Venn Diagrams & Hard Probability: exam practice

10 questions · 43 marks · worked solutions and markschemes

Name _____ Date _____ Score / 43

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/slai/venn-diagrams-and-hard-probability-exam-practice

1. **3 marks · Paper 1 style · calculator allowed**

$P(A) = 0.4$, $P(B) = 0.3$ and $P(A \cap B) = 0.1$.

Given that at least one of A or B happens, find the probability that A happens. **[3]**

2. **3 marks · Paper 1 style · calculator allowed**

A fair six-sided die is rolled. A is the event 'an even number' and B is the event 'a number greater than 3'.

(a) List the elements of $A \cap B$. **[1]**

(b) Find $P(A \cup B)$. **[2]**

3. **4 marks · Paper 1 style · calculator allowed**

In a group of 50 people, 20 like apples (A), 25 like bananas (B) and 8 like both.

(a) Find the number of people who like neither. **[2]**

(b) Find $P(A \cup B)$. **[1]**

(c) Find the probability that a person likes bananas but not apples. **[1]**

4. **4 marks · Paper 1 style · calculator allowed**

In a universal set of 40 elements, $n(A) = 18$, $n(B) = 22$, $n(A \cap B) = x$ and $n(A' \cap B') = 6$.

(a) Find x. **[2]**

(b) Find $P(A \mid B)$. **[2]**

5. **4 marks · Paper 1 style · calculator allowed**

$P(A) = 0.3$, $P(B) = 0.5$ and $P(A \cup B) = 0.65$.

(a) Find $P(A \cap B)$. **[2]**

(b) Find $P(A' \cap B)$. **[1]**

(c) Show that A and B are independent. **[1]**

6. **4 marks · Paper 1 style · calculator allowed**

Of 120 people asked, 70 drink coffee, 55 drink tea and 20 drink neither.

(a) Find the number who drink both. **[2]**

(b) A coffee drinker is chosen at random. Find the probability that they also drink tea. **[2]**

7. **5 marks · Paper 1 style · calculator allowed**

Events A and B have $P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cup B) = 0.7$.

(a) Find $P(A \cap B)$. **[2]**

(b) Find $P(A \mid B)$. **[1]**

(c) Determine whether A and B are independent. **[2]**

8. **5 marks · Paper 1 style · calculator allowed**

$P(A') = 0.35$, $P(B) = 0.4$ and $P(A \cap B) = 0.25$.

(a) Find $P(A \cup B)$. **[2]**

(b) Find $P(A' \cap B')$. **[1]**

(c) Find $P(B \mid A)$. **[2]**

9. **5 marks · Paper 2 style · calculator allowed**

In a survey of 100 people, 40 speak French, 35 speak Spanish and 20 speak German. 12 speak French and Spanish, 8 speak French and German, 6 speak Spanish and German, and 3 speak all three.

(a) Find the number of people who speak none of the three languages. **[2]**

(b) Find the probability that a person chosen at random speaks exactly two of the languages. **[3]**

10. **6 marks · Paper 2 style · calculator allowed**

In a class of 60 students, 25 study French, 20 study German and 18 study Spanish. 8 study French and German, 6 study German and Spanish, 7 study French and Spanish, and 3 study all three.

(a) Find the number of students who study none of these languages. **[3]**

(b) Find the probability that a student studies exactly one of the languages. **[3]**

Answers and worked solutions

Question 1

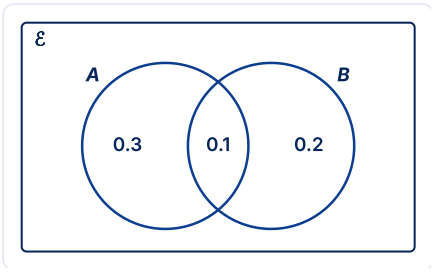
3 marks

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

$P(A \cup B) = 0.6$ (A1)

$\frac{P(A)}{P(A \cup B)} = \frac{0.4}{0.6}$ (M1)

$\frac{2}{3}$ A1



Condition on $A \cup B$

Question 2

3 marks

Answer: (a) $\{4, 6\}$; (b) $\frac{2}{3}$

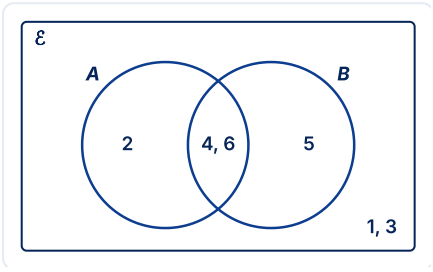
(a)

$\{4, 6\}$ A1

(b)

$\{2, 4, 5, 6\}$ (M1)

$\frac{2}{3}$ A1



$A \cap B = \{4, 6\}$

Question 3

4 marks

Answer: (a) 13; (b) $\frac{37}{50}$; (c) $\frac{17}{50}$

(a)

$20 + 25 - 8 = 37$ (M1)

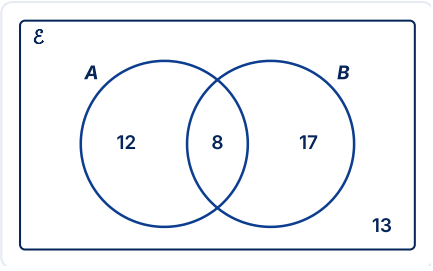
13 A1

(b)

$\frac{37}{50}$ A1

(c)

$\frac{17}{50}$ A1



Apples (A) and bananas (B)

Question 4

4 marks

Answer: (a) 6; (b) $\frac{3}{11}$

(a)

