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GCSE MATHEMATICS • PROBABILITY

Venn Diagrams

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Venn Diagrams worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Venn Diagrams worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $A = \{1, 2, 3, 4, 6, 12\}$ $B = \{1, 3, 5, 7, 9, 11\}$ $A \cap B = \{1, 3\}$

A2 Cycle only $20 - 9 = 11$, swim only $14 - 9 = 5$ $11 + 9 + 5 = 25$ $35 - 25 = 10$

A3 Outside A : $3 + 5 = 8$ out of 20 $\frac{8}{20} = \frac{2}{5}$

HIGHER

A4 Inside A : $8 + 4 = 12$, and 4 of them are in B $\frac{4}{12} = \frac{1}{3}$

A5 Total 30. C : $7 + 4 + 3 + 1 = 15$ $\frac{15}{30} = \frac{1}{2}$

A6 $3x + x + x + 4 + 6 = 50$ $5x = 40$, so $x = 8$ A only = 24 $\frac{24}{50} = \frac{12}{25}$

A7 A only = $0.6 - 0.25 = 0.35$ B only = $1 - 0.35 - 0.25 - 0.15 = 0.25$ $P(B) = 0.25 + 0.25 = 0.5$

B**Fluency solutions**One mark for each correct part. The notes in *italics* explain why each sequence was chosen.**FOUNDATION**

B1 (a) $\{2, 4\}$ (b) $\{1, 2, 3, 4, 5, 6, 8\}$ (c) $\{6, 7, 8, 9, 10\}$ (d) $\{7, 9, 10\}$

B2 (a) 2 (b) 7 (c) 6 (d) 1, 3, 5: 3



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B3 Total 30. (a) $8 + 5 = 13$ (b) 25 (c) $\frac{5}{30} = \frac{1}{6}$ (d) $8 + 5 = 13$: $\frac{13}{30}$

$n(A)$ includes the overlap: it is not just the 8

B4 (a) $12 + 10 - 4 = 18$, so 12 (b) in A or B : 23, and $16 + 12 - 23 = 5$ (c) $18 + 6 = 24$, so 6 (d) $20 + 16 - 30 = 6$

B5 (a) 0.3 (b) $0.4 + 0.3 - 0.1 = 0.6$ (c) 0.4

B6 (a) $A \cap B$ (b) $A \cap B'$ (c) $(A \cup B)'$ (d) $A' \cup B$

HIGHER

B7 (a) $\frac{6}{20} = \frac{3}{10}$ (b) $\frac{6}{16} = \frac{3}{8}$ (c) B' is $10 + 10$: $\frac{10}{20} = \frac{1}{2}$ (d) A' is $14 + 10$: $\frac{10}{24} = \frac{5}{12}$

Each time, the given set becomes the new total.

B8 Total 30. (a) $6 + 3 + 2 + 2 = 13$ (b) $3 + 2 = 5$ (c) $6 + 5 + 4 = 15$ (d) $\frac{3}{30} = \frac{1}{10}$

B9 (a) $6x + 6 = 30$: 4 (b) $4x + 6 = 30$: 6 (c) $3x + 8 = 32$, $x = 8$: $\frac{24}{32} = \frac{3}{4}$ (d) $3x + 0.55 = 1$: 0.15

B10 (a) 0.75 (b) 0.25 (c) $\frac{0.15}{0.4} = \frac{3}{8}$ (d) $0.5 + 0.45 - 0.8 = 0.15$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$: the overlap is counted twice otherwise.

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 A probability cannot be more than 1. Kim counted $A \cap B$ twice, once in A and once in B .

C2 5 is only the part of A outside B . A also includes the overlap: $n(A) = 5 + 3 = 8$



C3 $14 + 11 = 25$, but there are only 20 students, so at least $25 - 20 = 5$ study both.

C4 Primes up to 20: 2, 3, 5, 7, 11, 13, 17, 19. The odd ones: 3, 5, 7, 11, 13, 17, 19, which is 7 numbers
 $\frac{7}{20}$, as required

HIGHER

C5 $P(A|B) = \frac{5}{10} = \frac{1}{2}$ $P(B|A) = \frac{5}{15} = \frac{1}{3}$ They are different, so Jo is wrong.

C6 Some students may play more than one sport, and would be counted more than once.
 The smallest possible number is when every hockey and rugby player also plays football: 12

C7 $n(A) + n(B) - n(A \cap B) = (a+b) + (b+c) - b = a+b+c = n(A \cup B)$ **proved**

C8 (a) Total = $42+x$. $P(A) = \frac{6+x}{42+x}$, $P(B) = \frac{12+x}{42+x}$, $P(A \cap B) = \frac{x}{42+x}$
 Independent when $\frac{(6+x)(12+x)}{(42+x)^2} = \frac{x}{42+x}$, which gives $(6+x)(12+x) = x(42+x)$ **as required**
 (b) $72 + 18x + x^2 = 42x + x^2$ $24x = 72$ $x = 3$

D

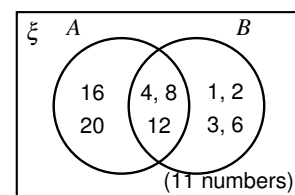
Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 Sister only = $15 - 5 = 10$ $\frac{10}{28} = \frac{5}{14}$

