

GCSE Maths: Sets and Venn diagrams (Higher): answers

GCSE Maths - Probability - Higher - Lesson 23.7

Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at websink.site/gcse/maths/ch23-probability/higher/sets-and-venn-diagrams/

Exercise 23I Sets and Venn diagrams Non-calculator

1 $\xi = \{1, 2, 3, \dots, 12\}$, $A = \{\text{odd numbers}\}$ and $B = \{\text{prime numbers}\}$. List the elements of...

(a) A

Answer: $\{1, 3, 5, 7, 9, 11\}$

(b) B

Answer: $\{2, 3, 5, 7, 11\}$

(c) $A \cap B$

Answer: $\{3, 5, 7, 11\}$

(d) $A \cup B$

Answer: $\{1, 2, 3, 5, 7, 9, 11\}$

(e) A'

Answer: $\{2, 4, 6, 8, 10, 12\}$

(f) $(A \cup B)'$

Answer: $\{4, 6, 8, 10, 12\}$

2 $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{4, 5, 6, 7, 8\}$, and $\xi = \{1, 2, \dots, 9\}$. Work out...

(a) $n(A)$

Answer: 6

(b) $n(A \cap B)$

Answer: 3

(c) $n(A \cup B)$

Answer: 8

(d) $n((A \cup B)')$

Answer: 1

3 For each question, draw a Venn diagram with two circles, A and B , and write the number in each region.

(a) 30 students. 18 play football (A), 12 play swimming (B) and 5 do both.

Answer: only A : 13, both: 5, only B : 7, neither: 5

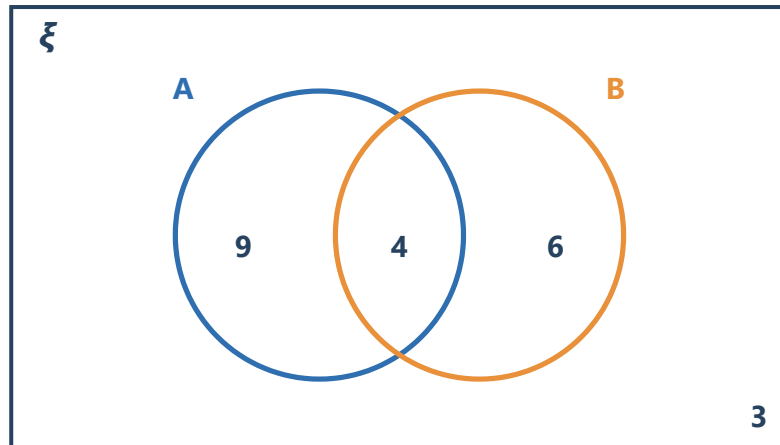
(b) 40 people. 25 own a cat (A), 17 own a dog (B) and 6 own both.

Answer: only A : 19, both: 6, only B : 11, neither: 4

- (c) 50 students. 28 study French (A), 25 study Spanish (B) and 10 study both.

Answer: only A: 18, both: 10, only B: 15, neither: 7

4 Use the Venn diagram to find...



- (a) A

Answer: 13

- (b) $A \cap B$

Answer: 4

- (c) $A \cup B$

Answer: 19

- (d) A'

