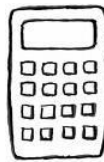| Name:	Teacher Assessment		Topic 8 - H Probability

Section A   Calculating Probabilities & Listing Outcomes   Grade F → D

1.   A fair ordinary six-sided dice is thrown once.
The boxes show some of the possible outcomes.

Draw a line from each box in column A to the box in column B which has the same probability.

Column A   **Column B**

Throwing a six		Throwing an even number

Throwing a two or a three		Throwing a one

Throwing an odd number		Throwing a four or a five

(Total 3 marks)

2.   Susan and Jill play a game.

(a)   Susan has a box containing 3 red, 4 yellow and 2 blue counters.
She picks a counter at random.

What is the probability that Susan picks a yellow counter?

Answer ....

(2)

(b)   Jill has a box containing 18 counters of which 8 are yellow.
She picks a counter at random.

What is the probability that Jill does **not** pick a yellow counter?

Answer ....

(2)

(c)   Who is more likely to pick a yellow counter?
Tick the correct box. Explain your answer.

☐   ☐   ☐

Susan   Jill   Neither

Explanation ....

....

(2)(Total 6 marks)

3. In a raffle 200 tickets are sold.
There is only one prize.
Mr Key buys 10 tickets.
Mrs Key buys 6 tickets.
Their children, Robert and Rachel, buy 2 tickets each.

(a) Which member of the family has the best chance of winning the prize?
Give a reason for your answer.

....

....

(2)

(b) What is the probability that Mrs Key wins the prize?

....

Answer ....

(2)

(c) What is the probability that **none** of the family wins the prize?

....

....

Answer ....

(3)
(Total 7 marks)

4. A bag contains blue, red and green cards only.
One card is taken at random from the bag.
The table shows the probabilities of taking a blue card and a red card.

Colour	Blue	Red	Green
Probability	0.3	0.5	

(a) What is the probability of taking a yellow card from the bag?

Answer ....

(1)

(b) What is the probability of taking a card that is **not** blue from the bag?

....

Answer ....

(1)

(c) Complete the table to show the probability of taking a green card from the bag.

....

(1)
(Total 3 marks)

5. Sarah is playing a game with a fair coin and a fair six-sided dice.
She spins the coin and then throws the dice.

If the coin shows heads Sarah's score is 1 **more** than the number shown on the dice. If the coin shows tails Sarah's score is 2 **less** than the number shown on the dice.

(a) Complete the table to show all possible scores.

Dice

Coin		1	2	3	4	5	6
	Heads				5		
	Tails	−1					

(2)

(b) Work out the probability that Sarah's score is

(i) negative

Answer ....

(1)

(ii) more than 3.

....

....

Answer ....

(2)
(Total 5 marks)

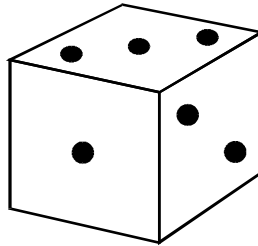| Teacher Assessment |
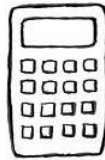
Section B   Relative Frequency and Expectation   Grade F → C

1. A dice is suspected of bias. Here are the results of 20 throws.

| 3 | 4 | 2 | 3 | 1 | 5 | 6 | 2 | 4 | 3 |
| 4 | 3 | 1 | 1 | 6 | 2 | 5 | 6 | 5 | 3 |

(a) Use these results to calculate the relative frequency of each score.

....

....

....

Score	1	2	3	4	5	6
Relative frequency						

(2)

(b) Use the relative frequency to calculate how many times you would expect to score 3 in 60 throws of this dice.

....

....

....

Answer ....

(2)

(c) Compare your answer to part (b) with the number of times you would expect to score 3 in 60 throws of a **fair** dice.

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....

