1 There are some counters in a bag.
The counters are blue or green or red or yellow.

The table shows the probabilities that a counter taken at random from the bag will be blue or will be green.

Colour	blue	green	red	yellow
Probability	0.32	0.20		

The probability that a counter taken at random from the bag will be red is five times the probability that the counter will be yellow.

There are 300 counters in the bag.

Total probability = 1

Work out the number of yellow counters in the bag.

probability red $P(R) = 5P(Y)$ → 5x probability yellow

$P(R+Y) = 1 - (0.32 + 0.20)$

$= 0.48$ (1)

$6P(Y) = 0.48$

$P(Y) = 0.48 \div 6$

$P(Y) = 0.08$ (1)

$P(R+Y) = P(R) + P(Y)$

$= 5P(Y) + P(Y)$

$= 6P(Y)$

Number of yellow counters : 0.08×300 → Total count

$= 24$ (1)

24

(Total for Question 1 is 3 marks)

2 A first aid test has two parts, a theory test and a practical test.
The probability of passing the theory test is 0.75
The probability of passing only one of the two parts is 0.36

The two events are independent. multiply them

Work out the probability of passing the practical test.

P pass theory = 0.75

fail theory = 1 − 0.75 = 0.25 ✓(1)

Pass one of 2 parts = 0.36

pass theory, fail practical

$0.75 \times y$ let fail practical = y

pass practical, fail theory

$(1-y) \times 0.25$ ✓(1)

$0.75y + 0.25(1-y) = 0.36$

$0.75y + 0.25 - 0.25y = 0.36$ ✓(1)

collect terms

$0.5y = 0.11$

$y = \frac{0.11}{0.5} = 0.22$

y was to fail practical

pass = 1 − 0.22 = 0.78

0.78 ✓(1)

(Total for Question 2 is 4 marks)

3 Ray has nine cards numbered 1 to 9

1	2	3	4	5	6	7	8	9

4 even
5 odd

Ray takes at random three of these cards.

He works out the sum of the numbers on the three cards and records the result.

Work out the probability that the result is an even number.

the sum of three numbers is even if and only if:

- all numbers are even
- two numbers are odd and one is even

E = even picked
O = odd picked

Probability of EEE = $\frac{4}{9} \times \frac{3}{8} \times \frac{2}{7} = \frac{1}{21}$ (1)

Probability of OOE = $\frac{5}{9} \times \frac{4}{8} \times \frac{4}{7} = \frac{10}{63}$ (1)

Probability of OEO = $\frac{5}{9} \times \frac{4}{8} \times \frac{4}{7} = \frac{10}{63}$

Probability of EOO = $\frac{4}{9} \times \frac{5}{8} \times \frac{4}{7} = \frac{10}{63}$

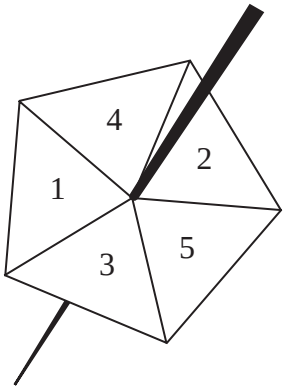
Sum of all four probabilities is the probability that Ray's total is even.

$\frac{1}{21} + 3 \times \frac{10}{63} = \frac{11}{21}$ (1) (1)

$\frac{11}{21}$

(Total for Question 3 is 4 marks)

4 Lina spins a biased 5-sided spinner 40 times.



Here are her results.

Score	1	2	3	4	5
Frequency	6	8	9	7	10

Lina is now going to spin the spinner another two times.

(a) Work out an estimate for the probability that she gets a score of 5 both times.

estimated probability of getting a score of 5:

$\frac{10}{6+8+9+7+10} = \frac{10}{40} = \frac{1}{4}$ (1)

getting 5 both times

$= \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$ (1)

$\frac{1}{16}$

(2)

Derek is going to spin the spinner a large number of times.

(b) Work out an estimate for the percentage of times Derek can expect to get a score of 1

estimated probability of getting a 1:

$\frac{6}{6+8+9+7+10} = \frac{6}{40}$ (1)

$\frac{6}{40} \overset{\div 2}{=} \frac{3}{20} \overset{\times 5}{=} \frac{15}{100} = 15\%$ (1)

% means out of 100

15 %

(2)

(Total for Question 4 is 4 marks)

5 Alfie has 11 cards.

He has

3 blue cards
7 green cards
and 1 white card.

Alfie takes at random 2 of these cards.

Work out the probability that he takes cards of different colours.

Alfie can either take cards of different colours or take cards of the same colour.

Hence P(takes different colours) = 1 − P(takes same colour) since probabilities add to 1.

$P(\text{takes two blue cards}) = \frac{3}{11} \times \frac{2}{10} = \frac{6}{110}$

$P(\text{takes two green cards}) = \frac{7}{11} \times \frac{6}{10} = \frac{42}{110}$

$P(\text{takes two white cards}) = \frac{1}{11} \times \frac{0}{10} = 0$ (1)

Add all together:

$P(\text{takes same colour}) = \frac{6}{110} + \frac{42}{110} + 0 = \frac{48}{110}$ (1)

$P(\text{takes different colours}) = 1 - \frac{48}{110} = \frac{62}{110}$ (1)

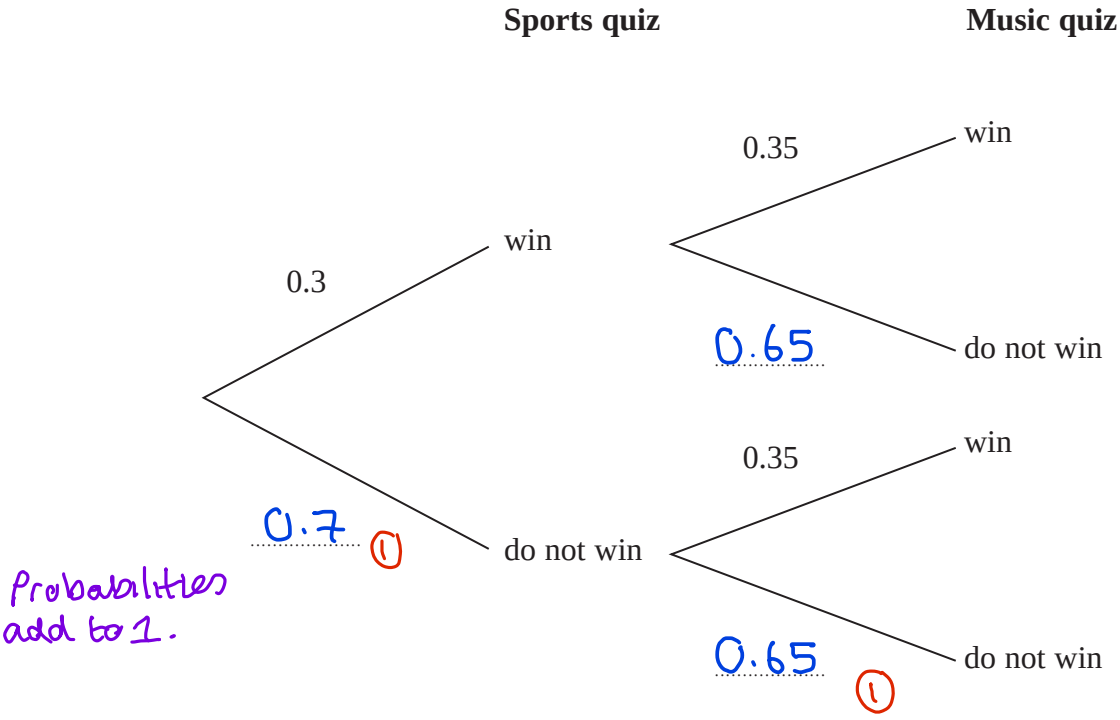
$\frac{62}{110}$

(Total for Question 5 is 3 marks)

6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

(a) Complete the probability tree diagram.



Probabilities add to 1. (1)

(2)

(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

Moving horizontally through branches ⇒ multiply probabilities

(1)

$\text{win both} = 0.3 \times 0.35 = 0.105$

(1)

0.105

(2)

(Total for Question 6 is 4 marks)

7 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

$7+8=15$

Probability of red or green $= 1 - 0.4 = 0.6$ (1)

Probability of green $= 0.6 \times \frac{8}{15} = 0.32$

(1)

Number of greens picked $= 0.32 \times 50 = 16$

(1)

16

(Total for Question 7 is 3 marks)

8 A biased dice is thrown 60 times.

The table shows information about the number that the dice lands on each time.

Number on dice	1	2	3	4	5	6
Frequency	12	7	8	9	9	15

Gethin throws the dice twice.

(a) Work out an estimate for the probability that the dice will land on 6 both times.

(1)

$\frac{15}{60} \times \frac{15}{60} = 0.0625$ (1)

(1)

0.0625

.....

(3)

Sally is going to throw the same dice n times and record the number it lands on each time.

She will use her results to work out a more reliable estimate for the probability in part (a).

(b) What can you say about the value of n?

↳ need more throws than in (a).

n has to be more than 60 (1)

.....

.....

.....

(1)

(Total for Question 8 is 4 marks)

9 There is a total of y counters in a box.

There are x pink counters and 5 blue counters in the box.
The rest of the counters are green.

$$x : y = 1 : 3$$

Freda takes at random two counters from the box.

Find, in terms of x, an expression for the probability that Freda takes two counters of the same colour.

Give your answer as a fraction in the form $\frac{ax^2 + bx + c}{dx^2 + ex}$ where a, b, c, d and e are integers.

Finding probability in x and y term:

$y = 3x$ (1)

First Pick	Second Pick of same colour
$P(P) = \frac{x}{y}$	$P(P) = \frac{x-1}{y-1}$
$P(B) = \frac{5}{y}$	$P(B) = \frac{4}{y-1}$ (1)
$P(G) = \frac{y-x-5}{y}$	$P(G) = \frac{y-x-6}{y-1}$

A: $P(P) \times P(P) = \frac{x}{y} \times \frac{x-1}{y-1} = \frac{x^2-x}{y^2-y} = \frac{x^2-x}{9x^2-3x}$

B: $P(B) \times P(B) = \frac{5}{y} \times \frac{4}{y-1} = \frac{20}{y^2-y} = \frac{20}{9x^2-3x}$ (1)

C: $P(G) \times P(G) = \frac{y-x-5}{y} \times \frac{y-x-6}{y-1} = \frac{3x-x-5}{3x} \times \frac{3x-x-6}{3x-1} = \frac{4x^2-22x+30}{9x^2-3x}$

A or B or C : A + B + C

$= \frac{x^2-x+20+4x^2-22x+30}{9x^2-3x}$ (1) $= \frac{5x^2-23x+50}{9x^2-3x}$ (1)

(Total for Question 9 is 5 marks)