Answer: 9

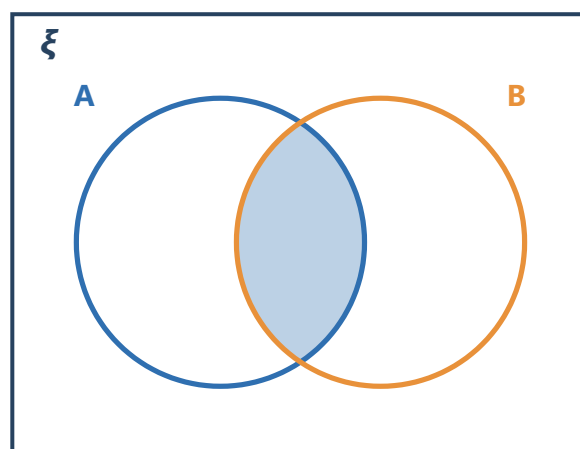
- (e) $A \cap B'$

Answer: 9

- (f) $(A \cup B)'$

Answer: 3

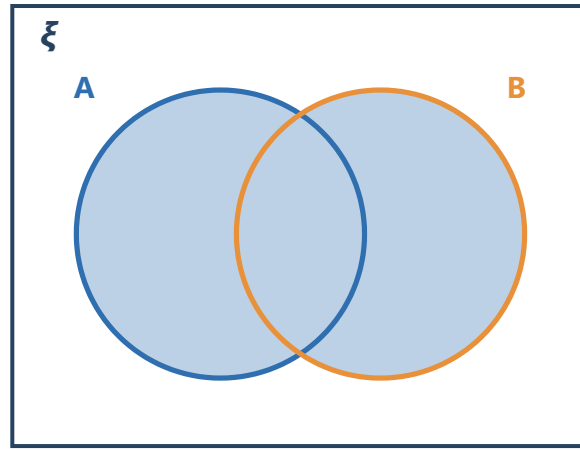
5 Describe the shaded region using set notation.



- (a)

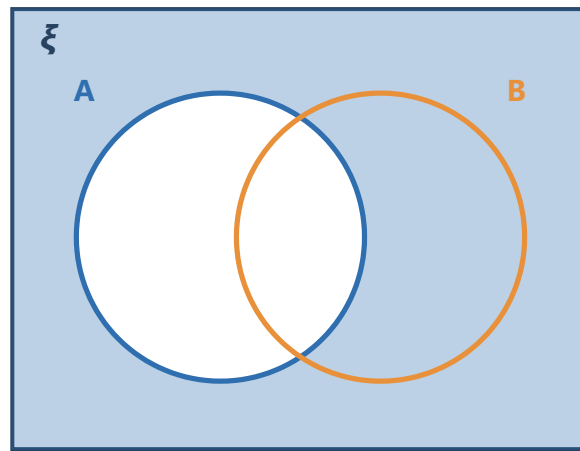
Answer: $A \cap B$

(b)



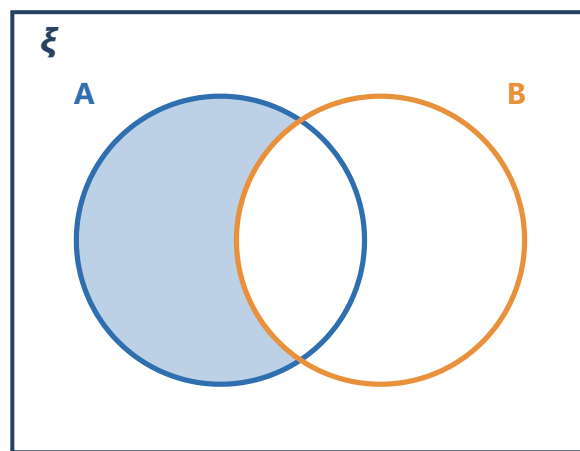
Answer: $A \cup B$

(c)



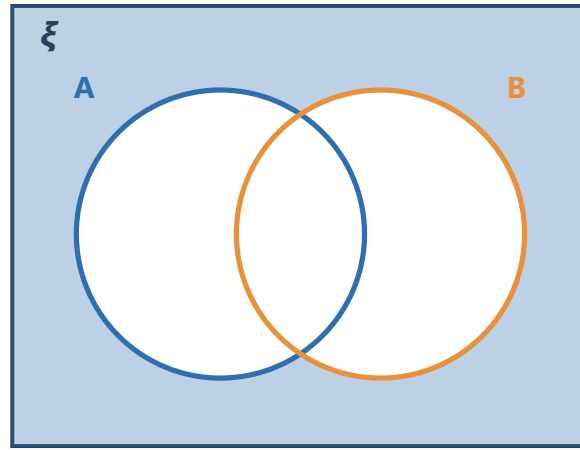
Answer: A'

(d)



Answer: $A \cap B'$

(e)



Answer: $(A \cup B)'$

- 6 A and B are two sets. Explain what $A \cap B = \emptyset$ tells you about A and B. Give an example.