(1)(Total 5 marks)

2.   Lynne has a spinner with coloured sections of equal size.
She wants to know the probability that her spinner lands on blue.
She spins it 100 times and calculates the relative frequency of blue after every 10 spins
Her results are shown on the graph.
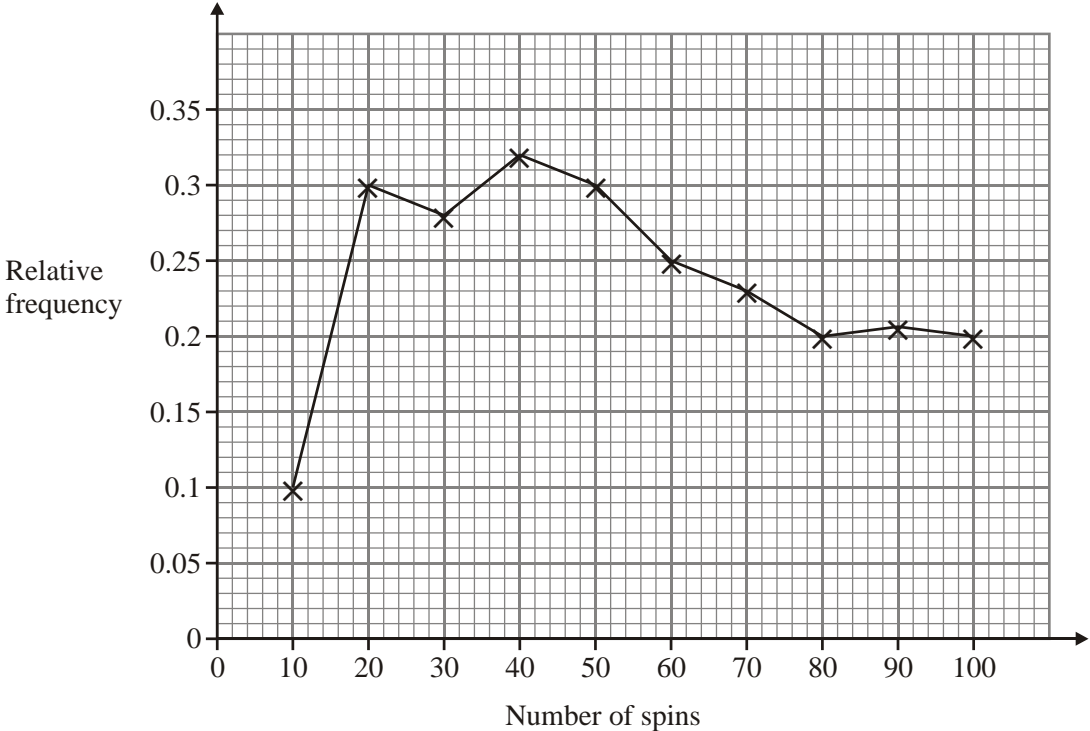
(a)   Use the graph to calculate the number of times the spinner landed on blue in the first 20 spins

....

....

Answer ....

(2)

Use the graph to estimate the probability that the spinner will land on blue.

....

Answer ....

(1)
(Total 3 marks)

3. A four-sided spinner has sections labelled A,B,C,D.
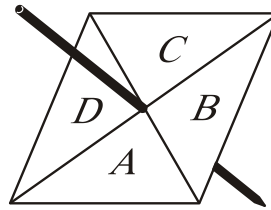
The spinner is spun and the relative frequency of the letter A is recorded after every 10 spins.

(a) After 50 spins there were 20 letters As.
Plot this relative frequency on the diagram.

....

....

(1)

Relative frequency

Number of spins
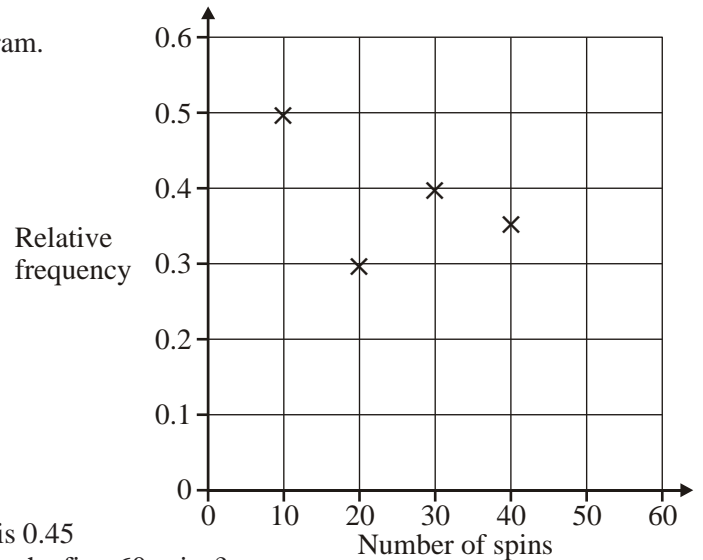
(b) The relative frequency after the first 60 spins is 0.45
How many times does the spinner land on A in the first 60 spins?

