2.12 Probability (Foundation): 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A fair ten-sided dice, numbered 1 to 10, is rolled once.

(a) Write down the probability that the dice lands on a multiple of 3. **(1)**

.....

(b) Work out the probability that the dice lands on a prime number. **(1)**

.....

(Total for Question 1 is 2 marks)

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2 A survey asked 80 students how they travel to school. The results are shown below.
Walk: 32 Bus: 24 Car: 16 Bike: 8
One of these students is chosen at random.

Travel method	Frequency
Walk	32
Bus	24
Car	16
Bike	8

(a) Work out the probability that this student walks to school. **(1)**

.....

(b) Work out the probability that this student does not travel by bus. **(1)**

.....

(c) Work out the percentage of students who travel by car or by bike. **(2)**

.....

(Total for Question 2 is 4 marks)

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3 A bag contains 20 sweets. 8 are strawberry, 5 are lime, 4 are orange and the rest are blackcurrant. A sweet is taken from the bag at random.

(a) Work out the probability that the sweet is blackcurrant. **(2)**

.....

(b) Work out the probability that the sweet is strawberry or lime. **(1)**

.....

(Total for Question 3 is 3 marks)

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4 A biased spinner can only land on red, blue, green or yellow. P(red) = 0.15, P(blue) = 0.3 and P(green) = 0.35.

(a) Work out P(yellow). **(1)**

.....

(b) The spinner is spun 200 times. Work out an estimate for the number of times it lands on yellow. **(2)**

.....

(Total for Question 4 is 3 marks)

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5 The probability that Jamal buys a sandwich for lunch is 0.4. The probability that he buys a salad is 0.25. Jamal never buys both a sandwich and a salad on the same day.

(a) Work out the probability that Jamal buys a sandwich or a salad. **(1)**

.....

(b) Work out the probability that Jamal buys neither a sandwich nor a salad. **(1)**

.....

(Total for Question 5 is 2 marks)

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6 Some probability questions about everyday events.

(a) A fair coin is flipped once. Write down the probability, as a fraction, that it lands on tails. **(1)**

.....

(b) A standard, well-shuffled pack of 52 playing cards is used. One card is picked at random. Write down the probability that the card is a picture card (a Jack, Queen or King). **(1)**

.....

(c) A fair spinner has 4 equal sections numbered 1, 2, 3, 4. The spinner is spun once. Write down the probability that it lands on a number greater than 4. **(1)**

.....

(Total for Question 6 is 3 marks)

---

7 Dan rolls a biased dice 50 times and scores a six on 20 of the rolls. Ella rolls a different biased dice 200 times and scores a six on 76 of the rolls.

(a) Work out the relative frequency of scoring a six for each dice. **(2)**

.....

(b) Whose result gives the more reliable estimate of the probability of scoring a six? Give a reason for your answer. **(1)**

(Total for Question 7 is 3 marks)

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8 The probability that Priya is late for school on any given day is 0.15.

(a) Work out the probability that Priya is not late for school. **(1)**

(b) There are 190 school days in the year. Work out an estimate for the number of days Priya is late. **(2)**

(c) Explain why your answer to part (b) is only an estimate. **(1)**

(Total for Question 8 is 4 marks)

9 A spinner is spun different numbers of times. The table shows the number of times it lands on green.

Number of spins: 10, 50, 200, 500

Times landed on green: 3, 14, 62, 151

(a) Work out the relative frequency of landing on green after 500 spins. **(1)**

(b) Which of the four relative frequencies gives the best estimate of the probability that the spinner lands on green? Give a reason for your answer. **(1)**

(c) Using your estimate from part (b), work out an estimate for the number of times the spinner will land on green in 1000 spins. **(2)**

(Total for Question 9 is 4 marks)

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10 Two fair four-sided dice, each numbered 1 to 4, are rolled together and the two scores are added to give a total.

(a) Work out the probability that the total is 5. **(2)**

.....