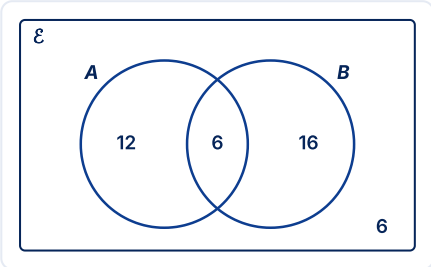
$18 + 22 - x + 6 = 40$ (M1)

$x = 6$ A1

(b)

$\frac{6}{22}$ (M1)

$\frac{3}{11}$ A1



$x = 6$

Question 5

4 marks

Answer: (a) 0.15; (b) 0.35

(a)

$0.3 + 0.5 - 0.65$ (M1)

0.15 A1

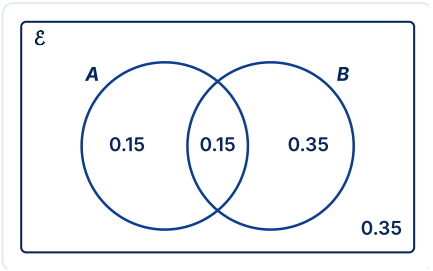
(b)

$0.5 - 0.15 = 0.35$ A1

(c)

$0.3 \times 0.5 = 0.15 = P(A \cap B)$

R1 AG



$P(A \cap B) = 0.15 = 0.3 \times 0.5$

Question 6

4 marks

Answer: (a) 25; (b) $\frac{5}{14}$

(a)

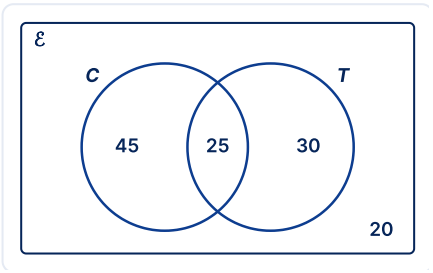
$70 + 55 + 20 - 120$ (M1)

25 A1

(b)

$\frac{25}{70}$ (M1)

$\frac{5}{14}$ A1



Coffee (C) and tea (T)

Question 7

5 marks

Answer: (a) 0.2; (b) 0.5

(a)

$0.5 + 0.4 - 0.7$ (M1)

0.2 A1

(b)

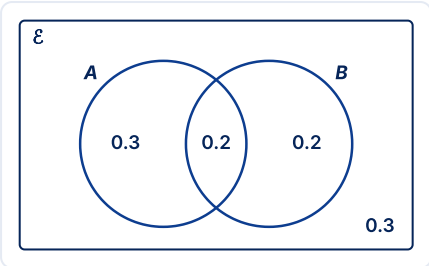
$\frac{0.2}{0.4} = 0.5$ A1

(c)

$P(A)P(B) = 0.2 = P(A \cap B)$

R1

independent A1



$P(A \cap B) = 0.2$

Question 8

5 marks

Answer: (a) 0.8; (b) 0.2; (c) $\frac{5}{13}$

(a)

$0.65 + 0.4 - 0.25$ **(M1)**

0.8 **A1**

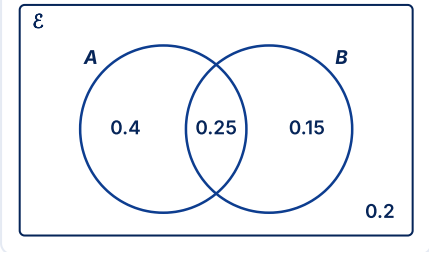
(b)

0.2 **A1**

(c)

$\frac{0.25}{0.65}$ **(M1)**

$\frac{5}{13}$ **A1**



$P(A \cup B) = 0.8$

Question 9

5 marks

Answer: (a) 28; (b) $\frac{17}{100}$

(a)

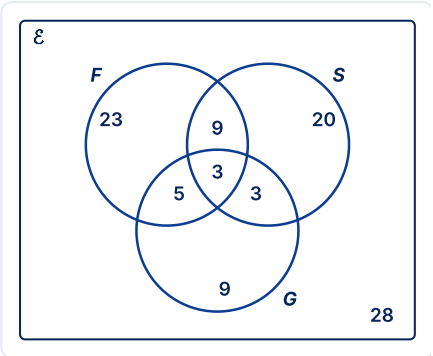
$40 + 35 + 20 - 12 - 8 - 6 + 3 = 72$ **(M1)**

28 **A1**

(b)

$9 + 5 + 3$ **(M1)(A1)**

$\frac{17}{100}$ **A1**



Exactly two: $9 + 5 + 3 = 17$

Question 10

6 marks

Answer: (a) 15; (b) $\frac{1}{2}$

(a)

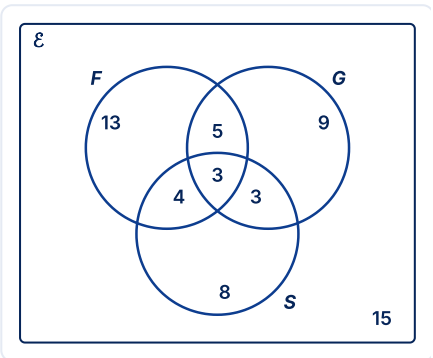
$25 + 20 + 18 - 8 - 6 - 7 + 3 = 45$ **(M1)(A1)**

15 **A1**

(b)

only F 13, only G 9, only S 8 **(M1)(A1)**

$\frac{30}{60} = \frac{1}{2}$ **A1**



Fill in from the centre outwards

Every solution is also on ibmathrevision.com/slai/venn-diagrams-and-hard-probability-exam-practice
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