

## 4.3 Probability

### Mark Schemes

Course	DP IB Maths
Section	4. Statistics & Probability
Topic	4.3 Probability
Difficulty	Medium

# Exam Papers Practice

To be used by all students preparing for DP IB Maths AI SL  
Students of other boards may also find this useful



## Question 1

(i) SUM OF MALES  $7+21+19+5+2+1=55$

$$P(\text{MALE}) = \frac{55}{120} = \frac{11}{24}$$

$$P(\text{MALE}) = \frac{11}{24}$$

(ii) SUM < 51 (FIRST 4 ROWS)

$$14+29+12+6+7+21=89$$

$$P(< 51) = \frac{89}{120}$$

(iii) NO MALES ARE < 45 cm

$$P(< 45) = 0$$

(iv) SUM  $45 \leq L < 54$  FOR FEMALES ONLY

$$12+6+3=21$$

$$P(45 \leq F < 54) = \frac{21}{120} = \frac{7}{40}$$

$$P(45 \leq F < 54) = \frac{7}{40}$$

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## Question 2

DRAW A SAMPLE SPACE DIAGRAM TO SHOW ALL POSSIBILITIES

x	1	2	3
1	1	2	3
2	2	4	6
3	3	6	9

USE THE SAMPLE SPACE DIAGRAM TO FIND REQUIRED PROBABILITIES

(i)

$$P(6) = \frac{2}{9}$$

(ii)

$$P(<4) = \frac{5}{9}$$

(iii)

$$P(000) = \frac{4}{9}$$

## Question 3

$$(a) (i) P(\text{chloridia}) = \frac{8}{25} = \frac{48}{150} \quad \text{OR} \quad \frac{8}{25} \times 150 = 48$$

$$x = 48 - 33 = 15$$

$$x = 15$$

$$(ii) y = 150 - (45 + 12 + 15 + 33 + 18)$$

$$y = 27$$

b)

(i)  $P(\text{ATLEAST ONE}) = 1 - P(\text{NONE})$

$$\frac{150 - 18}{150} = \frac{132}{150} = \frac{22}{25} = 0.88$$

$$P(\text{ATLEAST ONE}) = \frac{22}{25} \quad \text{OR } 0.88$$

(ii)  $P(\text{EXACTLY ONE}) = \text{INSIDE VENN, NOT IN INTERSECTIONS}$

$$\frac{45 + 27 + 33}{150} = \frac{105}{150} = \frac{7}{10} = 0.7$$

$$P(\text{EXACTLY ONE}) = \frac{7}{10} \quad \text{OR } 0.7$$

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# Question 4

a) 'GIVEN THEY ENJOY AT LEAST ONE GENRE' IGNORE VALUES OUTSIDE CIRCLES (24)

$$15 + 3 + 16 + 27 + 4 + 2 + 9 = 76$$

(i)  $P(\text{BOLLYWOOD MUSICALS}) = \frac{16 + 3 + 4 + 2}{76}$  ← VALUES IN B

$$P(\text{BOLLYWOOD}) = \frac{25}{76}$$

(ii)  $P(\text{ONLY ONE GENRE}) = \frac{15 + 16 + 9}{76} = \frac{40}{76}$  ← VALUES NOT IN INTERSECTIONS

$$P(\text{ONLY ONE GENRE}) = \frac{10}{19}$$

(iii)  $P(\text{EXACTLY TWO GENRES}) = \frac{3 + 27 + 2}{76} = \frac{32}{76}$  ← VALUES IN DUAL INTERSECTIONS

$$P(\text{EXACTLY TWO GENRES}) = \frac{8}{19}$$



(b) (i)

INTERSECTION

$$P(A \cap C) = \frac{27 + 4}{100} = \frac{31}{100} = 0.31$$

$$P(A \cap C) = \frac{31}{100}$$

OR 0.31

(ii)  $P(A \cup C)$  COULD ADD ALL VALUES IN  
UNION  $\nearrow$  A OR C OR TAKE VALUES  
NOT IN EITHER

$$\frac{15 + 3 + 4 + 27 + 9 + 2}{100} = \frac{60}{100} = \frac{3}{5} = 0.6$$

OR

$$\frac{100 - (16 + 24)}{100} = \frac{60}{100} = \frac{3}{5} = 0.6$$

$$P(A \cup C) = \frac{3}{5}$$

OR 0.6

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(iii)  $P(C|B)$  = CONDITIONAL C GIVEN B