(b) Work out the probability that the total is at least 7. **(1)**

.....

(Total for Question 10 is 3 marks)

---

11 A fair spinner can only land on red, blue or green. P(red) = 2 x P(blue). P(green) = 0.4.

(a) Work out P(blue). **(2)**

.....

(b) Work out P(red). **(1)**

.....

(Total for Question 11 is 3 marks)

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12 A bag contains 20 counters: 8 are lilac, 6 are grey and 6 are white. A counter is taken from the bag at random.

(a) Write down the probability that the counter is lilac. **(1)**

.....

(b) Write down the probability that the counter is not grey. **(1)**

.....

(c) Write down the probability that the counter is grey or white. **(1)**

.....

(Total for Question 12 is 3 marks)

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13 A charity raffle uses 45 tickets: 21 are blue, 15 are yellow and 9 are pink. One ticket is drawn from the raffle at random.

(a) Write down the probability that the ticket is yellow. **(1)**

.....

(b) Write down the probability that the ticket is not blue. **(1)**

.....

(c) Write down the probability that the ticket is blue or pink. **(1)**

.....

(Total for Question 13 is 3 marks)

---

14 The probability that the 42 bus from Leeds to Bradford arrives early is 0.15. The probability that it arrives on time is 0.62. The bus can only arrive early, on time or late.

(a) Work out the probability that the bus arrives late. **(1)**

.....

(b) Work out the probability that the bus does not arrive early. **(1)**

.....

(Total for Question 14 is 2 marks)

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15 A cafe surveyed 70 diners on one lunchtime about whether they ordered a hot drink.

	Hot drink	No hot drink	Total
Adults	32	?	50
Children	?	14	?
Total	?	?	70

Some values in the table are missing (shown as ?).

(a) Complete the two-way table. **(3)**

(b) One diner is picked at random from the 70. Find the probability that the diner is a child who ordered a hot drink. **(1)**

.....

(c) Given that a diner picked at random did not order a hot drink, find the probability that they are a child. **(2)**

.....

(Total for Question 15 is 6 marks)

16 On a particular day, the probability of rain is 3/10 and the probability of it being cloudy (with no rain) is 2/5. The day can only be rainy, cloudy or sunny.

(a) Work out the probability that the day is sunny. **(1)**

.....

(b) Work out the probability that the day is either rainy or sunny (but not cloudy). **(1)**

.....

(Total for Question 16 is 2 marks)

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17 Spinner A has three equal sections numbered 1, 2, 3. Spinner B has four equal sections numbered 1, 2, 3, 4. Both spinners are spun once and the two scores are added together to give a total score.

(a) Complete a sample space diagram to show all 12 possible total scores. **(2)**

(b) Find the probability that the total score is 5. **(1)**

.....

(c) Find the probability that the total score is greater than 6. **(1)**

.....

(Total for Question 17 is 4 marks)

---

18 A biased six-sided dice was rolled 150 times. The table shows the results.

Score	1	2	3	4	5	6
Frequency	18	22	19	20	26	45

(a) Find the relative frequency of rolling a 6. **(1)**

.....

(b) Kofi rolls the same dice 400 times. Use the relative frequency from part (a) to estimate how many times it will land on a 6. **(2)**

.....

(c) Comment on whether the dice appears to be fair. Give a reason for your answer. **(1)**

.....

.....

.....

.....

.....

.....

.....

(Total for Question 18 is 4 marks)

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19 A jar contains only yellow, purple and orange sweets, in the ratio yellow : purple : orange = 2 : 5 : 3.

(a) Find P(purple), the probability that a sweet taken at random from the jar is purple. **(2)**

.....

(b) Find P(orange). **(1)**

.....

(c) There are 80 sweets in the jar in total. Work out how many of the sweets are yellow. **(2)**

.....

(Total for Question 19 is 5 marks)

---

20 Spinner A has four equal sections numbered 1, 2, 3, 4. Spinner B has three equal sections numbered 1, 2, 3. Both spinners are spun once and the two scores are multiplied together to give a total score.

