



3.20H Two Way Tables: Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A survey of 120 students recorded whether they take Biology and whether they take Drama. The table below is started for the results.

	Drama	Not Drama	Total
Biology	28	22	50
Not Biology			70
Total	40		120

Complete the missing entries in the table.

(Total for Question 1 is 2 marks)

- 2** In a town, a council records whether households have broadband and whether they have a landline. Out of 500 households, 365 have broadband and 210 have a landline. Exactly 150 households have both broadband and a landline.

Complete the two-way table for Broadband / Landline and work out the number of households that have broadband only.

(Total for Question 2 is 3 marks)

- 3** A class of 30 pupils were asked whether they cycle to school and whether they wear a helmet. The completed two-way table is below.

	Helmet	No Helmet	Total
Cycle	8	4	12
Do not cycle	6	12	18
Total	14	16	30

Calculate the probability that a randomly chosen pupil cycles given that they wear a helmet. Give your answer as a fraction in lowest terms.

(Total for Question 3 is 3 marks)

- 4** A survey records whether adults exercise regularly and whether they are smokers. The table for 400 adults is below.

	Smoker	Non-smoker	Total
Exercise	40	160	200
No exercise	90	110	200
Total	130	270	400

Use this table to show whether the events 'exercise' and 'smoker' are independent. You must justify your conclusion.

(Total for Question 4 is 4 marks)

- 5** The table below shows results from a taste test of 200 people for two flavours, Lemon and Berry, and whether they preferred Brand X.

	Prefer Brand X	Do not prefer Brand X	Total
Lemon	54	26	80
Berry	a	b	120
Total	110	90	200

Find the values of a and b.

(Total for Question 5 is 4 marks)

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- 6** A two-way table classifies 360 people by whether they own a pet and whether they own a bicycle. It is known that 126 people own both a pet and a bicycle, 174 own a pet, and 210 own a bicycle.

Show that the number of people who own neither a pet nor a bicycle is 102.

(Total for Question 6 is 5 marks)

- 7 A medical study records 600 patients and classifies them by whether they received Treatment A and whether they recovered within 30 days. The two-way table is incomplete:

	Recovered	Not recovered	Total
Treatment A	210	90	300
No A	c	180	300
Total	330	270	600

- (a) Find c.
(b) Calculate the probability that a randomly chosen patient recovered given they did not receive Treatment A. Give your answer as a decimal to 3 significant figures.
(c) A critic says Treatment A doubles the chance of recovery. Evaluate this claim using your results, showing calculations.

(a) Find c. (1)

(b) Calculate $P(\text{recovered} \mid \text{No A})$ to 3 significant figures. (2)

(c) Evaluate the critic's claim that Treatment A doubles the chance of recovery. Use $P(\text{recovered} \mid \text{Treatment A})$ and $P(\text{recovered} \mid \text{No A})$. (3)

(Total for Question 7 is 6 marks)

8 Stretch question. A researcher considers a large sample where the proportion who prefer Coffee is p and the proportion who prefer Tea is $1 - p$. Independently, the proportion who choose Milk is m and choose No milk is $1 - m$. She assumes preference for drink and choice about milk are independent.

(a) Construct the 2×2 probability table with rows Coffee / Tea and columns Milk / No milk in terms of p and m .

(b) Find an expression for the probability that a randomly chosen person prefers Coffee given they choose Milk. (c) 'If $p = 0.6$ and $m = 0.25$ then $P(\text{Coffee} \mid \text{Milk}) = 0.6$.' Show whether this specific numerical claim is true. Give full working.

(a) Construct the 2×2 probability table. (2)

(b) Find $P(\text{Coffee} \mid \text{Milk})$ in terms of p and m . (2)

(c) Check the numerical claim for $p = 0.6$ and $m = 0.25$. (4)

(Total for Question 8 is 8 marks)

Mark scheme · 3.20H Two Way Tables: Higher Tier Practice

Question 1

- **M1** correct entry for Not Biology and Drama = 12 (or show $120 - 50 - (40 - 28)$ etc) or correct method
- **A1** complete table with entries: Not Biology & Drama 12; Not Biology & Not Drama 58; Total Not Drama 80 cao
- **Answer: Not Biology & Drama = 12; Not Biology & Not Drama = 58; Total Not Drama = 80; check totals 120.**