....

Answer ....

(1)

(c) Is the spinner biased? Give a reason for your answer.

....

....

(2)

(d) The spinner is spun 1000 times.
How many times would you expect the spinner to land on A?

....

Answer ....

(2)

(e) A different four-sided spinner has these probabilities.

Letter	A	B	C	D
Probability	0.2	0.3	0.4	0.1

What is the probability of getting a B or a C with one spin?

....

....

Answer ....

(2)(Total 8 marks)

4. A bag contains 200 coloured discs.
The discs are either red, blue or yellow.
There are 86 red discs in the bag.
The probability that a blue disc is chosen from the bag is 0.22

Calculate the number of yellow discs in the bag.

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Answer ....

(Total 4 marks)

5. Penny, Sam and Robert do this experiment on the **same** bag of **10** counters.

1. Take a counter from the bag at random.

2. Record its colour.

3. Put the counter back in the bag.

Repeat this trial a number of times.

Their results are shown in this table.

Name of pupil	Number of trials	Colour of counter		
		Black	White	Green
Penny	10	0	6	4
Sam	40	3	16	21
Robert	200	22	76	102

Estimate the number of each different coloured counter in the bag.
Clearly state the set of results that you use to make the estimate. Give a reason for your choice.

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Set of results used ....

Reason ....

....

Answer Black ...., White ...., Green …………………
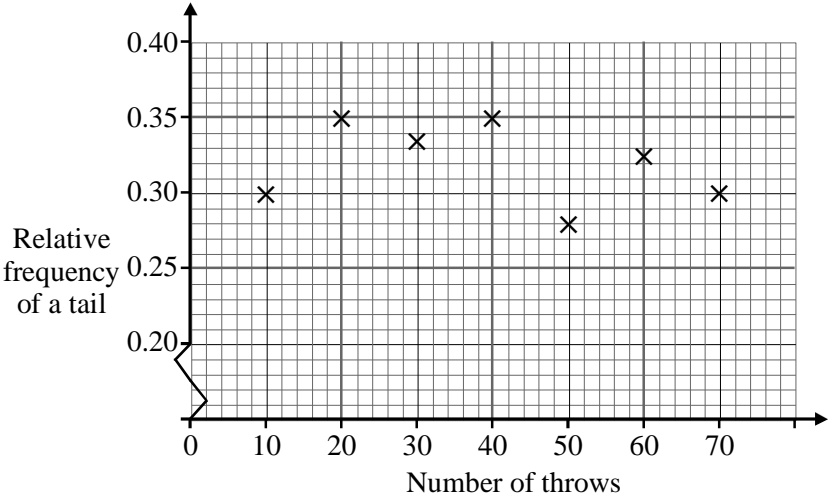
(Total 4 marks)

6. Geoff throws a coin 70 times.
He plots the relative frequency of the number of tails after every 10 throws.

(a) How many tails were obtained in 50 throws?

....

....

Answer .... tails

(2)

(b) Use the diagram to estimate the probability of obtaining a tail.

....

....

Answer ....

(1)

(c) Do you think the coin was biased?
Give a reason for your answer.

....

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....

(1)
(Total 4 marks)