(a) Complete a sample space diagram to show all 12 possible product scores. **(2)**

(b) Find the probability that the product is even. **(1)**

.....

(c) Find the probability that the product is greater than 6. **(2)**

.....

(Total for Question 20 is 5 marks)

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21 Chidi rolls a six-sided dice 60 times and scores a six 14 times. Aisha rolls an identical dice 500 times and scores a six 79 times.

(a) Work out the relative frequency of scoring a six in each experiment, giving your answers as decimals to 3 significant figures. **(2)**

(b) State, with a reason, whose experiment gives the more reliable estimate of the probability of scoring a six. **(1)**

(c) Kwame says: 'Chidi's dice must be biased, because his relative frequency of 14 out of 60 is higher than Aisha's.' Explain why Kwame's conclusion is not necessarily correct. **(2)**

(Total for Question 21 is 5 marks)

22 Amara has a large bag of sweets. Each time she takes a sweet at random, notes its colour, and replaces it before taking the next one. The probability that a sweet taken at random is red is 0.4.

(a) Work out the probability that she picks a red sweet on both of her first two picks. **(2)**

(b) Work out the probability that she picks exactly one red sweet in her first two picks. **(3)**

(Total for Question 22 is 5 marks)

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23 A biased spinner has two colours, orange and grey. The probability that it lands on orange is 0.55. The spinner is spun twice.

(a) Complete a probability tree diagram to show the possible outcomes of the two spins, with each branch labelled with a probability. **(2)**

(b) Work out the probability of getting exactly one orange. **(3)**

(c) Work out the probability of getting at least one orange. **(2)**

(Total for Question 23 is 7 marks)

24 A survey was carried out at Brightlow's supermarket of 200 customers. 65% of the customers shop online. Of the customers who shop online, 40% also use the loyalty app. Of the customers who do not shop online, 20% use the loyalty app.

(a) Work out the number of customers in the survey who shop online. **(1)**

(b) Work out the number of customers who shop online and use the loyalty app. **(2)**

(c) Find the probability that a customer selected at random from the survey does not use the loyalty app. **(3)**

(Total for Question 24 is 6 marks)

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Mark scheme · 2.12 Probability (Foundation): 2-hour Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

(a) 3/10 oe **B1**

(a) Answer: 3/10

(b) 2/5 oe (accept 4/10) **B1**

(b) Answer: 2/5

Question 2

(a) 2/5 oe (accept 32/80, 0.4, 40%) **B1**

(a) Answer: 2/5

(b) 7/10 oe (accept 56/80, 0.7, 70%) **B1**

(b) Answer: 7/10

(c) 16 + 8 (= 24), or 24/80 seen **M1**

(c) 30% cao **A1**

(c) Answer: 30%

Question 3

(a) 20 - 8 - 5 - 4 (= 3) to find the number of blackcurrant sweets **M1**

(a) 3/20 oe cao **A1**

(a) Answer: 3/20

(b) 13/20 oe **B1**

(b) Answer: 13/20

Question 4

(a) 0.2 cao (accept correct method 1 - 0.15 - 0.3 - 0.35) **B1**

(a) Answer: 0.2

(b) 0.2 x 200, ft their (a) **M1**

(b) 40 cao **A1**

(b) Answer: 40

Question 5

(a) 0.65 cao **B1**

(a) Answer: 0.65

(b) 0.35 oe, ft their (a) **B1**

(b) Answer: 0.35

Question 6

(a) 1/2 oe **B1**

(a) Answer: 1/2

(b) 12/52 oe (3/13) **B1**

(b) Answer: 3/13

(c) 0 cao **B1**

(c) Answer: 0

Question 7

(a) Dan: 0.4 oe (accept 20/50, 2/5) **B1**

(a) Ella: 0.38 oe (accept 76/200, 19/50) **B1**

(a) Answer: Dan: 0.4, Ella: 0.38

(b) Ella, because her dice was rolled more times (a larger sample size gives a more reliable estimate) **B1**

