11 Sid has 2 boxes of crayons, box **X** and box **Y**

5 of the 16 crayons in box **X** are red. **5/16 red**   $1 - 5/16 = 11/16$ **not**
7 of the 20 crayons in box **Y** are red. **7/20**   $1 - 7/20 = 13/20$ **not**
Sid takes at random one crayon from box **X** and one crayon from box **Y**

(a) Complete the probability tree diagram.

box **X**                    box **Y**

**7/20**  red   **R R**   $\frac{15}{16} \times \frac{7}{20} = \frac{105}{320}$

$\frac{5}{16}$  red

**13/20**  not red

**7/20**  red

$\frac{11}{16}$  not red

**13/20**  not red  **NR, NR**   $\frac{11}{16} \times \frac{13}{20} = \frac{143}{320}$

(2)

(b) Work out the probability that Sid takes two crayons that are red or two crayons that are not red.

$$\frac{105}{320} + \frac{143}{320} = \frac{248}{320}$$

$$= \frac{31}{40}$$

(3)

**(Total for Question 11 is 5 marks)**

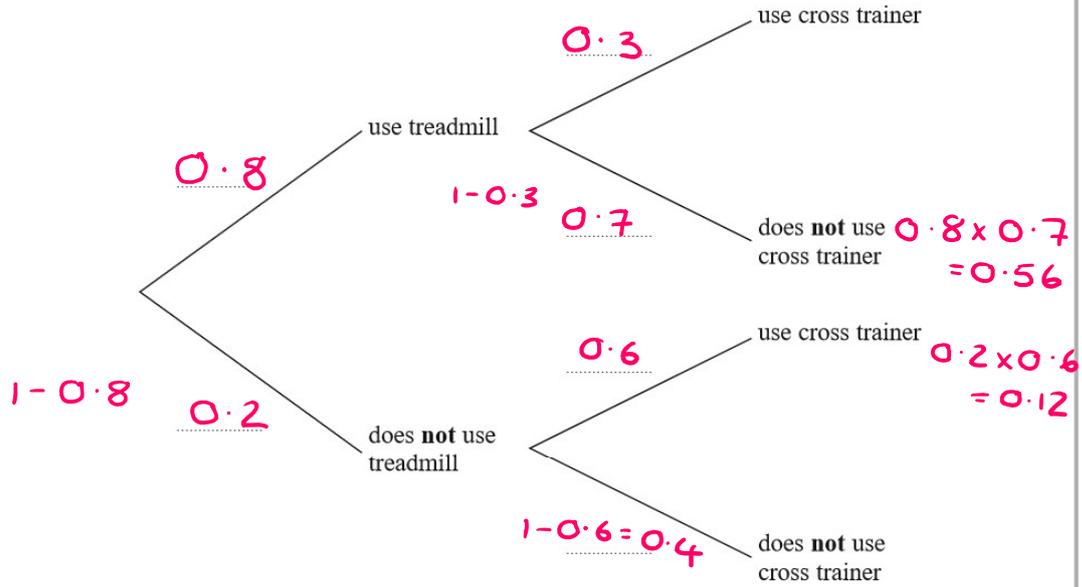P 7 3 4 6 9 A 0 1 1 2 4

Data Page 2

12 Rudolf goes to the gym.

The probability that he will use the treadmill is 0.8

When he uses the treadmill, the probability that he will use the cross trainer is 0.3
When he does **not** use the treadmill, the probability that he will use the cross trainer is 0.6

(a) Complete the probability tree diagram for this information.

use treadmill — **0.3** — use cross trainer

**0.8**

**1−0.3  0.7** — does **not** use cross trainer — **0.8 × 0.7 = 0.56**

**1−0.8  0.2** — does **not** use treadmill — **0.6** — use cross trainer — **0.2 × 0.6 = 0.12**

**1−0.6=0.4** — does **not** use cross trainer

(2)

(b) Work out the probability that Rudolf uses both the treadmill and the cross trainer.

**0.56 + 0.12 = 0.68**

(2)

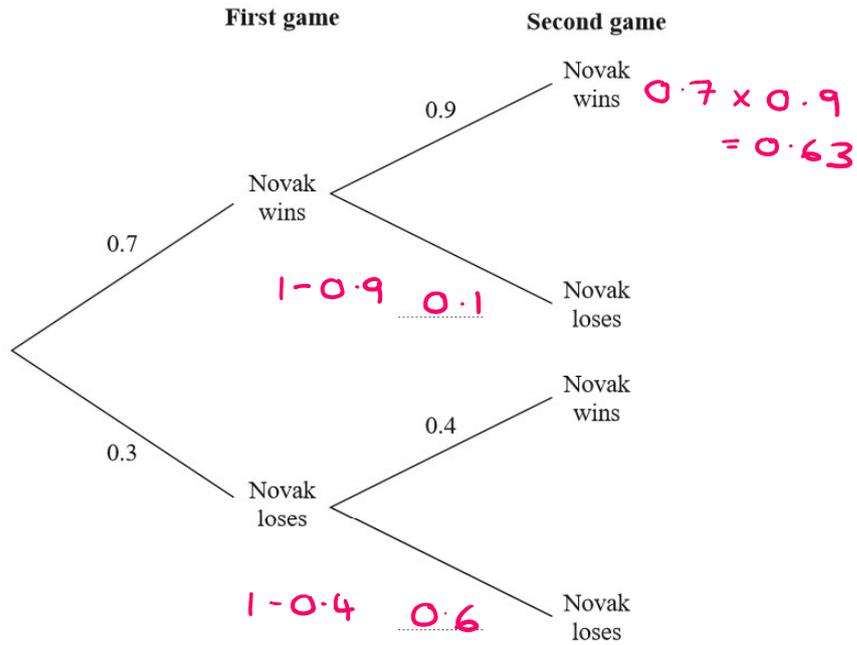(Total for Question 12 is 4 marks)

Data Page 3

13 Novak is going to play two games of tennis.

The probability that he wins the first game is 0.7

If he wins the first game, the probability that he wins the second game is 0.9
If he loses the first game, the probability that he wins the second game is 0.4

(a) Complete the probability tree diagram.