7. Kali has a spinner with coloured sections of equal size.
She wants to know the probability that her spinner lands on pink.
She spins it 100 times and calculates the relative frequency of pink after every 10 spins.
Her results are shown on the graph.
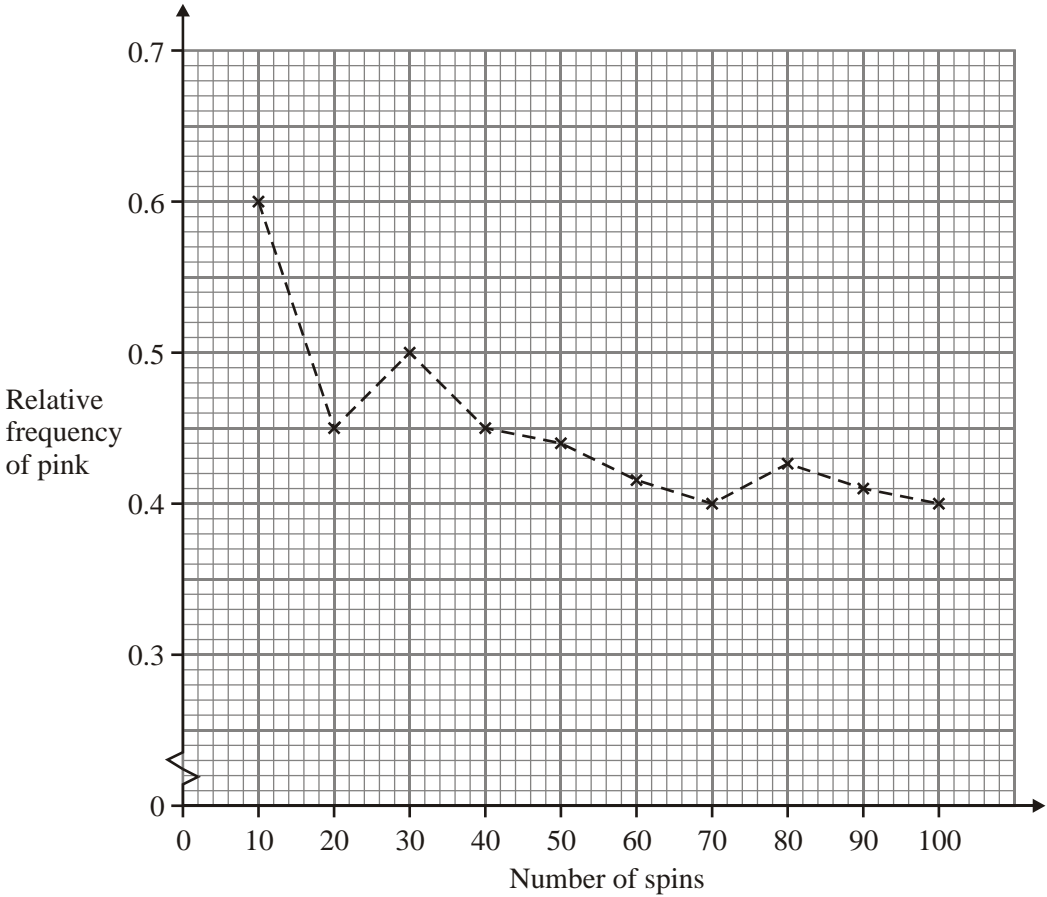
(a) Use the graph to calculate the number of times that the spinner landed on pink

(i) after the first 10 spins,

....

Answer ……………………………………… **(2)**

(ii) after the first 50 spins.

....

Answer ……………………………………… **(2)**

(b) From the graph, estimate the probability of the spinner landing on pink.

....

Answer ……………………………………… **(1)**

(c)   Kali's results confirm that her spinner is fair.
        The spinner has five equal sections.

    (i)   How many sections are pink?

    ....

                        Answer ……………………………………

                                                                                    (1)

    (ii)   Kali spins the spinner two more times.
            What is the theoretical probability that the spinner lands on pink both times?

    ....

    ....

    ....

                        Answer ……………………………………

                                                                                    (2)
                                                                        (Total 8 marks)

Success:	Target:

Teacher Assessment
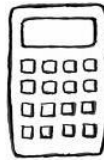
Section C   Tree Diagrams   Grade B → A*

1.   Danny has a biased coin.

The probability that the coin lands heads is $\frac{2}{3}$.

Danny throws the coin twice.

(a)   Fill in the probabilities on the tree diagram.

First throw   **Second throw**

```
                                              ............... ──── Head
                               Head ◄
                 ...............                      ............... ──── Tail

                 ...............
                               Tail ◄        ............... ──── Head

                                              ............... ──── Tail
```

