HIGHER

H15-30min Conditional Probability (Higher): 30-minute Pack

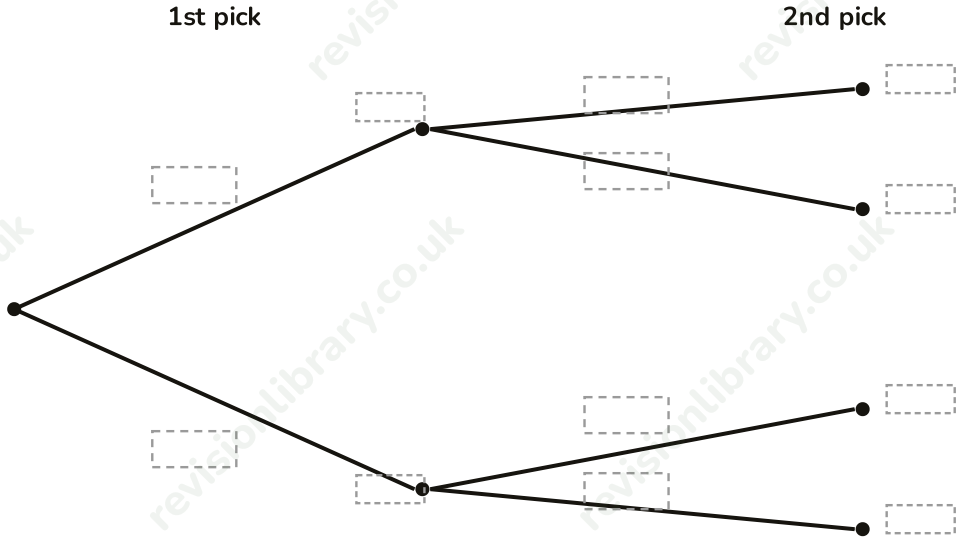
Total Marks

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A box contains 9 pens: 5 blue and 4 black. Tomasz takes a pen at random from the box and does not replace it. He then takes a second pen at random from the box. The diagram shows the blank structure of a tree diagram for this situation.



(a) Complete the tree diagram: label each of the six branches with its outcome (Blue or Black) and write its probability. **(3)**

(b) Use your tree diagram to find the probability that Tomasz takes two pens of the same colour. **(3)**

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(Total for Question 1 is 6 marks)

2 150 customers at a cafe were asked whether they bought a hot drink and whether they bought a pastry. The two-way table shows the results.

	Pastry	No pastry	Total
Hot drink	54	36	90
No hot drink	18	42	60
Total	72	78	150

(a) Write down P(Pastry). **(1)**

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(b) Find P(Pastry | Hot drink). **(2)**

.....

(c) Find P(Hot drink | Pastry). **(2)**

.....

(d) Explain why P(Pastry | Hot drink) is not equal to P(Hot drink | Pastry), even though both use the same 54 customers who bought both. **(2)**

(Total for Question 2 is 7 marks)

3 A pack of 15 cards is numbered 1 to 15. Two cards are drawn at random, one after another, without replacement.

(a) Find the probability that both cards drawn show multiples of 5. **(3)**

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(b) Given that the first card drawn shows a multiple of 5, find the probability that the second card drawn also shows a multiple of 5. **(2)**

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(c) Find the probability that neither card drawn shows a multiple of 5. **(2)**

.....

(Total for Question 3 is 7 marks)

4 A student wants to investigate whether Year 11 students who complete at least 4 hours of revision per week are more likely to achieve grade 7 or above in a mock Statistics exam.

(a) Write a suitable hypothesis for this investigation. **(1)**

(b) The student initially plans to collect data only from her own Statistics class of 28 students. Give one reason why this sampling method could make her conclusions unreliable, and suggest one improvement. **(2)**

(c) The student instead surveys 80 Year 11 students from across the school, recording whether each completed at least 4 hours of revision per week and whether they achieved grade 7 or above. The two-way table shows the results. **(4)**

	Grade 7+	Below grade 7	Total
At least 4 hours	21	14	35
Fewer than 4 hours	9	36	45
Total	30	50	80

Find P(Grade 7+ | At least 4 hours) and P(Grade 7+ | Fewer than 4 hours).