**First game**                    **Second game**

0.7 — Novak wins

0.9 — Novak wins    0.7 × 0.9 = 0.63

1 − 0.9    0.1 — Novak loses

0.3 — Novak loses

0.4 — Novak wins

1 − 0.4    0.6 — Novak loses

(1)

(b) Work out the probability that Novak wins both games of tennis.
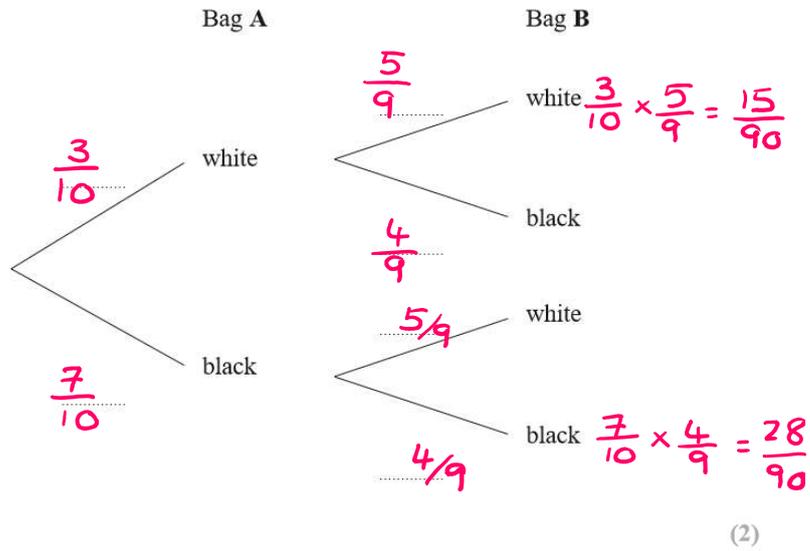
0.63

(2)

(Total for Question 13 is 3 marks)

Data Page 4

13  Narin has two fair 6-sided dice.

Dice **A** has 2 red faces and 4 yellow faces.
Dice **B** has 1 red face and 5 yellow faces.

Narin is going to throw each dice once.

(a) Complete the probability tree diagram.

Dice A                    Dice B

$\frac{1}{6}$ red

red

$\frac{2}{6}$

$\frac{5}{6}$ yellow

$\frac{4}{6}$

$\frac{1}{6}$ red

yellow

$\frac{5}{6}$ yellow

(2)

(b) Work out the probability that both dice land on yellow.

$$\frac{4}{6} \times \frac{5}{6} = \frac{20}{36}$$

$$= \frac{5}{9}$$

(2)

**(Total for Question 13 is 4 marks)**

P 7 2 8 2 8 A 0 1 3 2 8

13 The probability that Thomas gets to work early on Saturday is 0.7

If Thomas gets to work early on Saturday, the probability that he will get to work early on Sunday is 0.9

If Thomas does **not** get to work early on Saturday, the probability that he will get to work early on Sunday is 0.6

(a) Use this information to complete the probability tree diagram.

Saturday        Sunday

0.9    early    0.7 × 0.9 = 0.63

early

0.7

0.1    not early

0.6    early

0.3

not early

0.4    not early

(2)

(b) Work out the probability that Thomas gets to work early on both Saturday and Sunday.

0.63

(2)

**(Total for Question 13 is 4 marks)**

*Turn over* ▶

Data Page 6

13 Harman has two bags of beads.

In bag **A**, there are 3 white beads and 7 black beads.
In bag **B**, there are 5 white beads and 4 black beads.

Harman takes at random a bead from bag **A** and a bead from bag **B**

(a) Complete the probability tree diagram.

Bag **A**                    Bag **B**

$\frac{5}{9}$

white $\frac{3}{10} \times \frac{5}{9} = \frac{15}{90}$

$\frac{3}{10}$     white

black

$\frac{4}{9}$

5/9     white

$\frac{7}{10}$     black

black $\frac{7}{10} \times \frac{4}{9} = \frac{28}{90}$

4/9

(2)

(b) Work out the probability that Harman takes two beads of the same colour.

WW or BB

$\frac{15}{90} + \frac{28}{90} = \frac{43}{90}$

(3)

**(Total for Question 13 is 5 marks)**

P 7 3 9 9 0 A 0 1 4 2 8

13 Hector has a bag that contains 12 counters.
There are 7 green counters and 5 red counters in the bag.

Hector takes at random a counter from the bag.
He looks at the counter and puts the counter back into the bag.

Hector then takes at random a second counter from the bag.
He looks at the counter and puts the counter back into the bag.

(a) Complete the probability tree diagram.

**First counter**          **Second counter**

$\frac{7}{12}$ (handwritten) ........ Green

$\frac{7}{12}$ Green

$\frac{5}{12}$ (handwritten) ........ Red

$\frac{7}{12}$ Green

$\frac{5}{12}$ (handwritten) Red

$\frac{5}{12}$ Red $\frac{5}{12} \times \frac{5}{12} = \frac{25}{144}$ (handwritten)

