrow{AB}$
	$\overrightarrow{AB} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$			A1
	$\overrightarrow{DC} = 3 \times \begin{pmatrix} 1 \\ 4 \end{pmatrix} \left(= \begin{pmatrix} 3 \\ 12 \end{pmatrix} \right)$			M1
	$\overrightarrow{BC} = \begin{pmatrix} 1 \\ -7 \end{pmatrix} + \begin{pmatrix} 3 \\ 12 \end{pmatrix} \left(= \begin{pmatrix} 4 \\ 5 \end{pmatrix} \right)$ oe **or**			M1
	$\overrightarrow{BC} = \begin{pmatrix} -1 \\ -4 \end{pmatrix} + \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} 3 \\ 12 \end{pmatrix} \left(= \begin{pmatrix} 4 \\ 5 \end{pmatrix} \right)$ oe			
		$\sqrt{41}$ cao	5	A1 No isw

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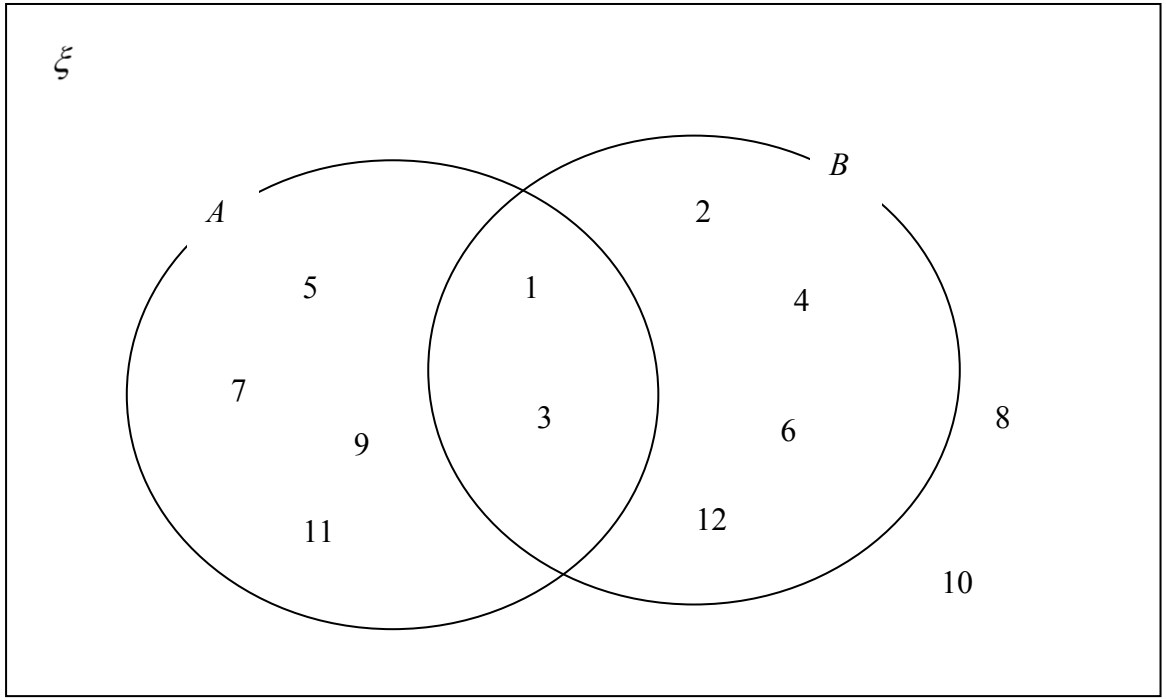
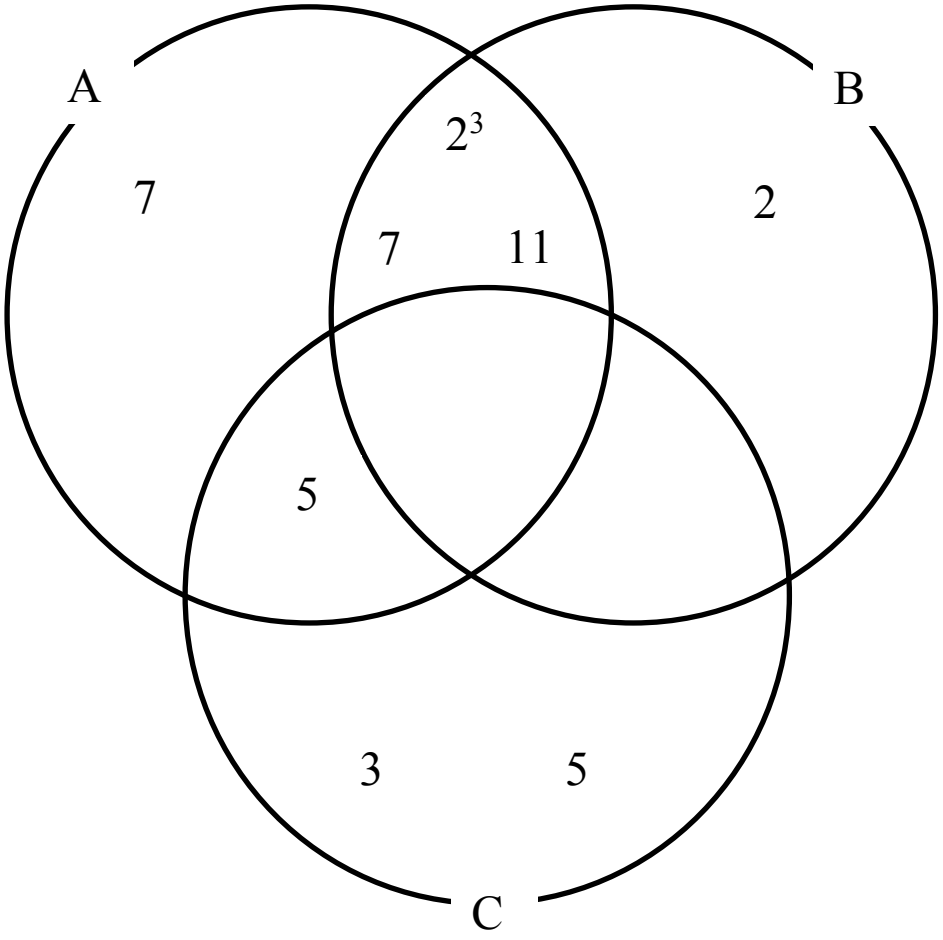
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