(d) Using your answers to part (c), comment on whether the data supports the hypothesis in part (a), and give one limitation of this conclusion. **(2)**

(Total for Question 4 is 9 marks)

Mark scheme · H15-30min Conditional Probability (Higher): 30-minute Pack

Question 1

- (a) **B1** 1st-pick branches labelled Blue (5/9) and Black (4/9)
- (a) **B1** 2nd-pick branches after Blue labelled Blue (4/8) and Black (4/8)
- (a) **B1** 2nd-pick branches after Black labelled Blue (5/8) and Black (3/8)
- **(a) Answer: 1st pick: Blue 5/9, Black 4/9. After Blue: Blue 4/8, Black 4/8. After Black: Blue 5/8, Black 3/8.**
- (b) **M1** 5/9 x 4/8, oe (both blue)
- (b) **M1** 4/9 x 3/8, oe (both black)
- (b) **A1** 4/9 oe cao (sum of both cases)
- **(b) Answer: 4/9**

Question 2

- (a) **B1** 72/150 oe (e.g. 12/25 or 0.48)
- **(a) Answer: 72/150 (= 12/25)**
- (b) **M1** 54/90 seen, oe
- (b) **A1** 3/5 oe cao
- **(b) Answer: 3/5**
- (c) **M1** 54/72 seen, oe
- (c) **A1** 3/4 oe cao
- **(c) Answer: 3/4**
- (d) **M1** identifies that the two conditional probabilities divide the 54 customers by different totals (90 hot-drink customers compared with 72 pastry customers)
- (d) **A1** correct conclusion that dividing the same joint frequency by different denominators gives different probabilities, because each conditioning event restricts the sample space differently
- **(d) Answer: P(Pastry|Hot drink) divides 54 by the 90 hot-drink customers, but P(Hot drink|Pastry) divides 54 by the 72 pastry customers; dividing by different totals gives different probabilities.**

Question 3

- (a) **B1** identifies the multiples of 5 from 1 to 15 as 5, 10, 15 (3 numbers)
- (a) **M1** 3/15 x 2/14, oe
- (a) **A1** 1/35 oe cao
- **(a) Answer: 1/35**
- (b) **M1** 2/14 seen, oe
- (b) **A1** 1/7 oe cao
- **(b) Answer: 1/7**
- (c) **M1** 12/15 x 11/14, oe
- (c) **A1** 22/35 oe cao
- **(c) Answer: 22/35**

Question 4

- (a) **B1** a clear, testable hypothesis linking hours of revision with achieving grade 7+, e.g. 'Students who do at least 4 hours of revision per week are more likely to achieve grade 7 or above.'
- **(a) Answer: Students who do at least 4 hours of revision per week are more likely to achieve grade 7 or above (accept any equivalent testable statement).**
- (b) **M1** identifies a valid limitation, e.g. one class of 28 is a small, possibly unrepresentative sample of all Year 11 students (same teacher/set, so biased)
- (b) **A1** suggests a valid improvement, e.g. take a (stratified) sample of students across several classes or the whole of Year 11
- **(b) Answer: Limitation: one class of 28 pupils may not represent all of Year 11 (same teacher/set, so biased). Improvement: take a stratified sample of students across all Year 11 classes.**
- (c) **M1** 21/35 seen, oe
- (c) **A1** 3/5 oe cao
- (c) **M1** 9/45 seen, oe
- (c) **A1** 1/5 oe cao
- **(c) Answer: P(Grade 7+ | At least 4 hours) = 3/5; P(Grade 7+ | Fewer than 4 hours) = 1/5**
- (d) **B1** valid comparative comment supporting the hypothesis, e.g. 3/5 (0.6) is much greater than 1/5 (0.2), so students doing at least 4 hours of revision were more likely to achieve grade 7+
- (d) **B1** a valid limitation, e.g. 80 students from one school is a limited sample, or an association does not prove that revision hours alone caused the higher grades (other factors, e.g. prior attainment, may contribute)
- **(d) Answer: The data supports the hypothesis: 3/5 (0.6) of students doing at least 4 hours of revision achieved grade 7+, compared with only 1/5 (0.2) of those doing fewer hours. Limitation: this is a sample of 80 students from one school, and an association does not prove revision hours alone caused the higher grades.**