5.22 Probability Trees: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A bag contains 3 red counters and 2 blue counters. A counter is taken at random. Write down the probability that the counter is blue.

(Total for Question 1 is 1 mark)

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2 A coin is tossed. If it lands heads, Sara picks a red marble from a bag with probability 1/4 of red; if it lands tails, she picks a red marble with probability 1/2. Draw a simple probability tree showing the two branches for the coin and the probabilities for picking a red marble on each branch. (No calculation of combined probability is required.)

(Total for Question 2 is 2 marks)

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3 A spinner has two equal sections: green and yellow. If the spinner lands on green, Tom rolls a 6-sided die. If it lands on yellow, he flips a coin. Write down the probability that Tom spins yellow and then flips tails.

(Total for Question 3 is 2 marks)

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4 State whether each statement about probability tree diagrams is True or False.

(a) The probabilities on each pair of branches leading from the same point on a tree diagram must add up to 1. **(1)**

- ☐ True
- ☐ False

(b) To find the probability of a combined outcome along a single path through a tree diagram, you multiply the probabilities along that path. **(1)**

- ☐ True
- ☐ False

(c) When counters are removed from a bag and not replaced, the probabilities on the second set of branches are always identical to the probabilities on the first set of branches. **(1)**

- ☐ True
- ☐ False

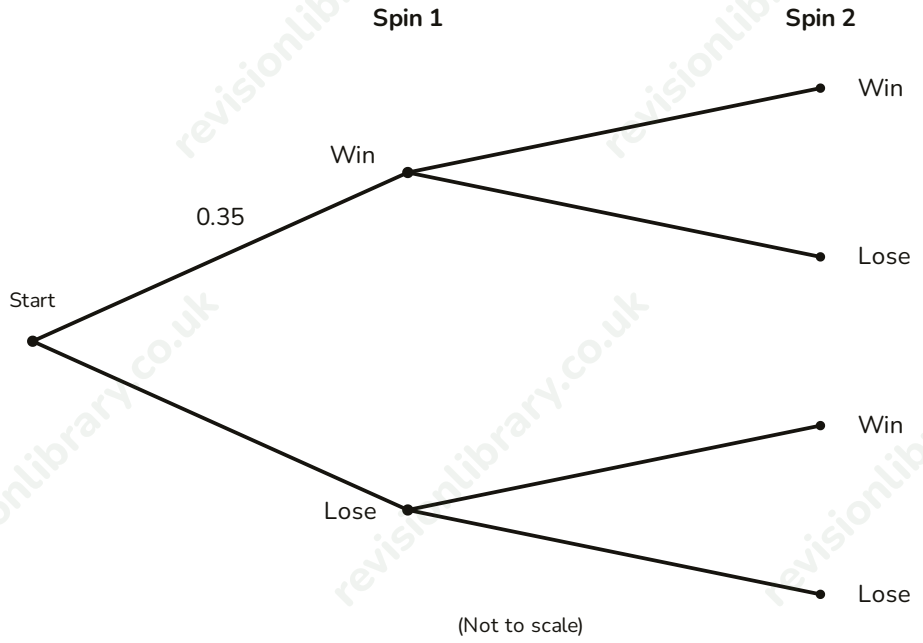
(d) To find the probability that either of two different, mutually exclusive routes through a tree diagram occurs, you add the two route probabilities. **(1)**

- ☐ True
- ☐ False

(Total for Question 4 is 4 marks)

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5 A biased spinner can only land on Win or Lose. The probability that it lands on Win is 0.35.



(a) Write down the probability that the spinner lands on Lose. **(1)**

.....

(b) The spinner is spun twice. The probability tree diagram shows the first spin, with all four second-stage branches left blank. Complete the tree diagram by writing the correct probability on each of the four second-stage branches. **(2)**

(Total for Question 5 is 3 marks)

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6 The probability that it snows on any given day in December this year is 0.1, independently of other days. Two December days are chosen at random.