D2 $A = \{4, 8, 12, 16, 20\}$ $B = \{1, 2, 3, 4, 6, 8, 12\}$
 (24 is not in ξ)
 Outside both: 5, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19
 $A' \cap B = \{1, 2, 3, 6\}$ $\frac{4}{20} = \frac{1}{5}$



D3 In bread or milk: $80 - 20 = 60$ Both = $45 + 30 - 60 = 15$ Milk only = $30 - 15 = 15$

$$\frac{15}{80} = \frac{3}{16}$$

D4 $P(\text{rainy or windy}) = 1 - 0.25 = 0.75$ Both = $0.4 + 0.5 - 0.75 = 0.15$

HIGHER

D5 (a) Physics: 55, of whom 30 study chemistry

$$\frac{30}{55} = \frac{6}{11}$$

(b) Not chemistry: 50. Neither: $120 - (70 + 55 - 30) = 25$

$$\frac{25}{50} = \frac{1}{2}$$

D6 Only rock = r , only jazz = $2r$ $2r + 8 + r + 12 = 50$ $r = 10$ Jazz = $20 + 8 = 28$

D7 $P(A \cap B) = 0.6 \times 0.5 = 0.3$, A only = 0.3, B only = 0.1

(a) $1 - 0.3 - 0.3 - 0.1 = 0.3$ (b) $\frac{0.3}{0.3 + 0.1} = \frac{3}{4}$

D8 (a) $A = 8 + 4 + x + 2 = x + 14$, and $A \cap C = x + 2$ $\frac{x+2}{x+14} = \frac{1}{2}$ $2x + 4 = x + 14$ $x = 10$

(b) Total = $8 + 10 + 30 + 4 + 10 + 6 + 2 + 5 = 75$ $C = 30 + 10 + 6 + 2 = 48$

$$\frac{48}{75} = \frac{16}{25}$$

E

Exam practice solutions

Marks are shown on the right of each line.

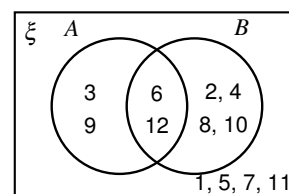
FOUNDATION

Foundation and Higher crossover

E1 (a) See the diagram.

(b) 6, 12

(c) 8 numbers are in $A \cup B$: $\frac{8}{12} = \frac{2}{3}$



B2 B1 B1

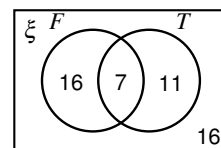


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E2 (a) See the diagram.

(b) $\frac{16}{50} = \frac{8}{25}$



B2 B1

E3 (a) $\frac{10}{20} = \frac{1}{2}$

B1

(b) $\frac{5}{20} = \frac{1}{4}$

B1

E4 Cat or dog: $30 - 8 = 22$

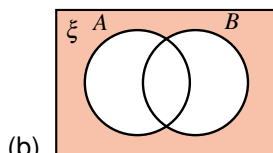
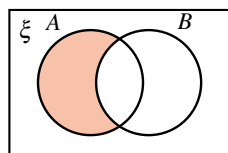
M1

$12 + 15 - 22$

M1

5

A1



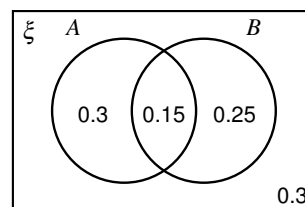
E5 (a)

(b)

B1 B1

E6 (a) A only 0.3, both 0.15, B only 0.25

(b) $1 - 0.7 = \mathbf{0.3}$



B2 B1

HIGHER

E7 (a) $\frac{8}{8+10}$

M1

$\frac{8}{18} = \frac{4}{9}$

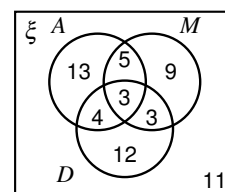
A1

(b) $\frac{12}{20} = \frac{3}{5}$

B1



- E8** Art and music only $8 - 3 = 5$, art and drama only
 $7 - 3 = 4$, music and drama only $6 - 3 = 3$
 Art only $25 - 5 - 4 - 3 = 13$, music only
 $20 - 5 - 3 - 3 = 9$, drama only $22 - 4 - 3 - 3 = 12$,
 none $60 - 49 = 11$



(b) $13 + 9 + 12 = 34$

$$\frac{34}{60} = \frac{17}{30}$$

B2 M1 A1

- E9** $2x + x + 3 + 3x - 2 + 11 = 60$
 $6x + 12 = 60$, so $x = 8$
 B : $11 + 22 = 33$, and $A \cap B = 11$

$$\frac{11}{33} = \frac{1}{3}$$

M1

A1

M1

A1

- E10** (a) $P(A \cup B) = 0.7 + 0.55 - x = 1.25 - x$, so $P(\text{neither}) = x - 0.25$

$$x - 0.25 = x^2, \text{ so } x^2 - x + 0.25 = 0$$

as required

M1

A1

(b) $(x - 0.5)^2 = 0$

$$x = 0.5$$

B1

(c) $\frac{0.5}{0.7}$

M1

$$\frac{5}{7}$$

A1