$\frac{5}{12}$

(2)
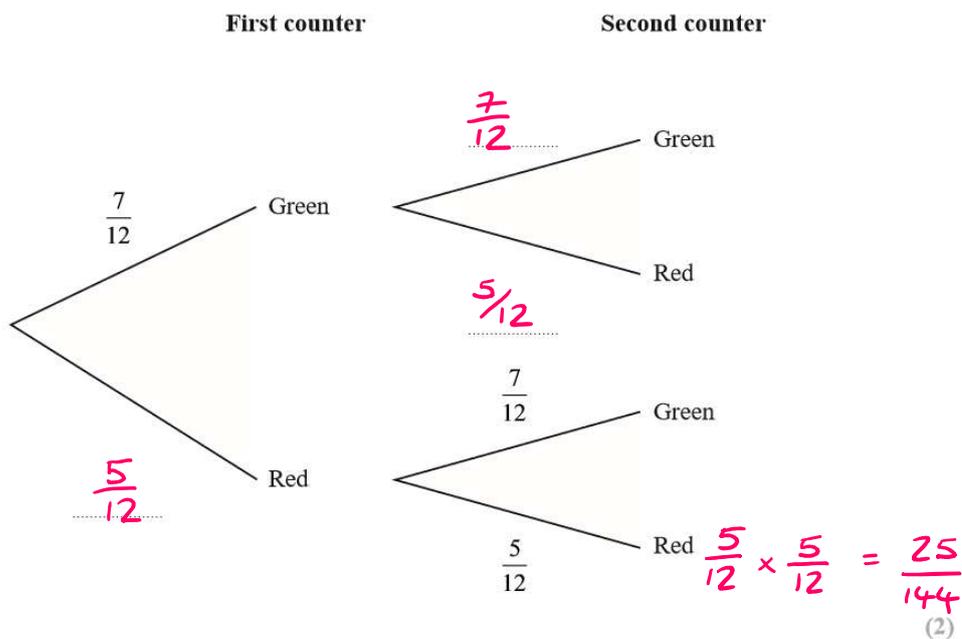
(b) Work out the probability that both counters are red.

$\frac{25}{144}$ (handwritten)

..................................................

(2)

Meghan has a jar containing 15 counters.
There are only blue counters, green counters and red counters in the jar.

Hector is going to take at random one of the counters from his bag of 12 counters.
He will look at the counter and put the counter back into the bag.

Hector is then going to take at random a second counter from his bag.
He will look at the counter and put the counter back into the bag.

Meghan is then going to take at random one of the counters from her jar of counters.
She will look at the counter and put the counter back into the jar.

The probability that the 3 counters each have a different colour is $\dfrac{7}{24}$

(c) Work out how many blue counters there are in the jar.

| Hector 1 | Hector 2 | Meghan |
|---|---|---|
| Green | Red | Blue |
| Red | Green | Blue |

$$\left( \frac{7}{12} \times \frac{5}{12} \times \frac{x}{15} \right) \times 2 = \frac{7}{24}$$

$$\frac{35}{144} \times \frac{x}{15} = \frac{7}{48}$$

$$\frac{x}{15} = \frac{3}{5}$$

$$x = 9$$

(3)

(Total for Question 13 is 7 marks)

Data Page 9

13 Felix has 10 cards.
There are 5 red cards, 4 blue cards and 1 green card.

Felix takes at random one of the cards.
He does not replace the card.
Felix then takes at random a second card.

(a) Complete the probability tree diagram.

First card          Second card

$\frac{4}{9}$    red   RR  ×

red   $\frac{4}{9}$   blue   RB ✓  $\frac{5}{10} \times \frac{4}{9} = \frac{20}{90}$

$\frac{5}{10}$   $\frac{1}{9}$   green   RG ×

$\frac{4}{10}$   $\frac{5}{9}$   red   BR ✓  $\frac{4}{10} \times \frac{5}{9} = \frac{20}{90}$

blue   $\frac{3}{9}$   blue   BB ✓   $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$

$\frac{1}{10}$   green   BG ×

$\frac{5}{9}$   red   GR ×

green   $\frac{4}{9}$   blue   GB ×

$0$   green   GG ×

(2)
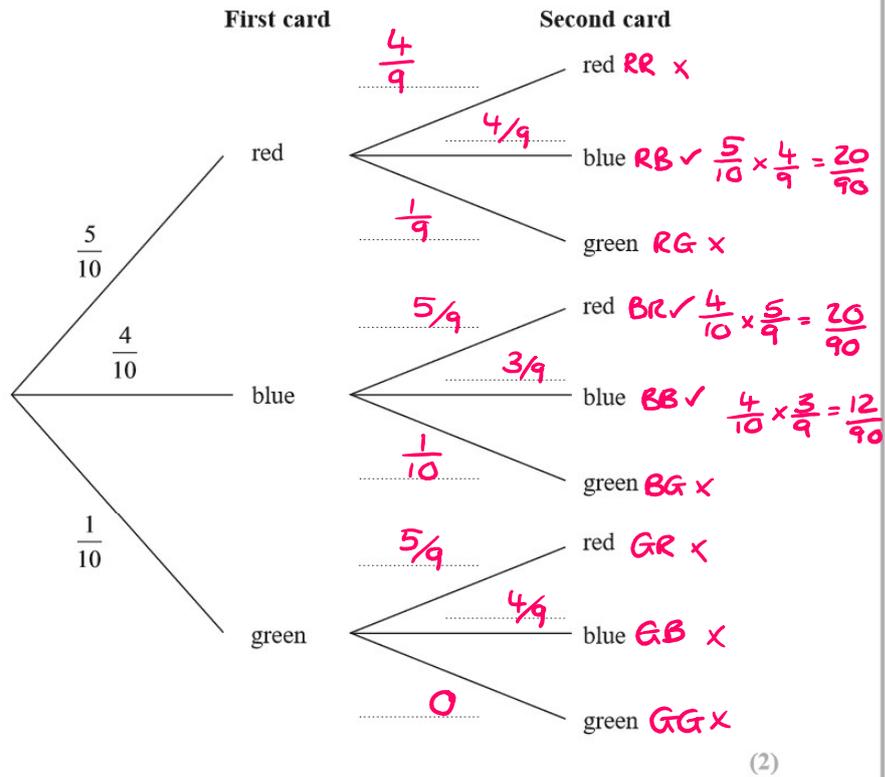
(b) Work out the probability that Felix takes at least one blue card and no green card.

