

Venn diagrams and sets

Foundation and Higher tiers | Total marks: 83

Marks

- M** Method mark, for a correct method. It can be implied by a correct answer.
- A** Accuracy mark, for a correct answer. It needs the method mark before it.
- B** A mark for a correct value or statement, with or without working.
- ft** Follow through: the mark is given for using an earlier wrong answer correctly.
- oe** Or equivalent.
- [a, b]** Any value from a to b inclusive.

Questions

Q	Skill	Spec	Tier	Grade	Calculator	Marks
1	Completing a Venn diagram from sets	P6	Foundation	3	No	4
2	Reading a Venn diagram	P6	Foundation	4	No	3
3	Completing a Venn diagram from information	P6	Foundation	4	No	4
4	Set notation	P6	Common	5	No	4
5	Shading regions	P6	Common	5	No	2
6	Venn diagrams with algebra	P6 A21	Common	6	No	5
7	Venn diagrams with three sets	P6	Common	6	No	5
8	Conditional probability from a Venn diagram	P9 P6	Higher	6	No	2
9	Probabilities in a Venn diagram	P9 P6	Higher	7	No	5
10	Testing for independence	P8 P9	Higher	8	No	3
11	Conditional probability with algebra	P9 A21	Higher	8	No	4
12	Three sets with algebra and conditional probability	P9 P6 A21	Higher	9	No	6
13	Reading a Venn diagram	P6	Foundation	2	Yes	3
14	Completing a Venn diagram from totals	P6	Foundation	3	Yes	3
15	Set notation and probability	P6	Common	4	Yes	4
16	Venn diagrams from percentages	P6	Common	6	Yes	4

Q	Skill	Spec	Tier	Grade	Calculator	Marks
17	Expected numbers from a Venn diagram	P6 P2	Common	6	Yes	3
18	Venn diagrams with three sets	P6	Common	6	Yes	5
19	Conditional probability from a Venn diagram	P9 P6	Higher	7	Yes	4
20	Independent events and a Venn diagram	P8 P6	Common	8	Yes	5
21	A Venn diagram with two picks and a quadratic	P8 P6 A18	Higher	9	Yes	5
	Total					83

Question 1 P6 · Foundation · Grade 3 · 4 marks

Q	Answer	Mark	Comments
1(a)	A only: 2, 4, 6, 12 A and B: 1, 3 B only: 5, 7, 9, 11 outside: 8, 10	B3	B2 for 10 or 11 numbers correctly placed, B1 for 7, 8 or 9 correctly placed
1(b)	$\frac{1}{6}$	B1ft	oe, ft their diagram

Question 2 P6 · Foundation · Grade 4 · 3 marks

Q	Answer	Mark	Comments
2(a)	25	B1	
2(b)	14 + 19 or 33	M1	oe
	$\frac{33}{50}$	A1	oe, e.g. 0.66

Question 3 P6 · Foundation · Grade 4 · 4 marks

Q	Answer	Mark	Comments
3(a)	12 in the overlap and 17 outside the circles	B1	
	22 in F only	B1	
	29 in D only	B1ft	ft 80 – 17 – their F total
3(b)	$\frac{41}{80}$	B1ft	oe, e.g. 0.5125, ft their diagram

Question 4 P6 · Common · Grade 5 · 4 marks

Q	Answer	Mark	Comments
4(a)	6, 12	B1	any order
4(b)	2, 3, 4, 6, 8, 9, 10, 12, 14, 15	B1	any order
4(c)	1, 2, 4, 5, 7, 8, 10, 11, 13, 14	B1	any order
4(d)	$\frac{1}{5}$	B1	oe, e.g. $\frac{3}{15}$

Question 5 P6 · Common · Grade 5 · 2 marks

Q	Answer	Mark	Comments
5(a)	only the region in B and not in A shaded	B1	
5(b)	$A \cap B'$	B1	

Question 6 P6 A21 · Common · Grade 6 · 5 marks

Q	Answer	Mark	Comments
6(a)	$3x + x + 2 + 2x - 1 + 9 = 64$	M1	oe
	$6x = 54$	M1	oe, collects terms correctly
	9	A1	
6(b)	(their $x + 2$) + ($2 \times$ their $x - 1$)	M1	oe, 11 + 17 or 28
	$\frac{7}{16}$	A1ft	oe, e.g. $\frac{28}{64}$, ft their x

Question 7 P6 · Common · Grade 6 · 5 marks

Q	Answer	Mark	Comments
7(a)	3, 5, 4 and 2 in the correct places	B1	
	10, 5 and 9	B1	F only, G only and S only
	12	B1ft	outside, ft 50 – their total inside
7(b)	$10 + 5 + 9$ or 24	M1	ft their diagram
	$\frac{12}{25}$	A1ft	oe, e.g. $\frac{24}{50}$

Question 8 P9 P6 · Higher · Grade 6 · 2 marks

Q	Answer	Mark	Comments
8	$18 + 27$ or 45	M1	the number who used the gym, or $\frac{18}{\text{their } 45}$
	$\frac{2}{5}$	A1	oe, e.g. $\frac{18}{45}$ or 0.4

Question 9 P9 P6 · Higher · Grade 7 · 5 marks

Q	Answer	Mark	Comments
9(a)	$0.45 + 0.3 + 0.35 - 1$	M1	oe, or 0.1 seen
	0.1 in the overlap	A1	
	0.35, 0.2 and 0.35 in the correct places	A1ft	ft their overlap
9(b)	$\frac{0.1}{0.3}$	M1	oe, ft their diagram
	$\frac{1}{3}$	A1	oe, accept 0.333...