$$n(B) = 3 + 4 + 2 + 16 = 25 \quad \text{TOTAL IN B}$$

$$n(C \cap B) = 4 + 2 = 6 \quad \text{TOTAL IN INTERSECTION}$$

$$P(C|B) = \frac{6}{25} = 0.24$$

$$P(C|B) = \frac{6}{25} \quad \text{OR } 0.24$$

(iv)  $P(B')$  =  $1 - P(B)$  NOT IN B

$$P(B) = \frac{3+4+2+16}{100} = \frac{25}{100}$$

$$P(B') = 1 - \frac{25}{100} = \frac{75}{100} = \frac{3}{4} = 0.75$$

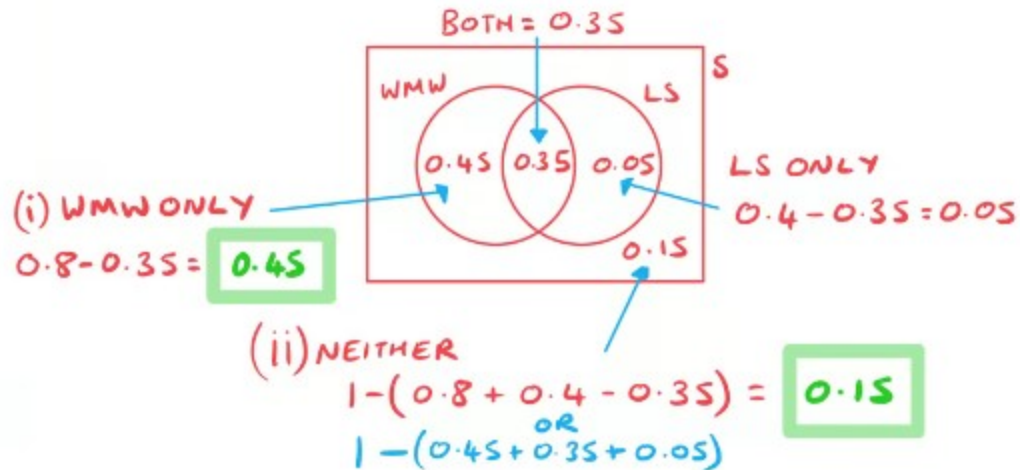
$$P(B') = \frac{3}{4} \quad \text{OR } 0.75$$

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### Question 5

DRAW A VENN DIAGRAM TO ORGANISE OPTIONS



OR USE JUST CALCULATIONS

(i) WMW ONLY  $0.8 - 0.35 = 0.45$

$$P(\text{WMW ONLY}) = 0.45$$

(ii) NEITHER  $1 - (0.8 + 0.4 - 0.35) = 0.15$

$$P(\text{NEITHER}) = 0.15$$

### Question 6

(a) 'U' = 'OR' = ADD PROBABILITIES

MUTUALLY EXCLUSIVE = NO COMMON OUTCOMES  
(NO OVERLAP IN VENN DIAGRAM)

$$P(A) + P(B) = 0.35 + 0.25 = 0.6 = P(A \cup B)$$

$$P(A) + P(B) = P(A \cup B)$$

A AND B ARE MUTUALLY EXCLUSIVE





(b) ' $\cap$ ' = 'AND' = MULTIPLY

INDEPENDENT = NO EFFECT ON EACH OTHER

$$P(C) \times P(D) = 0.2 \times 0.4 = 0.08 \neq 0.18 = P(C \cap D)$$

$$P(C) \times P(D) \neq P(C \cap D)$$

C AND D ARE NOT INDEPENDENT

Question 7

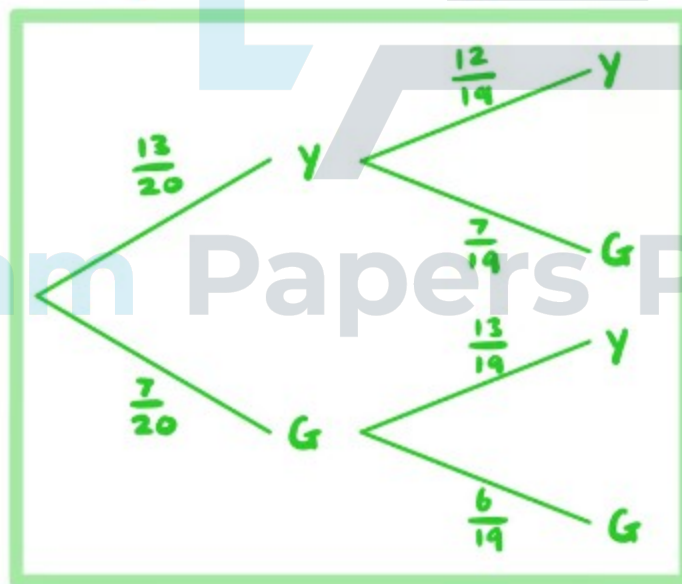
(a)