$$\frac{20}{90} + \frac{20}{90} + \frac{12}{90} = \frac{52}{90}$$
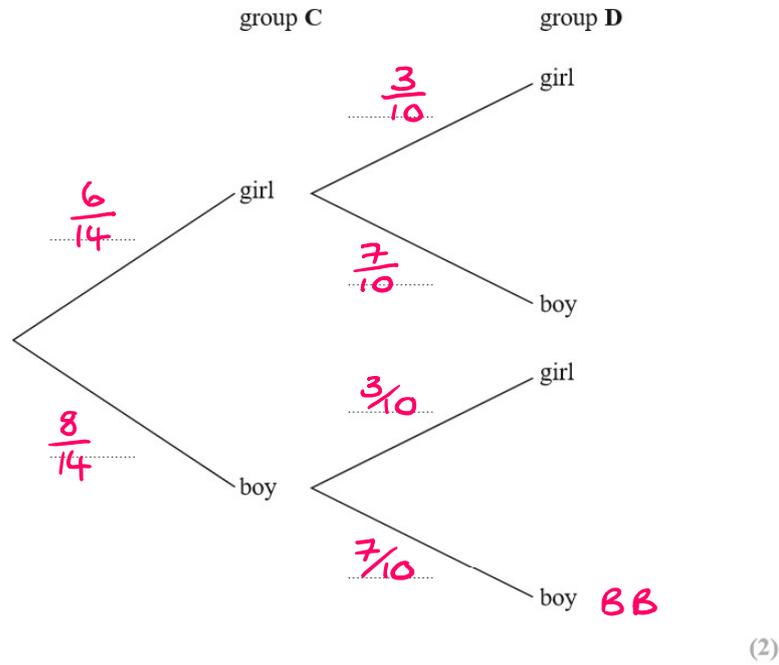
$$= \frac{26}{45}$$

(3)

(Total for Question 13 is 5 marks)

13  In group **C**, there are 6 girls and 8 boys.
    In group **D**, there are 3 girls and 7 boys.

    A team is made by picking at random one child from group **C** and one child from group **D**.

    (a) Complete the probability tree diagram.

                              group **C**                    group **D**

                                                    $\frac{3}{10}$        girl

                            $\frac{6}{14}$     girl

                                                    $\frac{7}{10}$        boy

                                                    $\frac{3}{10}$        girl

                            $\frac{8}{14}$     boy

                                                    $\frac{7}{10}$        boy  $BB$

                                                                          (2)

    (b) Work out the probability that there are two boys in the team.

        $$\frac{8}{14} \times \frac{7}{10} = \frac{56}{140}$$

        $$= \frac{2}{5}$$

                                                                          (2)

After the first team has been picked, a second team is picked.
One child is picked at random from the children left in group **C** and one child is picked at random from the children left in group **D**.

(c) Work out the probability that there are two boys in each of the two teams.

1st time - 2 boys

$\frac{2}{5}$

2nd time - 2 boys
Boy from C      Boy from D

$\frac{7}{13}$   ×   $\frac{6}{9}$   =   $\frac{42}{117}$

$\frac{2}{5} \times \frac{42}{117} = \frac{84}{585}$

$= \frac{28}{195}$

(3)

**(Total for Question 13 is 7 marks)**

13 Emilie takes part in two races.

The probability that she wins the first race is 0.7
The probability that she wins the second race is 0.4
The outcomes of the two races are independent.

(a) Complete the probability tree diagram.
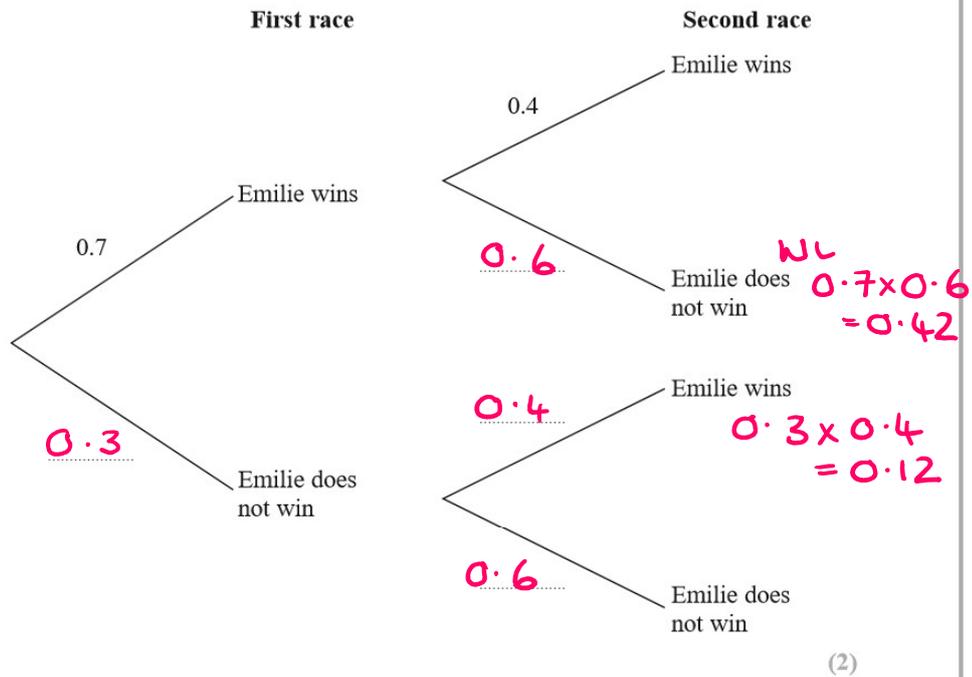
**First race**                                    **Second race**

                                                    Emilie wins
                                        0.4
                              Emilie wins
                0.7                                 Emilie does   WL
                                        0.6         not win       0.7×0.6
                                                                  =0.42

                                        0.4         Emilie wins
                                                                  0.3×0.4
                0.3                                                    =0.12
                              Emilie does
                              not win
                                        0.6
                                                    Emilie does
                                                    not win

(2)

(b) Work out the probability that Emilie wins exactly one of the two races.

↳ Win lose + lose win

0.42 + 0.12

= 0.54

(3)

P6 5 9 1 8 A 0 1 4 2 8

Emilie is going to take part in a third race.

If she wins both of the first two races, the probability that she will win the third race is 0.6

If she wins exactly one of the first two races, the probability that she will win the third race is 0.3

(c) Work out the probability that Emilie will win exactly two of the three races.

L = 0.4

WWL = 0.7 × 0.4 × 0.4

= 0.112

Wins 1 of 2 then win = 0.54 × 0.3

= 0.162

0.112 + 0.162 = 0.274

(3)

(Total for Question 13 is 8 marks)

P 6 5 9 1 8 A 0 1 5 2 8

Data Page 14

14 Each day that Barney goes to college, he either goes by bus or he walks.
The probability that Barney will go to college by bus on any day is 0.3

When Barney goes to college by bus, the probability that he will be late is 0.2
When Barney walks to college, the probability that he will be late is 0.1

(a) Complete the probability tree diagram.

0.2     late     0.3 x 0.2
                    = 0.06

bus

0.3

0.8     not late

0.1     late     0.7 x 0.1
                    = 0.07

0.7

walk

0.9     not late
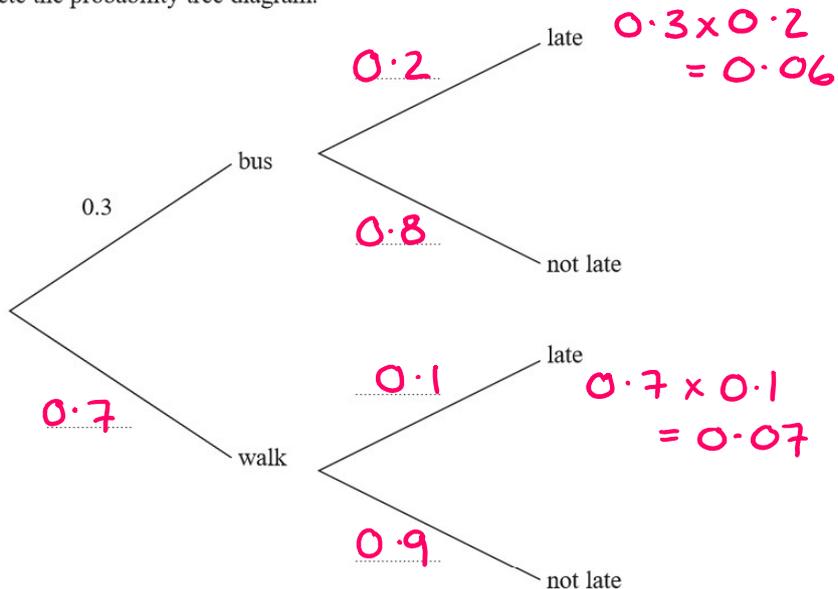
(2)

Barney will go to college on 200 days next year.

(b) Work out an estimate for the number of days Barney will be late for college next year.

Bus late + walk late

0.06 + 0.07 = 0.13

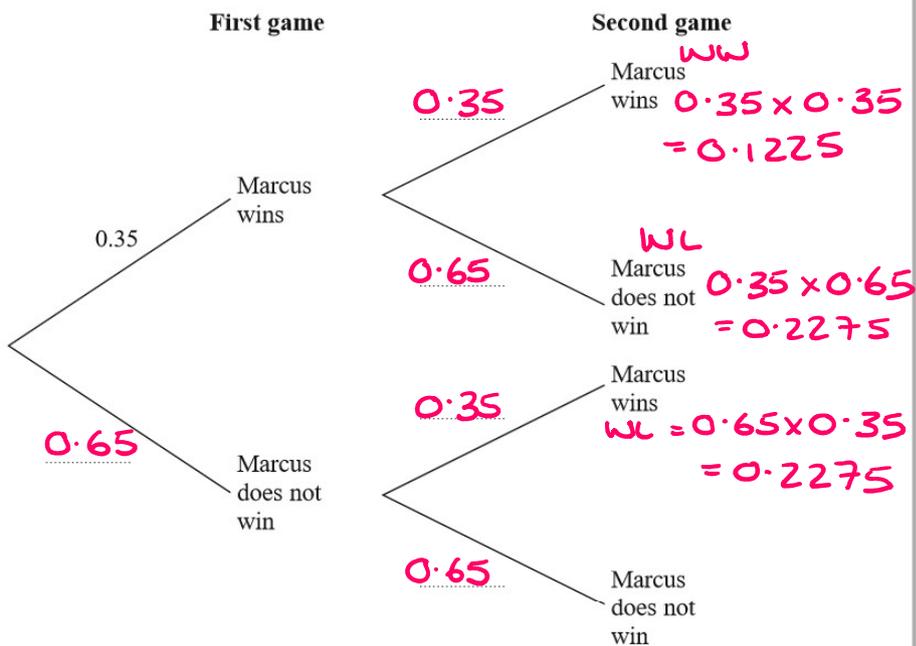200 x 0.13 = 26 days late

(4)

(Total for Question 14 is 6 marks)

14 Marcus plays two games of tennis.
For each game, the probability that Marcus wins is 0.35

(a) Complete the probability tree diagram.

**First game**                          **Second game**

                                        Marcus    WW
                            0.35        wins   0.35 × 0.35
                                               = 0.1225
            Marcus
            wins
    0.35                                       WL
                            0.65        Marcus   0.35 × 0.65
                                        does not   = 0.2275
                                        win

                                        Marcus
                            0.35        wins   WL = 0.65 × 0.35
                                                   = 0.2275
    0.65        Marcus
                does not
                win
                            0.65        Marcus
                                        does not
                                        win

(2)

(b) Work out the probability that Marcus wins at least one of the two games of tennis.

WW + WL + LW

0.1225 + 0.2275 + 0.2275 = 0.5775

(3)

(Total for Question 14 is 5 marks)

*Turn over* ▶
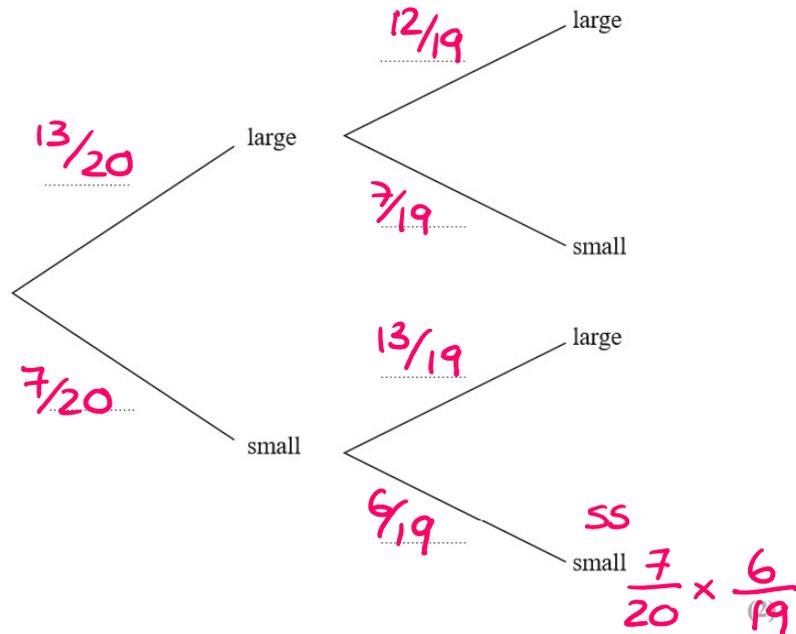
P 5 9 0 1 9 A 0 1 5 2 4

14 There are 20 glasses in a cupboard.

   13 of the glasses are large
   7 of the glasses are small

Roberto takes at random two glasses from the cupboard.

(a) Complete the probability tree diagram.

13/20 large

12/19 large

7/19 small

7/20 small

13/19 large

6/19 small

SS

$\frac{7}{20} \times \frac{6}{19}$

(b) Work out the probability that Roberto takes two small glasses.

$$\frac{42}{380} = \frac{21}{190}$$

(2)

(Total for Question 14 is 4 marks)

P 5 9 7 6 2 A 0 1 4 2 8

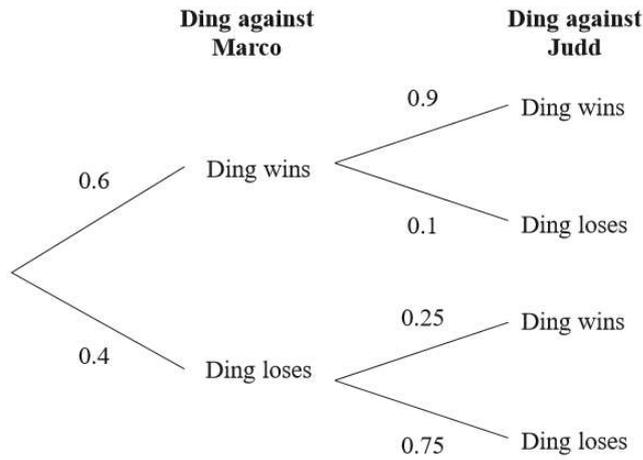DO NOT WRITE IN THIS AREA

14 Ding is going to play one game of snooker against each of two of his friends, Marco and Judd.

The probability tree diagram gives information about the probabilities that Ding will win or lose each of these two games.

Ding against Marco | Ding against Judd

0.6 — Ding wins
0.9 — Ding wins
0.1 — Ding loses

0.4 — Ding loses
0.25 — Ding wins
0.75 — Ding loses

(a) Work out the probability that Ding will win both games.

$0.6 \times 0.9 = 0.54$

(2)

(b) Work out the probability that Ding will win exactly one of the games.

WL + LW

$0.6 \times 0.1$ + $0.4 \times 0.25$

$0.06$ + $0.1$

$= 0.16$

(3)

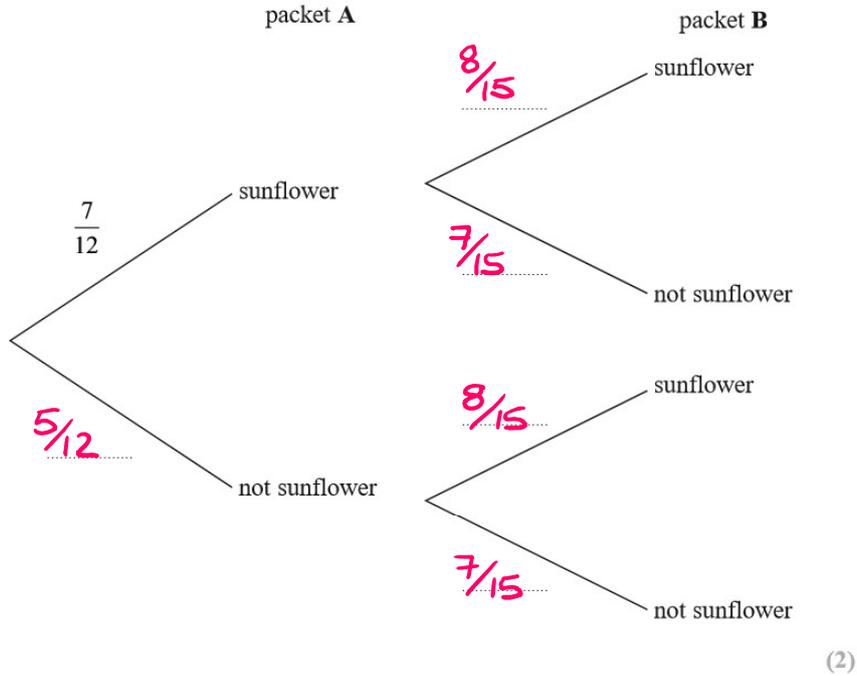(Total for Question 14 is 5 marks)

16

P 6 6 2 9 7 A 0 1 6 2 8

Data Page 18

14  Aika has 2 packets of seeds, packet **A** and packet **B**

There are 12 seeds in packet **A** and 7 of these are sunflower seeds.
There are 15 seeds in packet **B** and 8 of these are sunflower seeds.

Aika is going to take at random a seed from packet **A** and a seed from packet **B**

(a) Complete the probability tree diagram.

packet **A**                                        packet **B**

$\frac{8}{15}$  sunflower

$\frac{7}{12}$  sunflower

$\frac{7}{15}$  not sunflower

$\frac{5}{12}$

$\frac{8}{15}$  sunflower

not sunflower

$\frac{7}{15}$  not sunflower

(2)

(b) Calculate the probability that Aika will take two sunflower seeds.

$$\frac{7}{12} \times \frac{8}{15} \quad = \quad \frac{56}{180}$$

$$= \quad \frac{14}{45}$$

(2)

**(Total for Question 14 is 4 marks)**

P 6 9 1 9 6 A 0 1 5 2 8

Data Page 19

15 Harry has two fair 5-sided spinners.

red
red
green
green
green

Spinner **A**

red
red
green
red
red

Spinner **B**

Harry is going to spin each spinner once.

(a) Complete the probability tree diagram.

Spinner **A**          Spinner **B**

$\frac{4}{5}$      red

$\frac{2}{5}$   red

$\frac{1}{5}$      RG   green   $\frac{2}{5} \times \frac{1}{5} = \frac{2}{25}$

$\frac{4}{5}$   red   GR   $\frac{3}{5} \times \frac{4}{5} = \frac{12}{25}$

$\frac{3}{5}$   green

$\frac{1}{5}$   GG   green   $\frac{3}{5} \times \frac{1}{5} = _{(2)} \frac{3}{25}$

16

P 6 2 6 5 2 A 0 1 6 2 8

(b) Work out the probability that at least one of the spinners will land on green.

GG + RG + GR

$\frac{3}{25} + \frac{2}{25} + \frac{12}{25}$

$= \frac{17}{25}$

(3)

**(Total for Question 15 is 5 marks)**
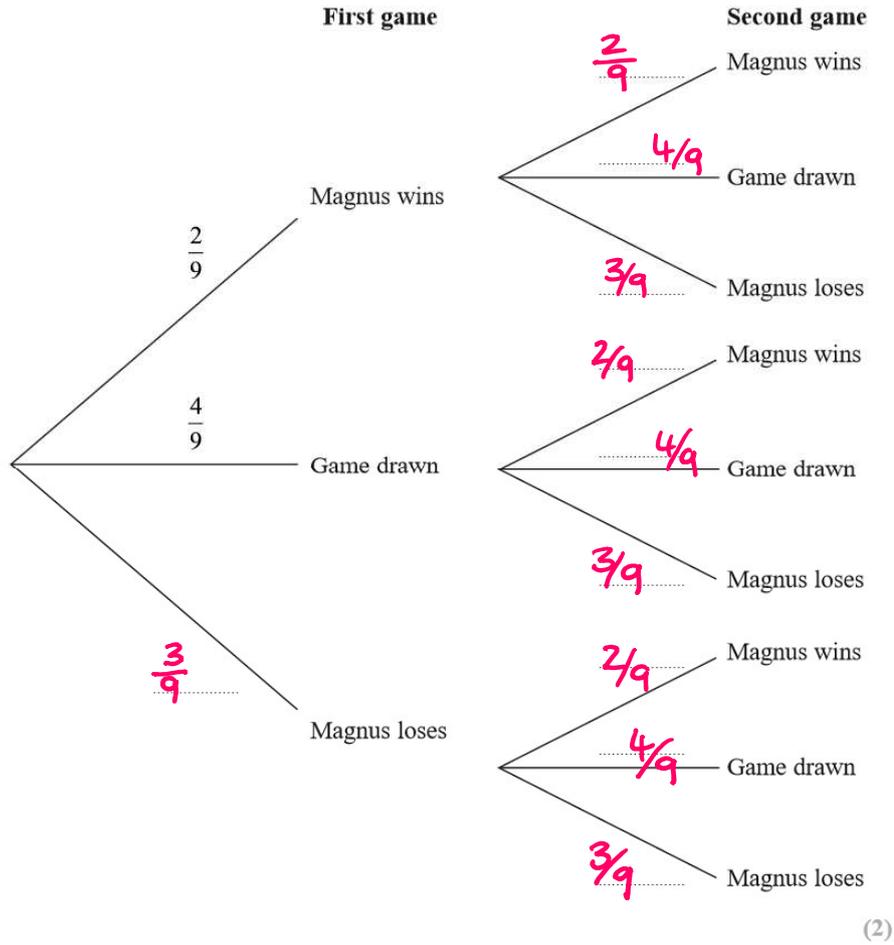
P 6 2 6 5 2 A 0 1 7 2 8

15 Magnus and Garry play 2 games of chess against each other.

The probability that Magnus beats Garry in any game is $\frac{2}{9}$

The probability that any game between Magnus and Garry is drawn is $\frac{4}{9}$

The result of any game is independent of the result of any other game.

(a) Complete the probability tree diagram.

**First game**　　　　　　　　　**Second game**

$\frac{2}{9}$ — Magnus wins
$\frac{4}{9}$ — Game drawn
$\frac{3}{9}$ — Magnus loses

Magnus wins $\frac{2}{9}$

$\frac{2}{9}$ — Magnus wins
$\frac{4}{9}$ — Game drawn
$\frac{3}{9}$ — Magnus loses

Game drawn $\frac{4}{9}$

$\frac{2}{9}$ — Magnus wins
$\frac{4}{9}$ — Game drawn
$\frac{3}{9}$ — Magnus loses

Magnus loses $\frac{3}{9}$

(2)

For each game of chess,

the winner gets 2 points and the loser gets 0 points,
when the game is drawn, each player gets 1 point.

(b) Work out the probability that, after 2 games, Magnus and Garry have the same number of points.

$$\frac{2}{9} \times \frac{3}{9} + \frac{4}{9} \times \frac{4}{9} + \frac{3}{9} \times \frac{2}{9}$$

$$\frac{6}{81} + \frac{16}{81} + \frac{6}{81}$$

$$= \frac{28}{81}$$

(3)

Magnus and Garry now play a third game of chess.

(c) Work out the probability that, after 3 games, Magnus and Garry have the same number of points.

| W | L | D | M 3 | G 3 | (×6) |
| D | D | D | 3 | 3 | |

$$= 6 \times \left(\frac{2}{9} \times \frac{3}{9} \times \frac{4}{9}\right) + \left(\frac{4}{9} \times \frac{4}{9} \times \frac{4}{9}\right)$$

$$= \frac{144}{729} + \frac{64}{729} = \frac{208}{729}$$

(3)

**(Total for Question 15 is 8 marks)**

15 Here are 9 cards. Each card has either a number on it or a letter on it.

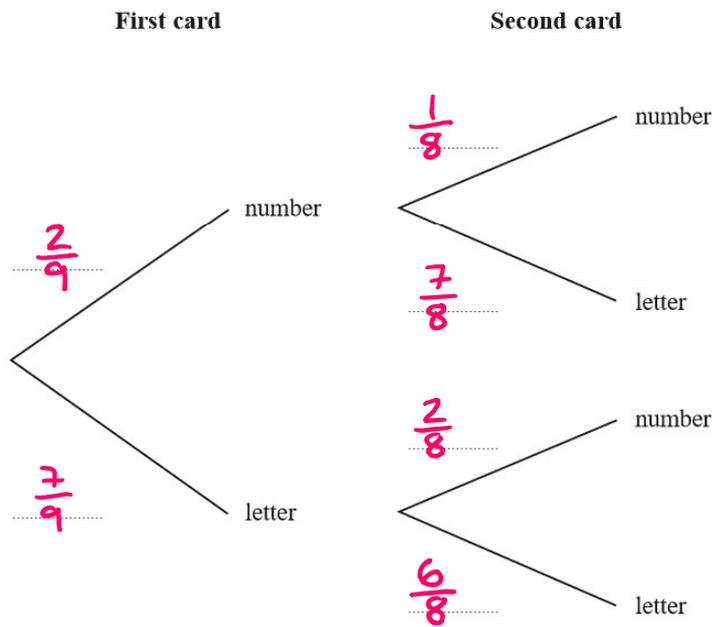| A | 7 | H | F | E | D | G | 5 | C |

Tomas is playing a game.

Tomas takes at random one of the cards and keeps it.

Tomas then takes at random another card and keeps it.

(a) Complete the probability tree diagram.

**First card**                    **Second card**

$\frac{2}{9}$ number

$\frac{1}{8}$ number

$\frac{7}{8}$ letter

$\frac{7}{9}$ letter

$\frac{2}{8}$ number

$\frac{6}{8}$ letter

(2)

(b) Work out the probability that each of the two cards has a number on it.

$$NN \quad = \quad \frac{2}{9} \times \frac{1}{8}$$

$$= \quad \frac{2}{72}$$

$$= \frac{1}{36}$$

(2)

(c) Work out the probability that there will be one card with a number on it and one card with a letter on it.

$$NL \quad + \quad LN$$

$$\frac{2}{9} \times \frac{7}{8} \quad + \quad \frac{7}{9} \times \frac{2}{8}$$

$$\frac{14}{72} \quad + \quad \frac{14}{72}$$

$$\frac{28}{72}$$

(3)

**(Total for Question 15 is 7 marks)**

$$= \frac{7}{18}$$

DO NOT WRITE IN THIS AREA

15  There are two bags of counters, bag **X** and bag **Y**.

There are 20 counters in bag **X**.
11 of the counters are blue and the rest are red.

There are 16 counters in bag **Y**.
9 of the counters are blue and the rest are red.

Arkady takes at random a counter from bag **X** and takes at random a counter from bag **Y**.

(a)  Complete the probability tree diagram.

bag X                                    bag Y

$\frac{9}{16}$  Blue

$\frac{11}{20}$  blue

$\frac{7}{16}$  Red

$\frac{9}{20}$  red

$9/16$  Blue

$7/16$  Red

(3)

P 5 9 0 1 2 A 0 1 4 2 4

(b) Work out the probability that the two counters are both red.

$$RR = \frac{9}{20} \times \frac{7}{16} = \frac{63}{320}$$

(2)

(c) Work out the probability that the two counters are both red or are both blue.

$$RR + BB$$

$$\frac{63}{320} + \frac{11}{20} \times \frac{9}{16}$$

$$\frac{63}{320} + \frac{99}{320}$$

(3)

**(Total for Question 15 is 8 marks)**

$$\frac{162}{320}$$

16 Cody has two bags of counters, bag **A** and bag **B**.

Each of the counters has either an odd number or an even number written on it.

There are 10 counters in bag **A** and 7 of these counters have an **odd** number written on them.
There are 12 counters in bag **B** and 7 of these counters have an **odd** number written on them.

Cody is going to take at random a counter from bag **A** and a counter from bag **B**.

(a) Complete the probability tree diagram.

|  | Bag A | Bag B |
|--|--|--|

$\frac{7}{10}$ — Odd number

$\frac{7}{12}$ — Odd number

$\frac{5}{12}$ — Even number

$\frac{3}{10}$ — Even number

$\frac{7}{12}$ — Odd number

$\frac{5}{12}$ — Even number

(2)

16