Maths IB_2

Test 3

3 december 2025

subjets : *Probability I*

Tot :[/ 15 marks]

Marksheme & Answers

Problem 1

[/ 7 marks]

(a) (i) $\frac{2}{n}$ **A1** **N1**

(ii) correct probability for one of the draws **A1**

eg $\mathrm{P}(\text{not blue first}) = \frac{n-2}{n}$, blue second $= \frac{2}{n-1}$

valid approach ***(M1)***

eg recognizing loss on first in order to win on second, $\mathrm{P}(B' \text{ then } B)$, $\mathrm{P}(B') \times \mathrm{P}(B \mid B')$, tree diagram

correct expression in terms of n **A1** **N3**

eg $\frac{n-2}{n} \times \frac{2}{n-1}$, $\frac{2n-4}{n^2-n}$, $\frac{2(n-2)}{n(n-1)}$

[4 marks]

(b) (i) correct working ***(A1)***

eg $\frac{3}{5} \times \frac{2}{4} \times \frac{2}{3}$

$\frac{12}{60} \left(= \frac{1}{5}\right)$ **A1** **N2**

(ii) correct working ***(A1)***

eg $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} \times \frac{2}{2}$

$\frac{6}{60} \left(= \frac{1}{10}\right)$ **A1** **N2**

Problem 2 [/ 9 marks]

(a) valid approach to find $\mathrm{P}(R)$ ***(M1)***

tree diagram (must include probabilty of picking box) with correct required probabilities OR $\mathrm{P}(R \cap B_1) + \mathrm{P}(R \cap B_2)$ OR $\mathrm{P}(R \mid B_1)\mathrm{P}(B_1) + \mathrm{P}(R \mid B_2)\mathrm{P}(B_2)$

$\frac{5}{7}\cdot\frac{1}{2}+\frac{4}{7}\cdot\frac{1}{2}$ ***(A1)***

$\mathrm{P}(R)=\frac{9}{14}$ ***A1***

[3 marks]

(b) events A and R are not independent, since $\frac{9}{14}\cdot\frac{1}{2}\neq\frac{5}{14}$ OR $\frac{5}{7}\neq\frac{9}{14}$ OR $\frac{5}{9}\neq\frac{1}{2}$

OR an explanation e.g. different number of red balls in each box ***A2***

Question 3

The following table shows the probability distribution of a discrete random variable where $a, k \in \mathbb{R}^+$.

x	1	2	3	4
$\mathrm{P}(X=x)$	k	k^2	a	k^3

Given that $\mathrm{E}(X)=2.3$, find the value of a.

Answers

$$\begin{cases} k+2k^2+3a+4k^3=2.3 \\ k+k^2+k^3+a=1 \end{cases} \quad \text{then } a=1-k-k^2-k^3$$

then $k+2k^2+3(1-k-k^2-k^3)+4k^3=2.3$

$k^3-k^2-2k+0.7=0$ as $k\in\mathbb{R}^+$: $k=0.315871$ or $k=1.86952$

therefore $a=1-k-k^2-k^3 = \boxed{0.552839}$ (the other value of k gives $a<0$)