(a) Write down the probability that it does not snow on a given day. **(1)**

.....

(b) Calculate the probability that it snows on both days. **(2)**

.....

(Total for Question 6 is 3 marks)

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7 A bag contains 4 red counters and 6 blue counters. A counter is chosen at random, its colour noted, and then it is replaced. This process is repeated once more. Draw a probability tree diagram and find the probability that both counters chosen are red.

(Total for Question 7 is 2 marks)

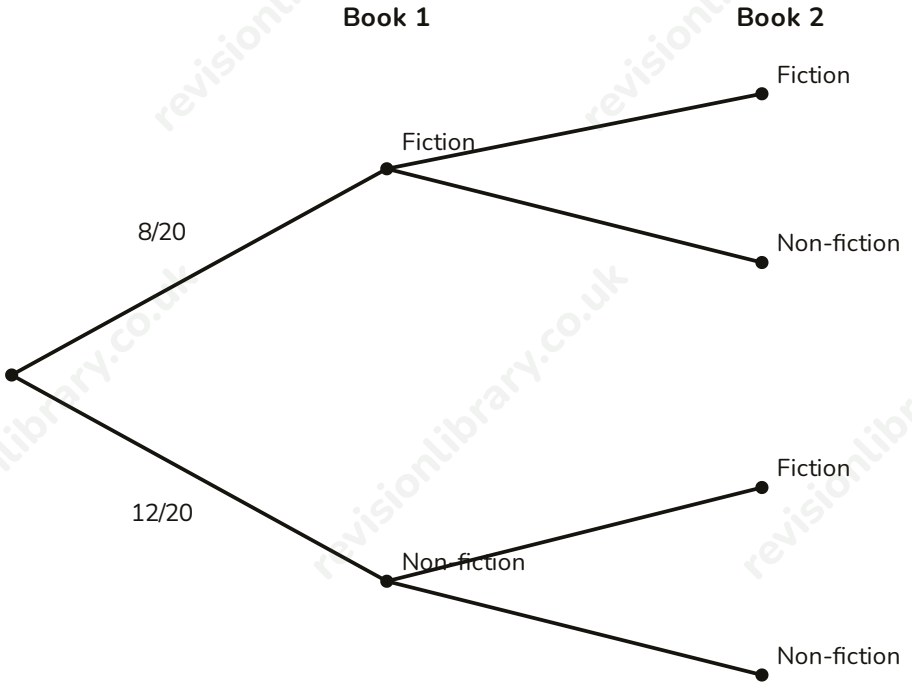
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8 A gardener plants 4 sunflower seeds. Each seed germinates independently with probability 0.9. Find the probability that at least one of the seeds fails to germinate.

(Total for Question 8 is 3 marks)

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9 A library shelf holds 8 fiction books and 12 non-fiction books only. Sophie picks two books from the shelf at random, one after another, without replacement.



(Not to scale)

(a) Complete the probability tree diagram, writing each missing probability as a fraction. **(2)**