(2)
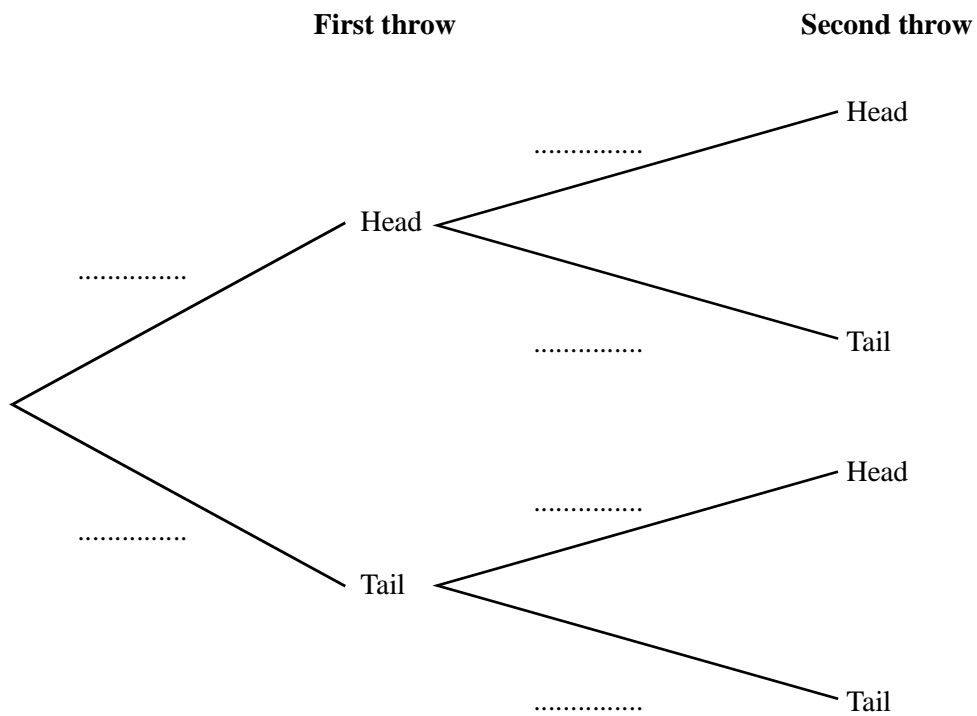
(b)   Calculate the probability that Danny gets two heads.

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Answer ....

(2)
(Total 4 marks)

2. The probability that it rains on any day in June is 0.3
   The tree diagram represents a Saturday and a Sunday in June.

   (a) Fill in the probabilities on the tree diagram.

   Saturday   **Sunday**

                                                              Rains
                                          ....
                            Rains
                                          ....
               ....   Does
                                                         not rain

                                                              Rains
                                          ....
               .... Does
                            not rain
                                                         Does
                                          ....   not rain

   (2)
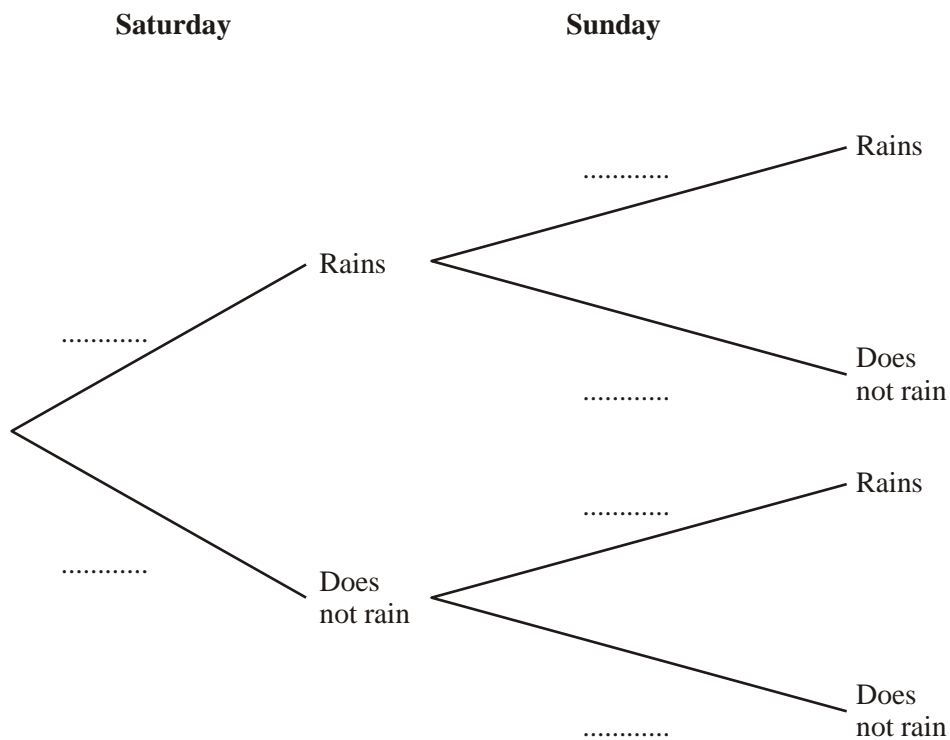
   (b) Calculate the probability that it rains on only one of these days.

