JP Maths Revision

Higher Tier

Probability Trees

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The marks for **each** question are shown in brackets- *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
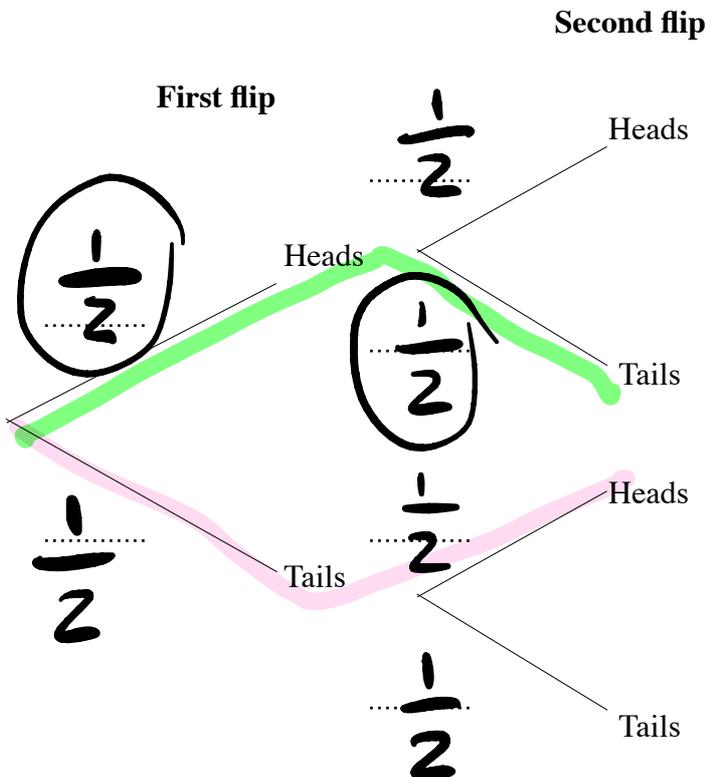- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages of your working.

1. A fair coin is flipped twice.

(a) Complete the probability tree diagram

Second flip

First flip

$\frac{1}{2}$

$\frac{1}{2}$

Heads

Heads

$\frac{1}{2}$

Tails

$\frac{1}{2}$

$\frac{1}{2}$

Tails

Heads

$\frac{1}{2}$

Tails

$= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ +

$= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

(2)

(b) Find the probability of getting exactly one head.

$\frac{1}{2}$

....

(3)

(Total for Question 1 is 5 marks)

2. A football team plays two matches. For each match, the probability of winning is 0.5 and the probability of drawing is 0.2.

(a) Complete the probability tree diagram

Second match

First match

0.5 — Win

0.5 — Win

0.2 — Draw   = 0.5 × 0.2 = 0.10

0.3 — Lose   0.5 × 0.3 = 0.15

0.2 — Draw

0.5 — Win   0.2 × 0.5 = 0.10

0.2 — Draw

0.3 — Lose

0.3 — Lose

0.5 — Win   0.3 × 0.5 = 0.15

0.2 — Draw

0.3 — Lose

(2)

(b) Find the probability that the team withs exactly one match.

0.10 + 0.15 + 0.10 + 0.15 = 0.5

0.5

(3)

(Total for Question 2 is 5 marks)