(b) Calculate the probability that both books are fiction. **(2)**

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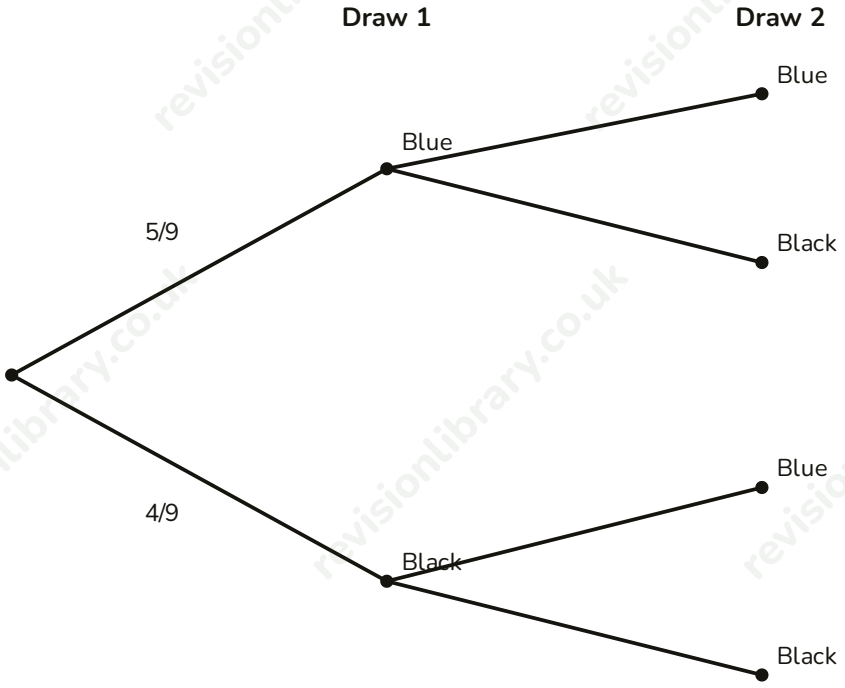
(c) Calculate the probability that exactly one of the two books is fiction. **(3)**

.....

(Total for Question 9 is 7 marks)

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10 A pencil case contains 5 blue pens and 4 black pens only. Ravi takes a pen at random from the pencil case and does not put it back. He then takes a second pen at random.



(Not to scale)

(a) Complete the probability tree diagram, writing each missing probability as a fraction. **(2)**

(b) Calculate the probability that both pens are blue. **(2)**

.....

(c) Calculate the probability that the two pens are different colours. **(3)**

.....

(Total for Question 10 is 7 marks)

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11 Tunde buys 2 raffle tickets from a box of 40 tickets, 5 of which are winning tickets.

(a) Find the probability that both of Tunde's tickets are winning tickets. **(2)**

.....

(b) Find the probability that neither of Tunde's tickets is a winning ticket. **(2)**

.....

(Total for Question 11 is 4 marks)

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12 A machine makes a small part. The probability a part is faulty is 0.02. If a part is faulty, the probability it fails the final inspection is 0.95. If a part is not faulty, the probability it fails the final inspection is 0.01. Use a probability tree to find the probability that a randomly chosen part fails the final inspection.

(Total for Question 12 is 4 marks)

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13 A footballer takes three penalties in training. Each penalty is scored independently with probability 0.75. Calculate the probability that she scores exactly 2 of the 3 penalties.

(Total for Question 13 is 3 marks)

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14 A box contains three green balls and n red balls. Two balls are taken at random one after the other without replacement. The probability both are green is 3/10.

(a) Use a probability tree and show that n satisfies an equation. Solve for n, stating any restrictions on n. **(3)**

(b) Give the probability that the second ball is green. **(2)**

(Total for Question 14 is 5 marks)

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Mark scheme · 5.22 Probability Trees: Test Pack

Question 1

2/5 cao **B1**

Answer: 2/5

Question 2

tree drawn with two first branches labelled Heads and Tails each with probability 1/2 **M1**

second stage probabilities shown as 1/4 on Heads branch and 1/2 on Tails branch **A1**

Answer: Tree with coin branches 1/2 each; from Heads shows red 1/4, from Tails shows red 1/2.