(b) Answer: Ella, because she rolled the dice more times

Question 8

(a) 0.85 cao **B1**

(a) Answer: 0.85

(b) 0.15 x 190 (= 28.5) **M1**

(b) awrt 29 (accept 28.5 or 28, since the number of days must be a whole number) **A1**

(b) Answer: 29 days (awrt)

(c) any valid reason, e.g. the probability of 0.15 is based on past data and may not stay the same for every day, or the actual number of late days may not match the calculation exactly **B1**

(c) Answer: Because the probability 0.15 may not apply equally to every day, the actual number of late days could differ from the calculated value

Question 9

(a) 0.302 oe (accept 151/500) **B1**

(a) Answer: 0.302

(b) the relative frequency from 500 spins, because it is based on the greatest number of trials (a larger sample size gives a more reliable estimate) **B1**

(b) Answer: The relative frequency from 500 spins (0.302), because it uses the greatest number of trials.

(c) 0.302 x 1000, ft their (b) estimate **M1**

(c) 302 cao **A1**

(c) Answer: 302

Question 10

(a) listing at least 3 of the 4 correct pairs (1,4) (2,3) (3,2) (4,1), or 4/16 seen **M1**

(a) 1/4 oe cao **A1**

(a) Answer: 1/4

(b) 3/16 oe, ft their method **B1**

(b) Answer: 3/16

Question 11

(a) 3x + 0.4 = 1 oe, or 2x + x = 0.6 seen **M1**

(a) 0.2 cao **A1**

(a) Answer: 0.2

(b) 0.4 cao, ft 2 x their (a) **B1**

(b) Answer: 0.4

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Question 12

(a) 8/20 oe (2/5) **B1**

(a) Answer: 2/5

(b) 14/20 oe (7/10) **B1**

(b) Answer: 7/10

(c) 12/20 oe (3/5) **B1**

(c) Answer: 3/5

Question 13

(a) 15/45 oe (1/3) **B1**

(a) Answer: 1/3

(b) 24/45 oe (8/15) **B1**

(b) Answer: 8/15

(c) 30/45 oe (2/3) **B1**

(c) Answer: 2/3

Question 14

(a) 0.23 cao **B1**

(a) Answer: 0.23

(b) 0.85 cao **B1**

(b) Answer: 0.85

Question 15

(a) Adults with no hot drink = 18 (50 - 32) **B1**

(a) Children total = 20 (70 - 50) and children with a hot drink = 6 (20 - 14) **B1**

(a) Total with a hot drink = 38 (32 + 6) and total with no hot drink = 32 (18 + 14) **B1**

(a) Answer: Adults no-hot-drink = 18; Children total = 20, Children hot-drink = 6; Total hot-drink = 38, Total no-hot-drink = 32

(b) 6/70 oe (3/35), ft from part (a) **B1**

(b) Answer: 3/35

(c) restricts the sample space to the 32 diners with no hot drink, ft from part (a) **M1**

(c) 14/32 oe (7/16) **A1**

(c) Answer: 7/16

Question 16

(a) 3/10 cao **B1**

(a) Answer: 3/10

(b) 3/5 oe (6/10), ft from part (a) **B1**

(b) Answer: 3/5

Question 17

(a) at least 8 of the 12 total scores correct **M1**

(a) all 12 total scores correct: 2,3,4,5 / 3,4,5,6 / 4,5,6,7 **A1**

(a) Answer: totals for A=1: 2,3,4,5; A=2: 3,4,5,6; A=3: 4,5,6,7

(b) 3/12 oe (1/4), ft from part (a) **B1**

(b) Answer: 1/4

(c) 1/12 cao, ft from part (a) **B1**

(c) Answer: 1/12

Question 18

(a) 45/150 oe (0.3) **B1**

(a) Answer: 0.3

(b) 0.3 x 400, ft from part (a) **M1**

(b) 120 cao **A1**

(b) Answer: 120

(c) valid comparison-based conclusion, e.g. a fair dice would land on 6 about 150/6 = 25 times in 150 rolls, but it landed on 6 much more often (45 times), so the dice appears to be biased towards 6, oe **B1**