INITIAL TOTAL

$$7 + 13 = 20$$

WITHOUT REPLACEMENT

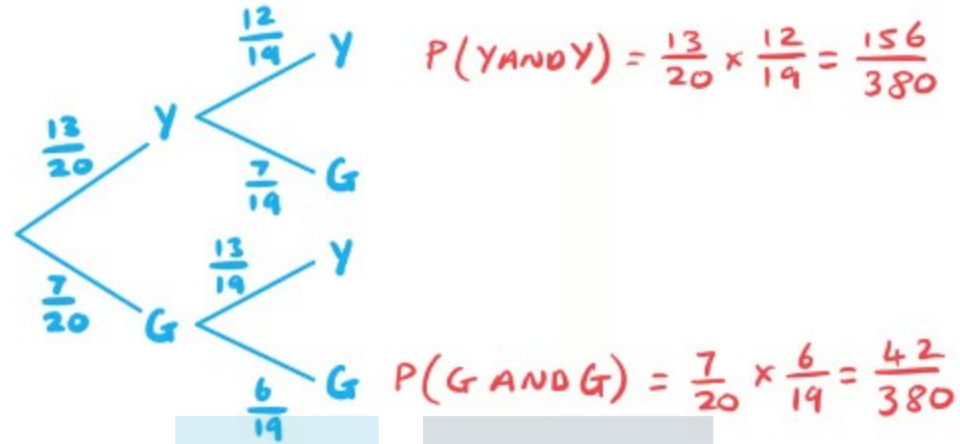
$$\text{TOTALS ARE NOW } 20 - 1 = 19$$



CHECK EACH  
BRANCH PAIR = 1

YOU CAN THEN CALCULATE ALL POSSIBLE  
OUTCOMES BY MULTIPLYING ALONG EACH  
BRANCH

(b) USING TREE DIAGRAM FROM PART (a)  
MULTIPLY ALONG BRANCHES WITH SAME COLOUR



NOT SIMPLIFYING MAKES PROBABILITIES  
EASIER TO ADD

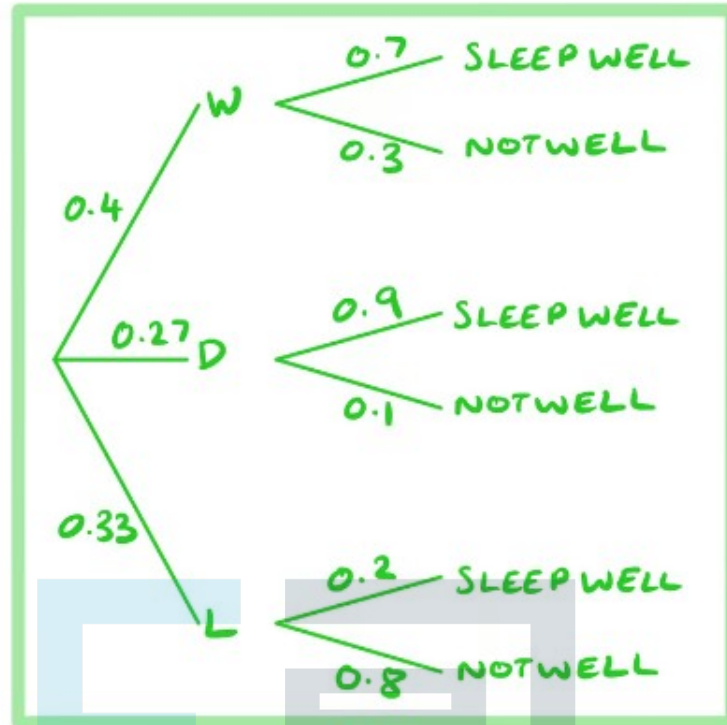
$$P(Y \text{ AND } Y) + P(G \text{ AND } G) = P(\text{SAME COLOUR})$$

$$\left( \frac{13}{20} \times \frac{12}{19} \right) + \left( \frac{7}{20} \times \frac{6}{19} \right) = \frac{156}{380} + \frac{42}{380} = \frac{198}{380} = \frac{99}{190}$$

$$P(\text{SAME COLOUR}) = \frac{99}{190}$$

## Question 8

(a)



↑  
CHECK EACH  
BRANCH PAIR = 1

YOU CAN THEN CALCULATE ALL POSSIBLE  
OUTCOMES BY MULTIPLYING ALONG EACH  
BRANCH

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(b)

$$(i) P(\text{LOSE AND SLEEP WELL}) = 0.33 \times 0.2 = 0.066$$

$$P(\text{LOSE AND SLEEP WELL}) = 0.066$$

$$(ii) P(\text{SLEEPS WELL}) = \text{SLEEP WELL AFTER WIN, DRAW AND LOSE}$$

$$0.4 \times 0.7 + 0.27 \times 0.9 + 0.33 \times 0.2$$

$$0.28 + 0.243 + 0.066$$

$$P(\text{SLEEPS WELL}) = 0.589$$

$$(c) \quad P(\text{DRAW}' | \text{SLEEPWELL}) = \frac{P(\text{WIN}_{\text{SLEEPWELL}}) + P(\text{LOSE}_{\text{SLEEPWELL}})}{P(\text{SLEEPWELL})}$$

$$\frac{(0.4 \times 0.7) + (0.33 \times 0.2)}{0.589} = \frac{0.346}{0.589}$$

← FROM  
(b)(i)

$$P(\text{DRAW}' | \text{SLEEPWELL}) = \frac{346}{589}$$



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