Question 10 P8 P9 · Higher · Grade 8 · 3 marks

Q	Answer	Mark	Comments
10	$P(A) = 0.4$ and $P(B) = 0.3$	M1	oe
	0.4×0.3	M1	oe, or $P(A \text{ given } B) = \frac{0.12}{0.3}$
	Yes with 0.12 = $P(A \cap B)$	A1	or Yes with $P(A \text{ given } B) = 0.4 = P(A)$

Question 11 P9 A21 · Higher · Grade 8 · 4 marks

Q	Answer	Mark	Comments
11	$\frac{x}{x+18} = \frac{1}{4}$	M1	oe
	$4x = x + 18$	M1	oe
	$x = 6$	A1	
	46	B1ft	ft 40 + their x

Question 12 P9 P6 A21 · Higher · Grade 9 · 6 marks

Q	Answer	Mark	Comments
12(a)	$7x + 3$ or $3x$ seen	M1	oe, the number who went kayaking or the number who went kayaking and climbing
	$\frac{3x}{7x+3} = \frac{2}{5}$	M1	oe
	$x = 6$	A1	
	84	A1	
12(b)	$\frac{7+9}{28}$	M1	oe, ft their x, e.g. $\frac{7+x+3}{2x+7+x+3}$
	$\frac{4}{7}$	A1	oe, e.g. $\frac{16}{28}$

Question 13 P6 · Foundation · Grade 2 · 3 marks

Q	Answer	Mark	Comments
13(a)	509	B1	may be on the diagram
13(b)	$\frac{238}{1857}$	M1	oe
	0.13	A1	accept 0.128 or [0.1281, 0.1282]

Question 14 P6 · Foundation · Grade 3 · 3 marks

Q	Answer	Mark	Comments
14(a)	512 in the overlap, 868 in C only and 453 in B only	B1	
	617 outside the circles	B1ft	ft 2450 – their total inside
14(b)	25.2	B1ft	accept $\frac{617}{2450} \times 100$ evaluated to 25.2 or better, ft their diagram

Question 15 P6 · Common · Grade 4 · 4 marks

Q	Answer	Mark	Comments
15(a)	562	B1	
15(b)	$\frac{486 + 327 + 391}{1375}$ or $\frac{1204}{1375}$	M1	oe, or $1 - \frac{171}{1375}$
	0.876	A1	accept 0.876 or [0.8756, 0.8757]
15(c)	0.284	B1	accept 0.284 or [0.2843, 0.2844]

Question 16 P6 · Common · Grade 6 · 4 marks

Q	Answer	Mark	Comments
16(a)	144 and 54	M1	oe, 40% and 15% of 360, may be on the diagram
	360 – 54 – 144 or 162 in D only	M1	oe, then C only = $162 \div 2 = 81$
	81, 63, 162 and 54 in the correct places	A1	
16(b)	$\frac{27}{40}$	B1ft	oe, e.g. $\frac{243}{360}$ or 0.675, ft their diagram

Question 17 P6 P2 · Common · Grade 6 · 3 marks

Q	Answer	Mark	Comments
17	0.28 or 0.15 seen	M1	oe, a region with only one of them
	$1 - (0.28 + 0.09 + 0.15)$ or 0.48	M1	oe, or $1 - (0.37 + 0.24 - 0.09)$
	8880	A1	

Question 18 P6 · Common · Grade 6 · 5 marks

Q	Answer	Mark	Comments
18(a)	0.375×1680 or 630	M1	oe
	$630 - 84 - 213 - 57$ or 276	M1	oe, drama only
	395	A1	
18(b)	$\frac{213+57+96}{1680}$ or $\frac{366}{1680}$	M1	oe
	0.218	A1	accept 0.218 or [0.2178, 0.2179]

Question 19 P9 P6 · Higher · Grade 7 · 4 marks

Q	Answer	Mark	Comments
19	$0.584 + 0.437 - 0.812$	M1	oe, or $0.812 - 0.437 = 0.375$ (glass only)
	0.209	A1	both
	$\frac{0.209}{0.584}$	M1	oe, ft their 0.209
	0.358	A1	accept 0.358 or [0.3578, 0.3579]

Question 20 P8 P6 · Common · Grade 8 · 5 marks

Q	Answer	Mark	Comments
20(a)	$0.42 + p - 0.42p = 0.5766$	M1	oe, or $P(S' \cap B) = 0.5766 - 0.42 = 0.1566$
	$0.58p = 0.1566$ or $0.1566 \div 0.58$	M1	oe
	0.27	A1	
20(b)	$0.5766 - 0.42 \times \text{their } 0.27$ or 0.4632	M1	oe, e.g. $0.42 \times 0.73 + 0.58 \times 0.27$
	2316	A1ft	ft their P(B)

Question 21 P8 P6 A18 · Higher · Grade 9 · 5 marks

Q	Answer	Mark	Comments
21	$\frac{21}{N} \times \frac{20}{N-1} = \frac{1}{26}$	M1	oe, where $N = 69 + 3x$ is the number of members
	$N^2 - N - 10\,920 = 0$	M1	oe, e.g. $9x^2 + 411x - 6228 = 0$
	$N = 105$	A1	or $x = 12$, the negative root rejected
	$105 - 69 = 3x$ or $x = 12$	M1	oe, implied by the answer
	33	A1	