Question 2

- **M1** correctly compute broadband only = $365 - 150$ or show method
- **A1** 215 cao
- **B1** complete table entries: Broadband & Landline 150; Broadband only 215; Landline only 60; Neither 75; totals 500 cao
- **Answer: Broadband only = 215. Full table: Broadband & Landline 150; Broadband only 215; Landline only 60; Neither 75.**

Question 3

- **M1** identify conditional probability $P(\text{cycle} | \text{helmet}) = \text{number cycling and wearing helmet} / \text{total wearing helmet} = 8/14$
- **A1** $4/7$ in lowest terms cao
- **B1** explicit statement: probability = $8/14 = 4/7$
- **Answer: $4/7$**

Question 4

- **M1** calculate $P(\text{exercise}) = 200/400 = 1/2$ and $P(\text{smoker}) = 130/400 = 13/40$ or state values
- **M1** compute $P(\text{exercise and smoker}) = 40/400 = 1/10$
- **A1** compare $1/10$ with $P(\text{exercise}) \times P(\text{smoker}) = (1/2) \times (13/40) = 13/80$ and note they are not equal
- **B1** conclude not independent with correct justification: $1/10 \neq 13/80$ so events are not independent
- **Answer: Not independent because $P(\text{exercise and smoker}) = 40/400 = 1/10$ but $P(\text{exercise})P(\text{smoker}) = (1/2) \times (13/40) = 13/80$; $1/10$ (0.10) does not equal $13/80$ (0.1625).**

Question 5

- **M1** use column totals: $a = 110 - 54 = 56$ or show method
- **A1** $a = 56$ cao
- **M1** use row total for Berry: $b = 120 - a = 120 - 56$
- **A1** $b = 64$ cao
- **Answer: $a = 56$, $b = 64$**

Question 6

- **M1** use inclusion-exclusion: number owning at least one = pet + bicycle - both = $174 + 210 - 126$
- **M1** compute $174 + 210 - 126 = 258$
- **M1** number neither = total - number owning at least one = $360 - 258$
- **A1** 102 cao
- **B1** clear statement: therefore 102 people own neither
- **Answer: 102 (since $174 + 210 - 126 = 258$ own at least one, and $360 - 258 = 102$ own neither).**

Question 7

- (a) **B1** $c = 330 - 210 = 120$ cao
- (a) **Answer: 120**
- (b) **M1** compute probability $= 120 / 300$
- (b) **A1** 0.400 to 3 s.f. cao
- (b) **Answer: 0.400**
- (c) **M1** compute $P(\text{recovered} \mid \text{Treatment A}) = 210 / 300 = 0.70$
- (c) **M1** compare ratio or factor: $0.70 / 0.40 = 1.75$ or show doubling check
- (c) **A1** conclude claim false with reason: treatment increases chance by factor 1.75 not 2 (70% vs 40%)
- (c) **Answer: $P(\text{recovered} \mid \text{Treatment A}) = 210/300 = 0.700$. This is $0.700 / 0.400 = 1.75$ times, not 2 times, so the claim is false; Treatment A increases recovery chance from 40% to 70%, a factor of 1.75.**

Question 8

- (a) **M1** fill entries as products since independent
- (a) **A1** table: Coffee & Milk $p m$; Coffee & No milk $p(1-m)$; Tea & Milk $(1-p)m$; Tea & No milk $(1-p)(1-m)$ with margins summing to 1
- (a) **Answer: Coffee & Milk = $p m$; Coffee & No milk = $p(1-m)$; Tea & Milk = $(1-p)m$; Tea & No milk = $(1-p)(1-m)$.**
- (b) **M1** write conditional probability $= P(\text{Coffee and Milk}) / P(\text{Milk}) = p m / (p m + (1-p)m)$
- (b) **A1** simplify to $p m / (m(p + 1 - p)) = p$
- (b) **Answer: $P(\text{Coffee} \mid \text{Milk}) = (p m) / (p m + (1-p)m) = p$**
- (c) **M1** substitute $p = 0.6$ into expression from (b) or compute directly
- (c) **M1** demonstrate algebraic simplification gives $P(\text{Coffee} \mid \text{Milk}) = p$ so equals 0.6
- (c) **A1** state numeric evaluation: 0.6 cao
- (c) **B1** clear conclusion that the claim is true for any m in $(0,1)$, so true for $m = 0.25$
- (c) **Answer: Substituting gives $P(\text{Coffee} \mid \text{Milk}) = p = 0.6$, so the claim is true; this holds for any $m > 0$ since the conditional simplifies to p .**