(c) Answer: The dice does not appear fair: for a fair dice you would expect about 25 sixes in 150 rolls, but 45 were observed

Question 19

(a) total ratio parts = 2 + 5 + 3 = 10 oe (5/10 unsimplified) **M1**

(a) 1/2 cao **A1**

(a) Answer: 1/2

(b) 3/10 cao **B1**

(b) Answer: 3/10

(c) P(yellow) = 1 - 1/2 - 3/10 (= 1/5), ft from parts (a) and (b) **M1**

(c) 16 cao **A1**

(c) Answer: 16

Question 20

(a) at least 8 of the 12 products correct **M1**

(a) all 12 products correct: 1,2,3 / 2,4,6 / 3,6,9 / 4,8,12 **A1**

(a) Answer: products for A=1: 1,2,3; A=2: 2,4,6; A=3: 3,6,9; A=4: 4,8,12

(b) 8/12 oe (2/3), ft from part (a) **B1**

(b) Answer: 2/3

(c) identifies the products greater than 6: 9, 8, 12 **M1**

(c) 3/12 oe (1/4), ft from part (a) **A1**

(c) Answer: 1/4

Question 21

(a) Chidi: 14/60 = 0.233 (awrt) **B1**

(a) Aisha: 79/500 = 0.158 **B1**

(a) Answer: Chidi: awrt 0.233; Aisha: 0.158

(b) Aisha's, because a larger number of trials generally gives a more reliable estimate of the true probability, oe **B1**

(b) Answer: Aisha's experiment

(c) recognises that relative frequency naturally varies between different sets of trials, particularly for a small number of trials, oe **M1**

(c) concludes that Chidi's smaller sample alone is not enough evidence to prove bias; more trials (or comparing to the theoretical probability 1/6) would be needed, oe **A1**

(c) Answer: Kwame is not necessarily correct: relative frequency varies between trials, especially for a small sample like Chidi's 60 rolls, so a higher result there does not on its own prove the dice is biased

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Question 22

(a) 0.4 x 0.4 **M1**

(a) 0.16 cao **A1**

(a) Answer: 0.16

(b) 0.4 x 0.6 (= 0.24) for one order (red then not-red, or not-red then red) **M1**

(b) doubles or adds both orders: (0.4 x 0.6) + (0.6 x 0.4) **M1**

(b) 0.48 cao **A1**

(b) Answer: 0.48

Question 23

(a) first pair of branches correctly labelled 0.55 (orange) and 0.45 (grey) **M1**

(a) both pairs of second-stage branches correctly labelled 0.55 and 0.45 **A1**

(a) Answer: every branch pair is labelled 0.55 (orange) and 0.45 (grey)

(b) 0.55 x 0.45 (= 0.2475) for one order **M1**

(b) doubles or adds both orders: (0.55 x 0.45) + (0.45 x 0.55) **M1**

(b) 0.495 cao **A1**

(b) Answer: 0.495

(c) 1 - (0.45 x 0.45) oe **M1**

(c) 0.7975 cao **A1**

(c) Answer: 0.7975

Question 24

(a) 130 cao **B1**

(a) Answer: 130

(b) 0.4 x 130, ft from part (a) **M1**

(b) 52 cao **A1**

(b) Answer: 52

(c) customers who do not shop online = 200 - 130 = 70, and of these, app users = 0.2 x 70 = 14 **M1**

(c) total using the app = 52 + 14 = 66 (oe: total not using = 200 - 66 = 134 found directly) **M1**

(c) 134/200 oe (0.67, 67/100) **A1**

(c) Answer: 0.67

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