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   ....

   ....

   ....

                   Answer ....

   (3)
   (Total 5 marks)

3. Bob is taking penalties.

The probability that Bob scores from the penalty spot is $\frac{3}{5}$ for each penalty.

Bob takes two penalties.

(a) Draw a fully labelled tree diagram showing all the probabilities.

(3)

(b) Calculate the probability that Bob scores exactly once on his two attempts.

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Answer ……………………………………

(3)
(Total 6 marks)

4. Philip and Abdul run in different races.
The probability that Philip wins his race is 0.7
The probability that Abdul wins his race is 0.6

(a) Fill in the missing probabilities on the tree diagram.

Philip	**Abdul**

Win
0.6 — Win
.... — Not win
0.7
.... Not win
0.6 — Win
.... — Not win
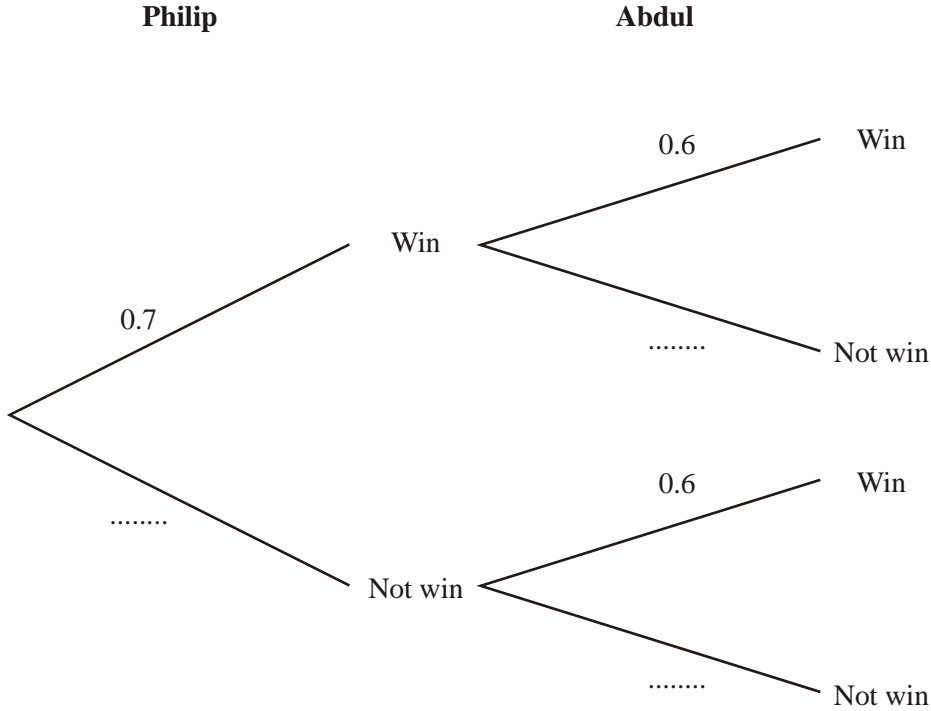
(1)

(b) Calculate the probability that only one of the boys wins his race.

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Answer ....

(3)
(Total 4 marks)

5. The diagram shows a spinner.

When the arrow is spun the probability of scoring 2 is 0.3

The arrow is spun twice and the scores are added.

(a) Complete the tree diagram.

First spin

Second spin

(1)

(b) What is the probability that the total score is 4?

....

....

....

Answer ....

(2)
(Total 3 marks)

6. Shereen has two bags of marbles.
Bag *A* contains 3 red marbles and 4 green marbles.
Bag *B* contains 2 red marbles and 3 green marbles.

Shereen throws a fair six-sided dice.
If the dice lands on a six, she takes a marble at random from bag *A*.
If the dice lands on any other number, she takes a marble at random from bag *B*.

(a) Draw a fully labelled tree diagram showing the above information.
Mark the probabilities on the appropriate branches.

(3)

(b) Calculate the probability that a red marble is selected.

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....

Answer ....

(3)
(Total 6 marks)

7. Jean enters an archery competition.

If it is raining the probability that she hits the target is 0.4.

If it is not raining the probability that she hits the target is 0.7

The probability that it rains on the day of the competition is 0.2

(a) Draw a fully labelled tree diagram showing all the probabilities.

(3)

(b) Calculate the probability that Jean hits the target with her first arrow in the competition.

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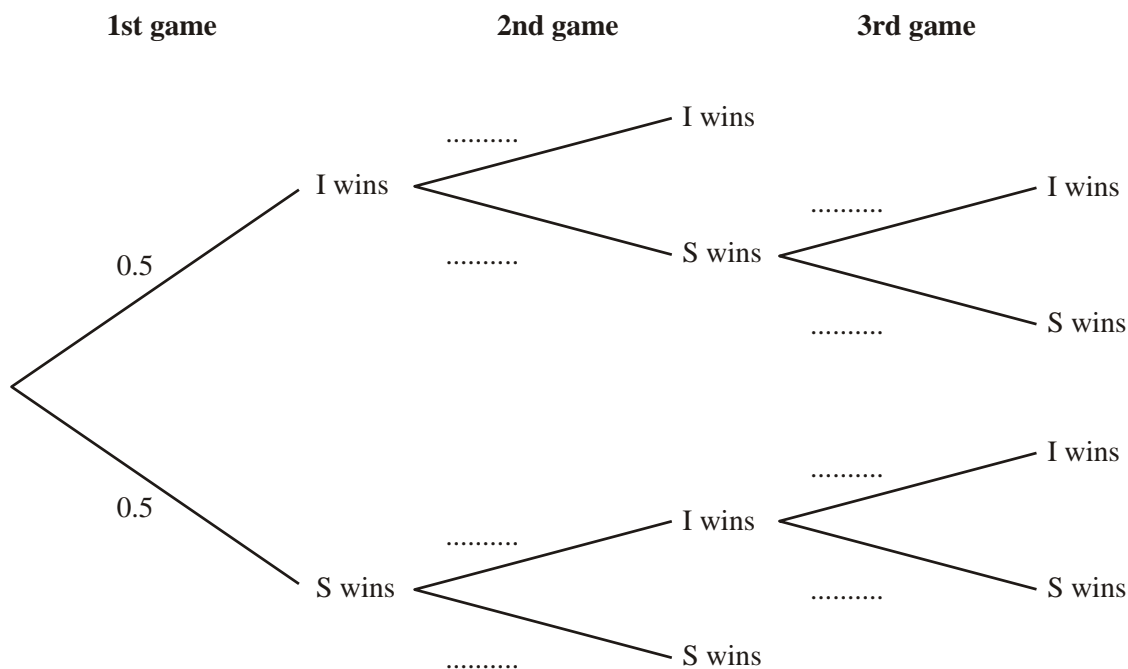Answer ....

(3)
(Total 6 marks)

8. Ian and Simon play each other in a darts match.
The match consists of three games.
The winner of the match is the first player to win two games.

The tree diagram shows all the possible outcomes.
'I wins' means that Ian wins the game.
'S wins' means that Simon wins the game.

1st game	2nd game	3rd game

The probability that Ian wins the first game is 0.5
Whenever Ian wins a game the probability that he wins the next game is 0.7
Whenever Simon wins a game the probability that he wins the next game is 0.6

(a) Complete the tree diagram.

(2)

(b) Calculate the probability that Ian wins the darts match.

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Answer ....

(4)
(Total 6 marks)

9. In a village $\frac{3}{5}$ of the pensioners have had a flu jab.

If a pensioner has had the flu jab the probability of catching flu is $\frac{1}{30}$

If a pensioner has **not** had the flu jab the probability of catching flu is $\frac{7}{10}$

(a) Calculate the probability that a pensioner, picked at random, from this village catches flu.

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Answer ....

(3)

(b) A statistician calculated that 120 pensioners from this village are expected to catch flu.
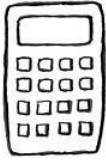
Calculate how many pensioners live in the village.

....

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Answer ....

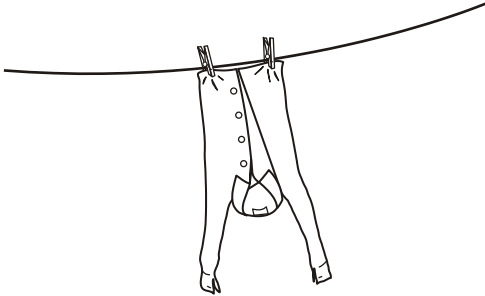**(2)(Total 5 marks)**

Success:

Target:

Teacher Assessment

Section D   Problem Solving Using Probability   Grade B → A*

1. Joe hangs a shirt on the washing line using coloured pegs from a bag.

The bag contains 10 red, 5 yellow and 5 green pegs.
Joe picks two pegs at random from the bag to hang the shirt.