Answer: They have no elements in common

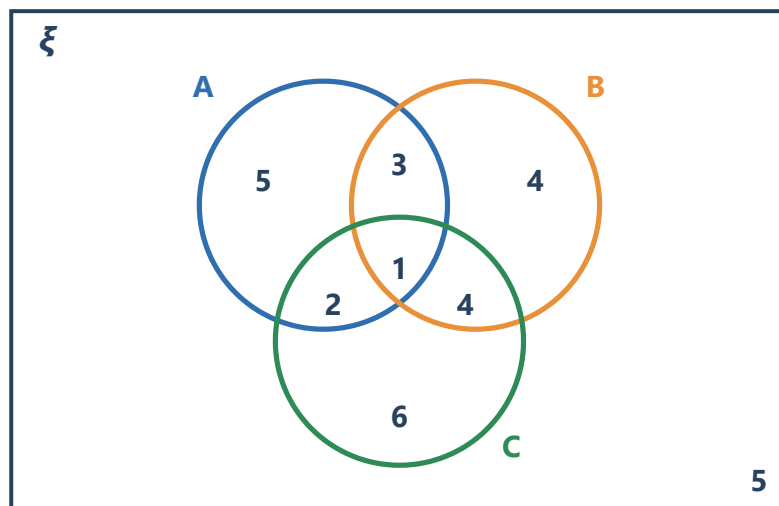
- 7 In a class of 28 students, 15 have brothers (B) and 12 have sisters (S). 7 have both. Work out how many students have neither a brother nor a sister.

Answer: 8

- 8 A and B are sets with $n(A) = 14$, $n(B) = 9$ and $n(A \cap B) = 4$. Show that $n(A \cup B) = 19$.

Answer: $14 + 9 - 4 = 19$

- 9 The Venn diagram shows the number of students in three clubs, A, B and C. Find...



- (a) $A \cap B \cap C$

Answer: 1

- (b) $A \cup B \cup C$

Answer: 25

- (c) $A \cap B \cap C'$

Answer: 3

(d) $(A \cup B \cup C)'$

Answer: 5

(e) $B \cap C'$

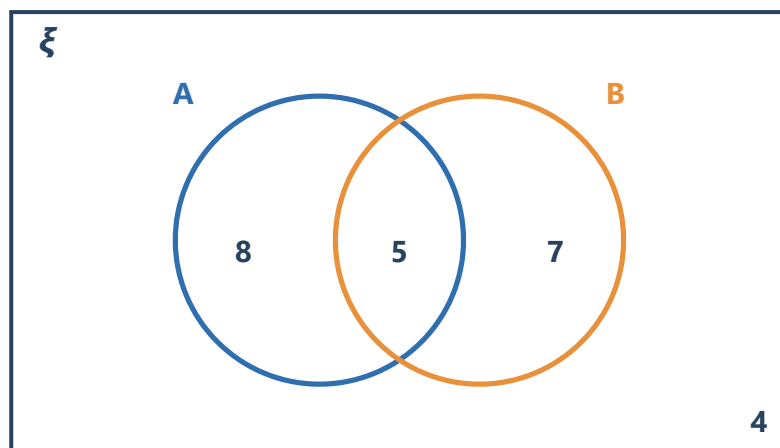
Answer: 7

- 10 60 students were asked which of three subjects they study: art (A), biology (B) and chemistry (C). 30 study A, 28 study B and 25 study C. 12 study A and B, 10 study A and C, 9 study B and C, and 4 study all three. Draw a Venn diagram and find how many students study none of the three subjects.

Answer: 4

Exercise 23J Probability from Venn diagrams Non-calculator

- 1 The Venn diagram shows 24 students. A student is chosen at random. Find the probability that the student is in...



(a) A

Answer: $\frac{13}{24}$

(b) B

Answer: $\frac{1}{2}$

(c) $A \cap B$

Answer: $\frac{5}{24}$

(d) $A \cup B$

Answer: $\frac{5}{6}$

(e) A'

Answer: $\frac{11}{24}$

(f) $A \cap B'$

Answer: $\frac{1}{3}$

- 2 30 students were asked about sport. 18 play football (F), 12 swim (S) and 5 do both. A student is chosen at random. Find the probability that the student...

(a) plays football but does not swim

Answer: $\frac{13}{30}$

(b) plays neither sport

Answer: $\frac{1}{6}$

(c) plays at least one of the sports

Answer: $\frac{5}{6}$

(d) plays exactly one of the sports

Answer: $\frac{2}{3}$

- 3 40 people were asked about pets. 25 own a cat (C), 17 own a dog (D) and 6 own both. A person is chosen at random. Find the probability that the person owns...

(a) a cat only

Answer: $\frac{19}{40}$

(b) a dog

Answer: $\frac{17}{40}$

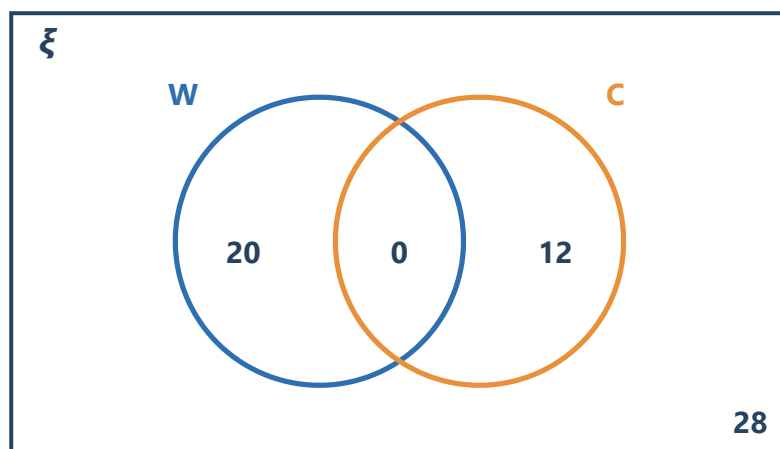
(c) no cat

Answer: $\frac{3}{8}$

(d) neither pet

Answer: $\frac{1}{10}$

- 4 The numbers of students in a year group who walk (W) and cycle (C) to school are shown. Find the probability that a student chosen at random walks or cycles.



Answer: $\frac{8}{15}$

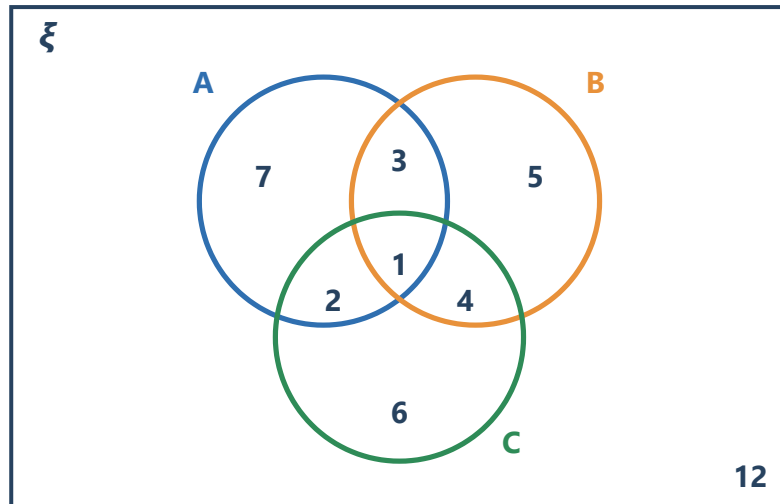
- 5 In a Venn diagram, $n(A) = 12$, $n(B) = 9$, $n(A \cap B) = 4$ and $n(\xi) = 30$. Find the probability that a randomly chosen element is in neither A nor B.

Answer: $\frac{13}{30}$

- 6 In a group of 24 students, 13 are in set A and 12 are in set B, and 5 are in both. Ali says: " $P(A) = \frac{13}{24}$ and $P(B) = \frac{12}{24}$, so $P(A \text{ or } B) = \frac{25}{24}$." Explain why Ali must be wrong.

Answer: A probability cannot be more than 1

- 7 The Venn diagram shows how 40 students use three types of transport to school: bus (A), bike (B) and car (C). A student is chosen at random. Find the probability that the student uses...



- (a) all three types of transport

Answer: $\frac{1}{40}$

- (b) bus and bike only

Answer: $\frac{3}{40}$

- (c) exactly one type of transport

Answer: $\frac{9}{20}$

- (d) no transport from these three

Answer: $\frac{3}{10}$

- 8 $P(A) = 0.6$, $P(B) = 0.3$ and $P(A \cap B) = 0.1$. Work out...

- (a) $P(A \cup B)$

Answer: 0.8

- (b) $P(\text{neither})$

Answer: 0.2

- (c) $P(A \cap B')$

Answer: 0.5

- 9 $P(A) = 0.45$, $P(B) = 0.35$ and $P(A \cup B) = 0.65$. Find $P(A \cap B)$. Are A and B mutually exclusive? Give a reason.

Answer: 0.15; not mutually exclusive