5.22 Probability Trees: 1-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A bag contains 2 green, 3 red and 5 white beads. Rachel picks a bead at random. If she picks white, she replaces it and then picks again. If she picks green or red, she does not replace it and picks again. Draw a probability tree and find the probability Rachel picks white on the first pick and red on the second pick.

(Total for Question 1 is 4 marks)

2 A school lottery has two stages. Stage 1: 30% of entrants win a small prize. Stage 2: those who did not win stage 1 take part in a draw where there is a 5% chance of winning a second prize. Find the probability an entrant wins a prize in stage 2.

(Total for Question 2 is 3 marks)

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3 The probability that Leon's football team wins any given match is 0.3, independently of other matches. Consider the team's next two matches.

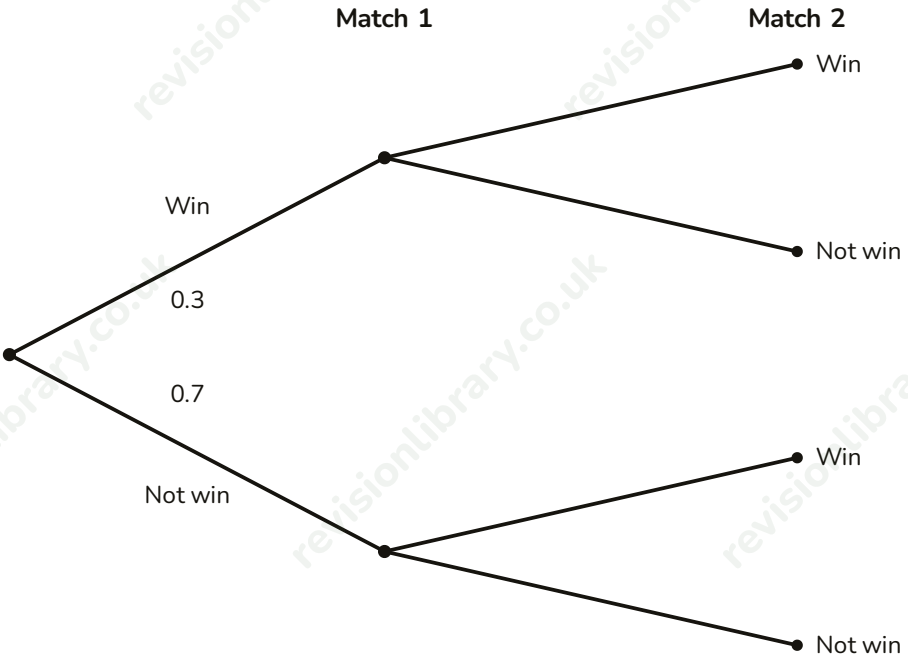


Diagram NOT to scale

(a) Complete the probability tree diagram for the two matches by writing the missing probability on each of the four second-stage branches. **(2)**

(b) Calculate the probability that the team wins exactly one of the two matches. **(3)**

.....

(c) Calculate the probability that the team wins at least one of the two matches. **(3)**

.....

(Total for Question 3 is 8 marks)

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4 On any given day, the probability that Jamal passes his driving theory mock test is 0.8. The probability that he passes his practical mock test is 0.75. The results of the two mock tests are independent of each other.

(a) Find the probability that Jamal passes both mock tests. **(2)**

(b) Find the probability that Jamal passes exactly one of the two mock tests. **(3)**

(Total for Question 4 is 5 marks)

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5 A box contains 4 blue cards and 6 yellow cards. A card is chosen at random. If the card is blue, it is replaced and the process ends. If the card is yellow, it is not replaced and a second card is chosen.

(a) Draw a probability tree for the process. **(2)**

(b) Find the probability that two cards are chosen and both are yellow. **(2)**

(c) Find the probability that the process ends after the first draw (that is, a blue card is drawn first). **(2)**

(Total for Question 5 is 6 marks)

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6 A school has two routes for pupils to arrive by bus: Route X and Route Y. On any day, 60% of pupils use Route X and 40% use Route Y. On Route X a pupil is late with probability 0.05. On Route Y a pupil is late with probability 0.12.