 Calculate the probability that he picks two red pegs.

....

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....

Answer ………………………………………………………

(Total 3 marks)

2.   Sam and Tom both own a dog.

The probability that Sam walks his dog on a given day is 0.7
The probability that Tom walks his dog on a given day is x.
These are independent events.

(a)   (i)   Write down an expression for the probability that Tom does not walk his dog on a given day.

....

....

Answer ....

(1)

(ii)   Show that the probability that neither of them walks their dog on a given day is 0.3 − 0.3x

....

....

....

(2)

(b)   You are given that $x = 0.6$

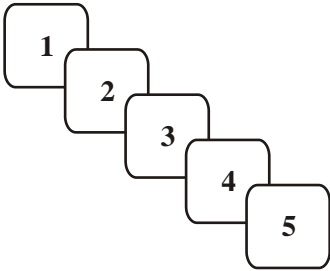Find the probability that at least one of them walks their dog on three consecutive days.

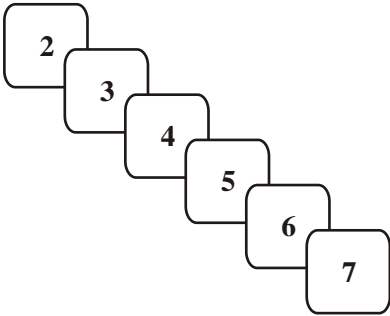...

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Answer ....

(3)
(Total 6 marks)

3. Two different packs of cards are shown below.

First pack   **Second pack**

A card is picked at random from the first pack and placed into the second pack.
A card is then picked at random from the second pack.

Calculate the probability that

(a) the card picked from the first pack is numbered 5 and the card picked from the second
     pack is also numbered 5.

     ....

     ....

     ....

     ....

                         Answer ....

                                                                                              (2)

(b) the card picked from the first pack and the card picked from the second pack have the
     same number.

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                         Answer ....

                                                                                              (3)
                                                                                (Total 5 marks)

4. Charlie is inspecting chocolates at his chocolate factory.
He rejects chocolates that are the wrong size and also those that are the wrong shape.
The probability that a chocolate is the **correct size** is p.
The probability that a chocolate is the **correct shape** is q.
The size and shape of a chocolate are independent events.

(a) Complete the probabilities in the table.

Event	Probability
Chocolate is the correct size and the correct shape.	
Chocolate is the correct size and the wrong shape.	$p(1-q)$
Chocolate is the wrong size and the correct shape.	
Chocolate is the wrong size and the wrong shape.	

(2)

(b) Show clearly that these probabilities have a total of 1.

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....

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....

(2)

(c) The probability that a chocolate is both the correct size and the correct shape is 0.765
The probability that a chocolate is the correct size is 0.9
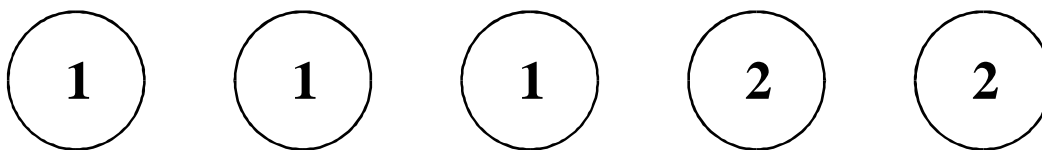What is the probability that a chocolate is the correct shape?

....

....

....

Answer..

(2)
(Total 6 marks)

5. Jill is playing a game with a set of five discs.
Three of the discs are numbered 1 and the other two are numbered 2.

$$\textbf{1} \quad \textbf{1} \quad \textbf{1} \quad \textbf{2} \quad \textbf{2}$$

The discs are placed in a bag.
Jill draws a disc from the bag and looks at its number.

If the first disc drawn is numbered 1, she takes one more disc from the bag.
Her score is the total of the three discs left in the bag.

If the first disc drawn is numbered 2, she takes two more discs from the bag.
Her score is the total of the two discs left in the bag.

(a)   Complete the table below.

First disc drawn	Further disc(s) taken	Discs left in the bag	Score

(2)

(b)   Calculate the probability that Jill gets a score of 3.

....

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....

Answer ....

(3)
(Total 5 marks)

Success:

Target: