IB MATHS AI HL · UNIT 4

Venn Diagrams & Hard Probability: exam practice

10 questions · 29 marks · worked solutions and markschemes

Name _____ Date _____ Score / 29

- 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/hlai/venn-diagrams-and-hard-probability-exam-practice

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

A and B are independent with $P(A) = 0.4$ and $P(B) = 0.25$.

Find the probability that exactly one of A and B occurs. **[2]**

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

Events A and B are mutually exclusive with $P(A) = 0.3$ and $P(B) = 0.45$.

Find $P(A \cup B)$ and $P(A' \cap B')$. **[2]**

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

A password is 4 digits (0 to 9), and digits may repeat.

Find the probability that a random password has all four digits different. **[2]**

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

In a class of 32, 18 study art, 14 study music and 6 study both.

Find the probability a student studies neither, and the probability an art student also studies music. **[3]**

5. **3 marks · Paper 1 style · calculator allowed**

$P(A) = 0.5$, $P(B) = 0.35$, $P(A \cup B) = 0.7$.

Find $P(A \cap B)$, $P(A \cap B')$ and $P(B \mid A)$. **[3]**

6. **3 marks · Paper 1 style · calculator allowed**

In a group of 60, 35 like apples, 28 like bananas and 10 like neither.

Find the number who like both and the probability that someone who likes bananas also likes apples. **[3]**

7. **3 marks · Paper 2 style · calculator allowed**

A box has 3 defective and 9 good bulbs. Three are chosen without replacement.

Find the probability that at least one is defective. **[3]**

8. **3 marks · Paper 1 style · calculator allowed**

$P(A) = 0.6$, $P(B \mid A) = 0.5$ and $P(B \mid A') = 0.2$.

Find $P(B)$ and $P(A \mid B)$. **[3]**

9. **4 marks · Paper 2 style · calculator allowed**

Of 100 students, 45 play football (F), 38 play basketball (B) and 30 play tennis (T). 12 play F and B, 10 play F and T, 8 play B and T, and 4 play all three.

Find the number who play none of the three, and the probability a student plays exactly one. **[4]**

10. **4 marks · Paper 2 style · calculator allowed**

Ana, Ben and Chloe take turns in that order to roll a fair dice, and the first to roll a 6 wins.

Find the probability that Chloe wins. **[4]**

Answers and worked solutions

Question 1 — 2 marks

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

$0.4(0.75) + 0.6(0.25)$ **M1**

0.45 **A1**

Question 2 — 2 marks

Answer: 0.75; 0.25

0.75 **A1**

0.25 **A1**

Question 3 — 2 marks

Answer: 0.504

$\frac{10 \times 9 \times 8 \times 7}{10^4}$ **M1**

0.504 **A1**

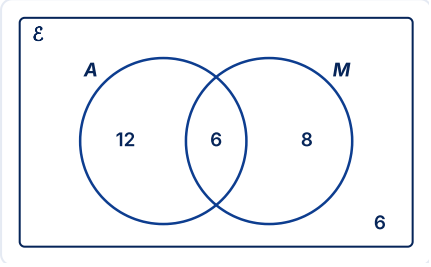
Question 4 — 3 marks

Answer: $\frac{3}{16}$; $\frac{1}{3}$

neither $32 - 26 = 6$ **M1**

$\frac{3}{16}$ **A1**

$\frac{6}{18} = \frac{1}{3}$ **A1**



Art (A) and music (M)

Question 5 — 3 marks

Answer: 0.15; 0.35; 0.3

0.15 **A1**

0.35 **A1**

0.3 **A1**

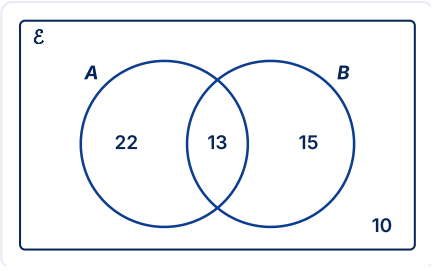
Question 6 — 3 marks

Answer: 13; $\frac{13}{28}$

$35 + 28 - x = 50$ **M1**

13 **A1**

$\frac{13}{28}$ **A1**



Apples (A) and bananas (B)

Question 7 — 3 marks

Answer: $\frac{34}{55}$

$P(\text{none}) = \frac{9}{12} \cdot \frac{8}{11} \cdot \frac{7}{10}$ **M1**

$= \frac{21}{55}$ **A1**

$\frac{34}{55}$ **A1**

Question 8 — 3 marks

Answer: 0.38; $\frac{15}{19}$

$0.3 + 0.08 = 0.38$ **A1**

$\frac{0.3}{0.38}$ **M1**

$\frac{15}{19}$ **A1**

Question 9 — 4 marks

Answer: 13; 0.65

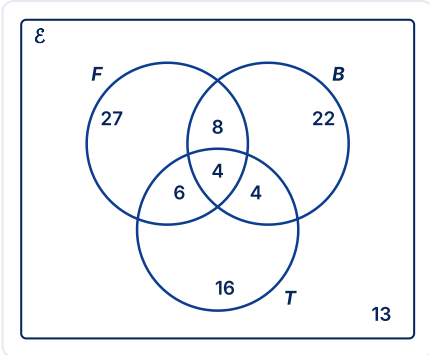
$|F \cup B \cup T| = 45 + 38 + 30 - 12 - 10 - 8 + 4 = 87$

$M1$**A1**

none 13 **A1**

exactly one:

$27 + 22 + 16 = 65$, so 0.65 **A1**



Football, basketball, tennis

Question 10 — 4 marks

Answer: $\frac{25}{91}$

$\left(\frac{5}{6}\right)^2 \frac{1}{6} + \left(\frac{5}{6}\right)^5 \frac{1}{6} + \ldots$

$M1$**A1**

$\frac{\frac{25}{216}}{1 - \frac{125}{216}}$ **M1**

$\frac{25}{91}$ **A1**

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