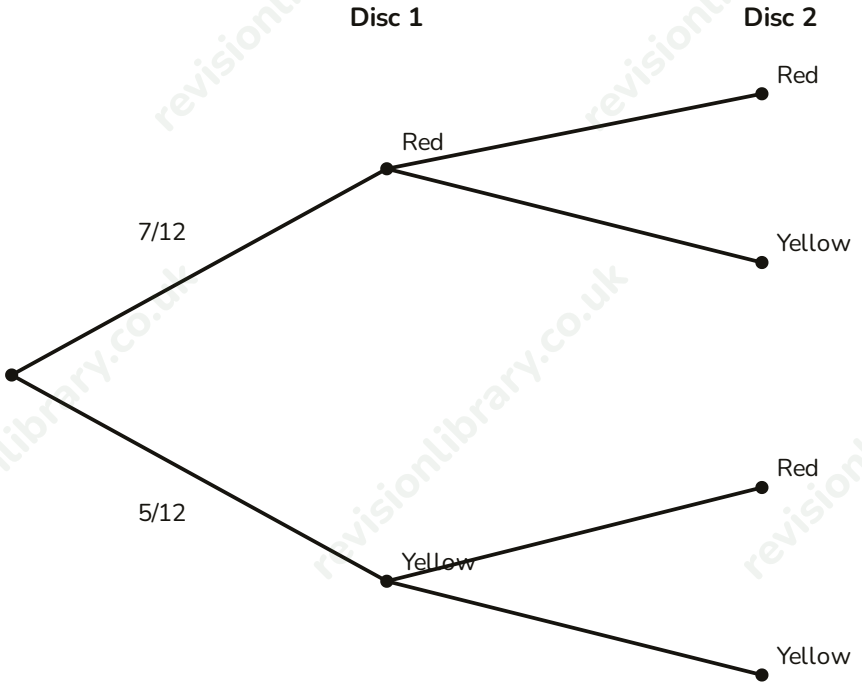
(a) Find the probability that the pupil uses Route Y and is late. **(1)**

(b) Find the probability that the pupil is late (use the tree). **(2)**

(Total for Question 6 is 3 marks)

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7 A box contains 7 red discs and 5 yellow discs only. Mei takes a disc at random from the box and does not replace it. She then takes a second disc at random.



(Not to scale)

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

(b) Given that the first disc Mei takes is red, write down the probability that the second disc is yellow. **(1)**

.....

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

.....

(Total for Question 7 is 6 marks)

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8 A box contains 3 winning raffle tickets and 17 non-winning tickets only. Callum takes two tickets from the box at random, one after another, without replacement. Find the probability that at least one of Callum's tickets is a winning ticket.

(Total for Question 8 is 3 marks)

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9 A bag contains 4 gold discs and n silver discs only, where $n > 0$. Two discs are taken from the bag at random, one after another, without replacement.

(a) Show that the probability that both discs are gold is $12 / ((n+4)(n+3))$. **(3)**

(b) Given that the probability that both discs are gold is 2/15, show that $n^2 + 7n - 78 = 0$. **(2)**

(c) Hence find the number of silver discs in the bag. **(3)**

(Total for Question 9 is 8 marks)

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Mark scheme · 5.22 Probability Trees: 1-hour Pack

Question 1

tree showing first pick probabilities 2/10, 3/10, 5/10 and second pick branches with replacement for white and without replacement otherwise	**M1**
compute probability for white then red: P(white first) x P(red second given white replaced) = 5/10 x 3/10	**M1**
numerical multiplication shown 1/2 x 3/10	**M1**
3/20 = 0.15 cao	**A1**

Answer: 3/20 or 0.15

Question 2

recognise P(not win stage 1) = 0.7 and multiply by 0.05	**M1**
compute 0.7 x 0.05 = 0.035	**M1**
0.035 or 3.5% cao	**A1**

Answer: 0.035 or 3.5%

Question 3

(a) 0.3 (Win) on both second-stage branch pairs	**B1**
(a) 0.7 (Not win) on both second-stage branch pairs	**B1**

(a) Answer: Win = 0.3 and Not win = 0.7 on each set of second-stage branches

(b) 0.3 x 0.7 (or 0.7 x 0.3) for one correct route	**M1**
(b) 0.3 x 0.7 + 0.7 x 0.3 (both routes identified and added)	**M1**
(b) 0.42 cao	**A1**

(b) Answer: 0.42

(c) 0.7 x 0.7 (= P(no wins in either match))	**M1**
(c) 1 - 0.7 x 0.7	**M1**
(c) 0.51 cao	**A1**

(c) Answer: 0.51

Question 4

(a) 0.8 x 0.75	**M1**
(a) 0.6 cao	**A1**

(a) Answer: 0.6

(b) 0.8 x 0.25 (or 0.2 x 0.75) for one correct route	**M1**
(b) 0.8 x 0.25 + 0.2 x 0.75 (both routes added)	**M1**
(b) 0.35 cao	**A1**

(b) Answer: 0.35

Question 5

(a) tree with first branches Blue 4/10 and Yellow 6/10 and second branch from Yellow with two outcomes: Blue 4/9 and Yellow 5/9	**M1**
(a) replacement noted for blue branch (process ends) and no replacement for yellow branch	**A1**

(a) Answer: Tree with first draw Blue 4/10 ends, Yellow 6/10 then second draw probabilities 4/9 blue and 5/9 yellow.

(b) use P(Y then Y) = 6/10 x 5/9 (one yellow removed leaves 5 yellow out of 9)	**M1**
(b) 30/90 = 1/3 cao	**A1**

(b) Answer: 1/3

(c) recognise this is P(first draw is blue) = 4/10	**M1**
(c) 2/5 or 0.4 cao	**A1**

(c) Answer: 2/5 or 0.4

Question 6

(a) 0.4 * 0.12 = 0.048 cao	**B1**

(a) Answer: 0.048

(b) sum probabilities: 0.6*0.05 + 0.4*0.12 or equivalent	**M1**
(b) 0.078 cao	**A1**

(b) Answer: 0.078

Question 7

(a) 6/11 and 5/11 on the branches after Red	**B1**
(a) 7/11 and 4/11 on the branches after Yellow	**B1**

(a) Answer: After Red: Red 6/11, Yellow 5/11. After Yellow: Red 7/11, Yellow 4/11

(b) 5/11 oe	**B1**

(b) Answer: 5/11

(c) 7/12 x 5/11 (or 5/12 x 7/11) for one correct route	**M1**
(c) 7/12 x 5/11 + 5/12 x 7/11 (both routes added)	**M1**
(c) 35/66 oe (e.g. 70/132, awrt 0.530)	**A1**

(c) Answer: 35/66

Question 8

17/20 x 16/19 (= P(neither ticket wins))	**M1**
1 - 17/20 x 16/19	**M1**
27/95 oe (e.g. 1 - 68/95, awrt 0.284)	**A1**

Answer: 27/95

Question 9

(a) P(first gold) = 4/(n+4)	**M1**
(a) P(second gold | first gold) = 3/(n+3)	**M1**
(a) cso: 4/(n+4) x 3/(n+3) = 12/((n+4)(n+3))	**A1**

(a) Answer: 12 / ((n+4)(n+3)) shown

(b) 12/((n+4)(n+3)) = 2/15 oe, i.e. (n+4)(n+3) = 90	**M1**
(b) cso: expands to $n^2 + 7n + 12 = 90$, giving $n^2 + 7n - 78 = 0$	**A1**

(b) Answer: $n^2 + 7n - 78 = 0$ (shown)

(c) (n - 6)(n + 13) = 0 oe, or correct use of the quadratic formula	**M1**
(c) n = 6 selected, rejecting n = -13 since n > 0	**M1**
(c) n = 6 cao	**A1**

(c) Answer: 6 silver discs

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