3. A bag contains 3 red and 2 blue counters. The two counters are taken without replacement. Below is the tree diagram.

Second counter

First counter

$\frac{2}{5}$ $\frac{3}{5}$ Red

$\frac{1}{5}$ Red

$\frac{3}{5}$ Blue

$\frac{3}{5}$ $\frac{2}{5}$ Blue

$\frac{2}{5}$ Red

$\frac{2}{5}$ Blue
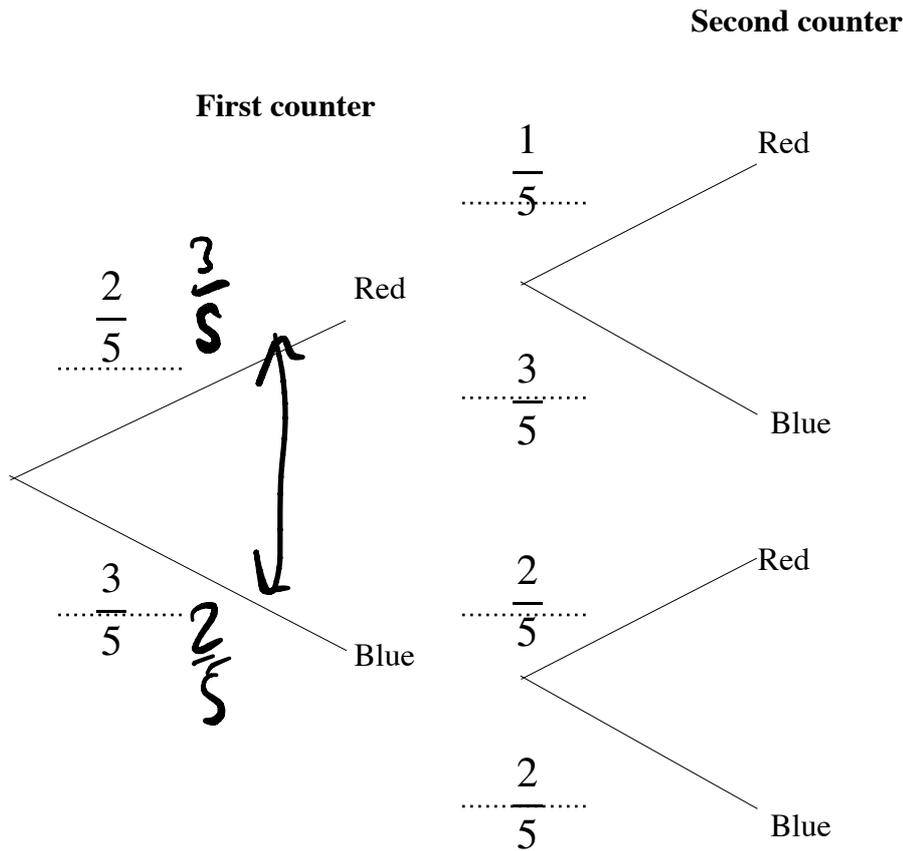
Write down two things that are wrong with the tree diagram.

1. The outcomes for second counter add to 4/5, not 1.

2. Probability of red for first counter

(Total for Question 3 is 2 marks)

Should be $\frac{3}{5}$, and blue should be

$\frac{2}{5}$.

4. A bag contains 4 green counters and 6 yellow counters. A counter is taken at random. The colour is recorded and the counter is replaced. A second counter is then taken.

a) Draw a probability tree diagram

1st counter   **2nd counter**

$\frac{4}{10}$ G $= \frac{16}{100}$

G

$\frac{4}{10}$

$\frac{6}{10}$ Y

$\frac{6}{10}$

$\frac{4}{10}$ G

Y

$\frac{6}{10}$ Y $= \frac{36}{100}$

(3)
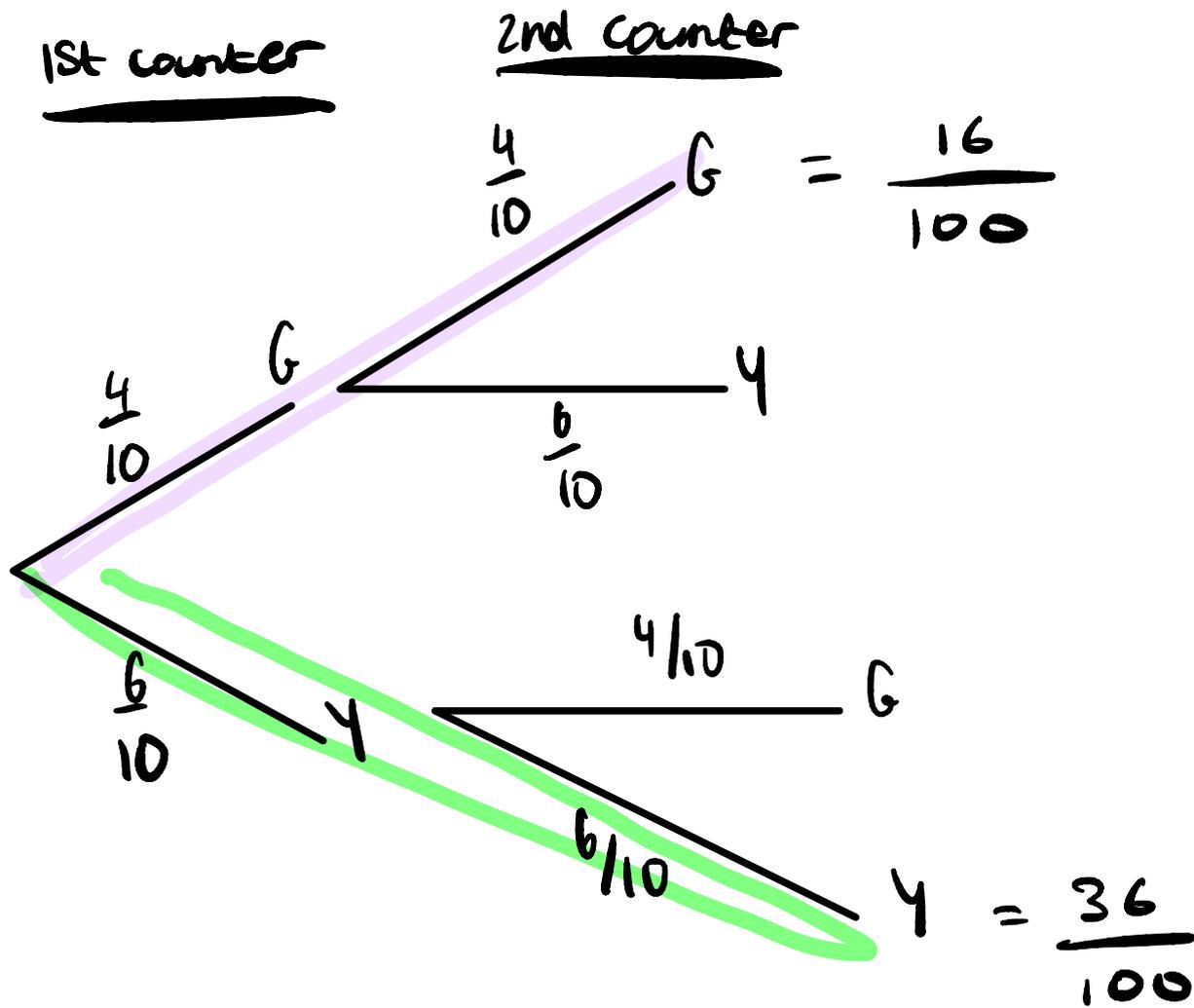
b) Find the probability that both counters are the same colour.

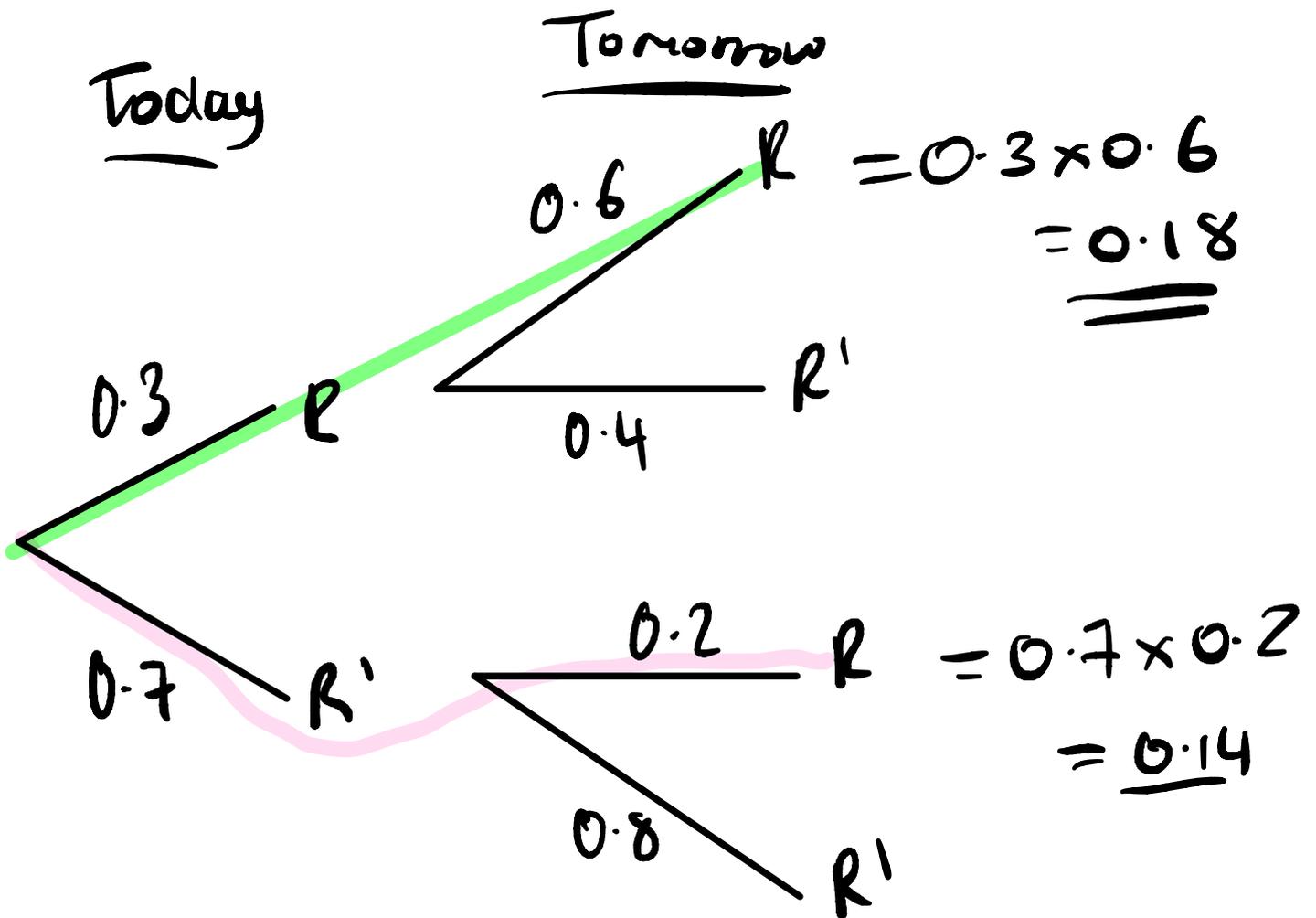$$\frac{16}{100} + \frac{36}{100} = \frac{52}{100}$$