Question 3

use of probability rule: P(spin yellow) x P(tails) = 1/2 x 1/2 **M1**

1/4 cao **A1**

Answer: 1/4

Question 4

(a) True **B1**

(a) Answer: True

(b) True **B1**

(b) Answer: True

(c) False **B1**

(c) Answer: False

(d) True **B1**

(d) Answer: True

Question 5

(a) 0.65 cao **B1**

(a) Answer: 0.65

(b) 0.35 (Win) and 0.65 (Lose) on the branches after Win **B1**

(b) 0.35 (Win) and 0.65 (Lose) on the branches after Lose **B1**

(b) Answer: Win = 0.35 and Lose = 0.65 on each pair of second-stage branches

Question 6

(a) 0.9 cao **B1**

(a) Answer: 0.9

(b) 0.1 x 0.1 **M1**

(b) 0.01 cao **A1**

(b) Answer: 0.01

Question 7

construct tree with probabilities P(R)=4/10 and P(B)=6/10 on each stage or equivalent **M1**

Probability both red = (4/10)*(4/10) = 16/100 = 4/25 cao **A1**

Answer: 4/25 (0.16 or 16/100)

Question 8

0.9^4 (= P(all four seeds germinate)) **M1**

$1 - 0.9^4$ **M1**

0.3439 oe (awrt 0.344) **A1**

Answer: 0.3439

Question 9

(a) 7/19 and 12/19 on the branches after Fiction **B1**

(a) 8/19 and 11/19 on the branches after Non-fiction **B1**

(a) Answer: After Fiction: Fiction 7/19, Non-fiction 12/19. After Non-fiction: Fiction 8/19, Non-fiction 11/19

(b) 8/20 x 7/19 **M1**

(b) 14/95 oe (e.g. 56/380, awrt 0.147) **A1**

(b) Answer: 14/95

(c) 8/20 x 12/19 (or 12/20 x 8/19) for one correct route **M1**

(c) 8/20 x 12/19 + 12/20 x 8/19 (both routes added) **M1**

(c) 48/95 oe (e.g. 192/380, awrt 0.505) **A1**

(c) Answer: 48/95

Question 10

(a) 4/8 and 4/8 on the branches after Blue **B1**

(a) 5/8 and 3/8 on the branches after Black **B1**

(a) Answer: After Blue: Blue 4/8, Black 4/8. After Black: Blue 5/8, Black 3/8

(b) 5/9 x 4/8 **M1**

(b) 5/18 oe (e.g. 20/72) **A1**

(b) Answer: 5/18

(c) 5/9 x 4/8 (or 4/9 x 5/8) for one correct route **M1**

(c) 5/9 x 4/8 + 4/9 x 5/8 (both routes added) **M1**

(c) 5/9 oe (e.g. 40/72) **A1**

(c) Answer: 5/9

Question 11

(a) 5/40 x 4/39 **M1**

(a) 1/78 oe (e.g. 20/1560, awrt 0.0128) **A1**

(a) Answer: 1/78

(b) 35/40 x 34/39 **M1**

(b) 119/156 oe (e.g. 1190/1560, awrt 0.763) **A1**

(b) Answer: 119/156

Question 12

tree or method showing P(faulty and fails) = 0.02 x 0.95 and P(not faulty and fails) = 0.98 x 0.01 **M1**

compute both products 0.019 and 0.0098 (or equivalent) **M1**

sum the two probabilities **M1**

0.019 + 0.0098 = 0.0288 cao **A1**

Answer: 0.0288

Question 13

0.75 x 0.75 x 0.25 (= 0.140625, one correct route) **M1**

3 x (0.75 x 0.75 x 0.25) (all three arrangements identified and added) **M1**

0.421875 oe (awrt 0.422) **A1**

Answer: 0.421875

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Question 14

(a) write probability both green = (3/(3+n))*((3-1)/(2+n)) = (3/(3+n))*(2/(2+n)) **M1**

(a) set equal to 3/10 and rearrange to (3+n)(2+n) = 20 or equivalent quadratic **M1**

(a) n = 2 with restriction n is a non-negative integer and n <> -2, -3; reject n = -7 **A1**

(a) Answer: n = 2

(b) use total probability: P(second green) = P(GG) + P(RG) = (3/5)*(2/4) + (2/5)*(3/4) **M1**

(b) 3/5 = 0.6 cao **A1**

(b) Answer: 3/5 (0.6)

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