0.52

(2)

(Total for Question 4 is 5 marks)

5. The probability that it rains today is 0.3. If it rains today, the probability that it rains tomorrow is 0.6.
If it does not rain today, the probability that it rains tomorrow is 0.2.

a) Draw a probability tree diagram to represent this information.

Today

Tomorrow

0.3 R
0.6 R $= 0.3 \times 0.6$
$= 0.18$

0.4 R'

0.7 R'
0.2 R $= 0.7 \times 0.2$
$= 0.14$

0.8 R'

(3)

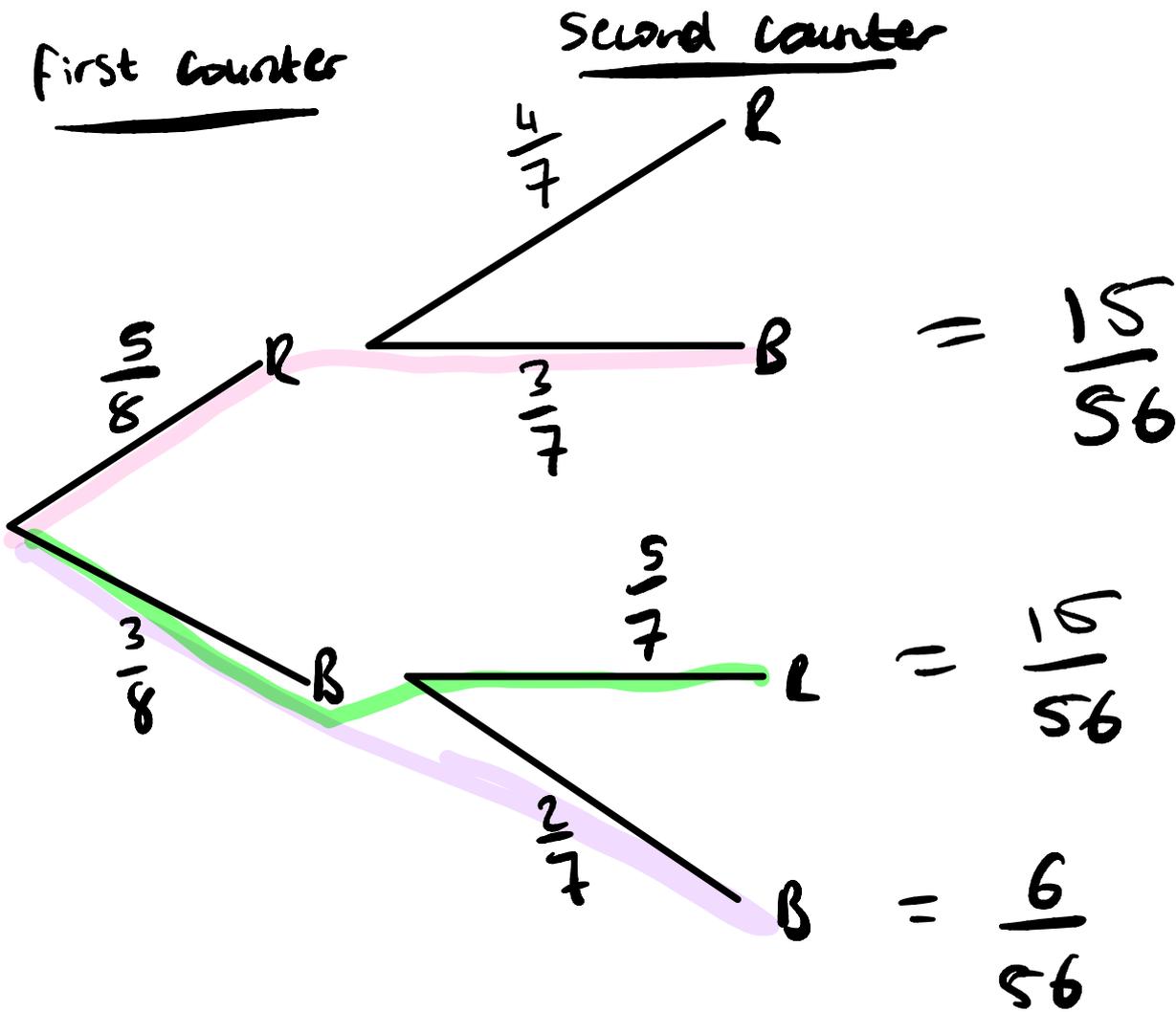b) Find the probability that it rains tomorrow

$0.18 + 0.14 = 0.32$

0.32

(2)

(Total for Question 5 is 5 marks)

6. A bag contains 5 red counters and 3 blue counters. Two counters are taken without replacement.

a) Draw a probability tree diagram to represent this information.

First counter

Second counter

$\frac{5}{8}$ R

$\frac{4}{7}$ R

$\frac{3}{7}$ B $= \frac{15}{56}$

$\frac{3}{8}$ B

$\frac{5}{7}$ R $= \frac{15}{56}$

$\frac{2}{7}$ B $= \frac{6}{56}$

....
(2)

b) Find the probability that at most one counter is red.

B B
R B
B R

$\frac{36}{56}$

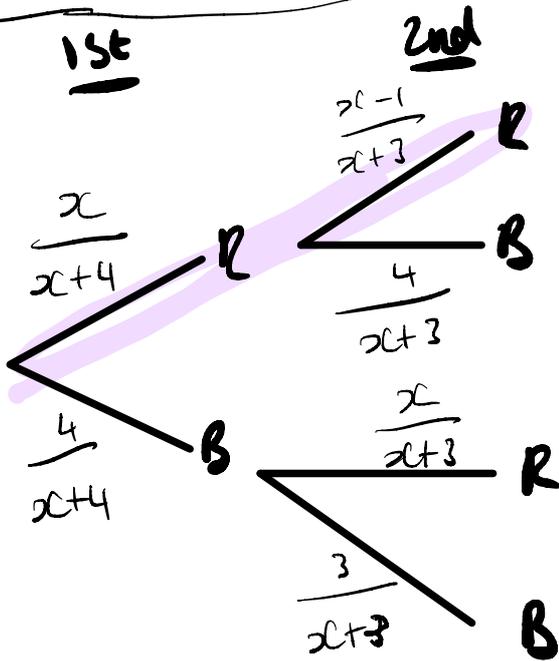...
(3)

(Total for Question 6 is 5 marks)

7. A bag contains x red counters and 4 blue counters. Two counters are taken at random without replacement. The probability that both counters are red is $\frac{1}{3}$.

a) Show that $x^2 - 5x - 6 = 0$

Total $= x+4$

1st   2nd

$\frac{x}{x+4}$ R $\frac{x-1}{x+3}$ R

$\frac{4}{x+3}$ B

$\frac{4}{x+4}$ B $\frac{x}{x+3}$ R

$\frac{3}{x+3}$ B

$\frac{x}{(x+4)} \times \frac{x-1}{(x+3)} = \frac{1}{3}$

$\frac{x^2-x}{x^2+3x+4x+12} = \frac{1}{3}$

$\frac{x^2-x}{x^2+7x+12} \neq \frac{1}{3}$

$3(x^2-x) = x^2+7x+12$
$3x^2-3x = x^2+7x+12$
$2x^2-3x = 7x+12$

$2x^2-10x-12 = 0$

$x^2-5x-6 = 0$

(3)

b) Work out the number of red counters originally in the bag.

$x^2-5x-6 = 0$

$(x-6)(x+1) = 0$

$x = 6$

$\cancel{x=-1}$

$-6 \times 1 = -6$

$-6 + 1 = -5$

6

(2)

(Total for Question 7 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS