

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic

Probability

Expected results from repeated experiments

v1.0

Name _____

Materials

For this paper you must have:

- Mathematical instruments

Information

- The marks for questions are shown in brackets

Advice

- In all calculations, show clearly how you work out your answer

Questions 1 to 20 are **foundation** tier only

For questions 1 to 7 you must **NOT** use a calculator.



Q1.



At a lucky dip stall, players pick a ball at random from a tub and then **replace it**.

The tub contains 180 red balls
 170 yellow balls
 50 blue balls.

Caroline has a go at the lucky dip.

(a) What is the probability that Caroline wins a prize with her first pick?

(2)

(b) Caroline has 16 goes on the lucky dip and wins 3 prizes.

Is this **more** than the expected number?

You **must** show your working.

(2)

(Total 4 marks)

Q2.

Bag A contains 10 blue balls and 20 red balls.

Bag B contains 8 blue balls and 12 red balls.



A ball is chosen at random from each bag.

Jo says,

“It is more likely that a blue ball is chosen from Bag A than Bag B because there are more blue balls in Bag A.”

Is she correct?

You **must** show your working.

(Total 3 marks)

Q3.

At a lucky dip stall, players pick a ball at random from a tub and then replace it.



The tub contains 250 red balls
 230 yellow balls
 120 green balls.

Emma has 15 picks.

(a) What is the probability that Emma wins a prize with her first pick?

(2)

(b) With her 15 picks, Emma wins 4 prizes.
Is this **more** than the expected number?
You **must** show your working.

(2)

(Total 4 marks)

Q4.

A bag has only red, white, blue and yellow counters.

A counter is taken from the bag at random.

Here are some of the probabilities.

Colour	Red	White	Blue	Yellow
Probability	0.1		0.3	

(a) The probability of taking a white counter is twice the probability of taking a yellow counter.
Complete the table.

(2)

(b) There are 500 counters in the bag altogether.
Complete the table.

Colour	Red	White	Blue	Yellow	Total
Number of counters in the bag	50				500

(2)

(c) All of the yellow counters are taken out of the bag.
Work out the probability of taking a red counter at random from the bag now.

(2)

(Total 6 marks)

Q5.

Fay is testing an ordinary six-sided dice to see if it is biased.
She throws the dice 120 times.

(a) Work out the number of times the dice is expected to land on 1

(1)

(b) Here are the actual results.

Number on dice	1	2	3	4	5	6	Total
Frequency	5	19	17	20	21	38	120

Is the dice biased?

Tick a box.

Yes ☐ No ☐ Cannot tell ☐

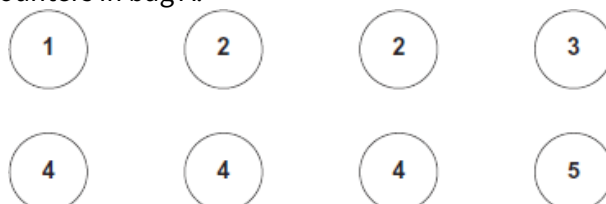
(2)

(Total 3 marks)

Q6.

Two bags, A and B, contain numbered counters.

(a) Here are the 8 counters in bag A.



A counter is chosen at random from bag A.

Write down the probability that the number on the counter is 4

(1)

(b) A counter is chosen at random from bag B.

The table gives the probabilities of the numbers on the counters in bag B.

Number on counter	6	7	8	9
Probability	0.2	0.1	0.4	0.3

Which bag has the greater probability of choosing an **even** number?

You **must** show your working.

(2)

(Total 3 marks)

Q7.

There are 24 counters in a bag.

One-third of the counters are blue.

5 red, 5 white and 5 blue counters are added to the bag.

Tom says, "The probability of taking a blue counter from the bag is still $\frac{1}{3}$ "
Is he correct? Tick a box.

☐ Yes ☐ No ☐ Cannot tell

Give a reason for your answer.

(Total 3 marks)

For questions 8 to 20 you may use a calculator.



Q8.

On a biased dice,

$$P(\text{lands on } 6) = 0.38$$

This dice is rolled 150 times.

How many times would you expect the dice **not** to land on 6 ?

(Total 3 marks)

Q9.

An ordinary fair dice is rolled ten times.

Here are the first nine results.

6 1 3 2 1 5 5 5 5

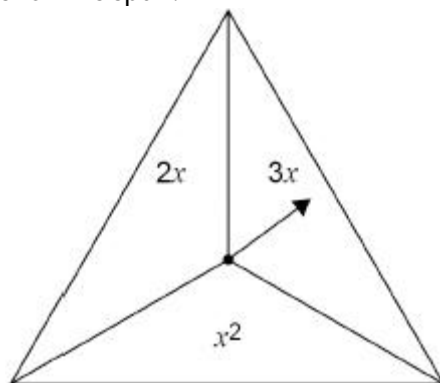
Write down the probability of getting a 5 on the tenth roll.

(Total 1 mark)

Q10.

In a game,

- an ordinary fair six-sided dice is rolled
- the fair spinner shown is spun.



The score is the dice number **substituted** into the spinner expression.

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

	1	2	3	4	5	6
$2x$				8		
$3x$		6				
x^2					25	

(2)

(b) A player wins the game if their score is 10 or more.

Work out the probability that they win the game.

(1)

(c) The game is played 711 times.

Estimate the number of games that are won.

(2)

(Total 5 marks)

Q11.

Here is an ordinary dice.



(c) Shenki/iStock

- (a) Ali is going to throw the dice six times.
He says, "I will get one of each number."
Give a reason why he could be wrong.

(1)

- (b) Lucy throws the dice 50 times.
Her results are shown.

Number thrown	1	2	3	4	5	6
Frequency	7	4	12	5	9	13

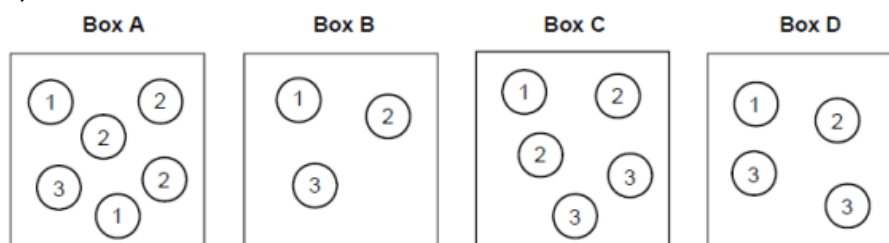
Work out the relative frequency of throwing an odd number.

(2)

(Total 3 marks)

Q12.

Boxes A, B, C and D contain balls with numbers on them.



A ball is picked at random from each box.

- (a) Which box gives the **greatest** chance of picking a 3?
You **must** show your working.
- (b) Which two boxes give the **same** chance of picking a 1?

(2)

(1)

(Total 3 marks)

Q13.

- (a) Lucy thinks people prefer dogs to cats.
She asks dog owners, "Do you prefer dogs or cats?"
Is the data likely to be biased?
Give a reason for your answer.

(1)

- (b) Sam asks 30 people, "Do you prefer dogs or cats?"
One-fifth of the 30 people have no preference.
Twice as many choose cats as choose dogs.
Complete the table.

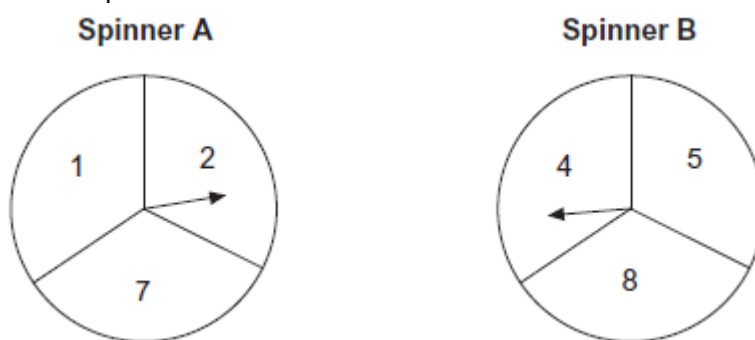
	Frequency
Dogs	
Cats	
No preference	
Total = 30	

(3)

(Total 4 marks)

Q14.

- (a) Here are two fair spinners.



In a game, both spinners are spun and the **higher** number is the final score.
 For example, if 2 and 4 are spun the score is 4
 Complete the table to show the possible scores when both spinners are spun.

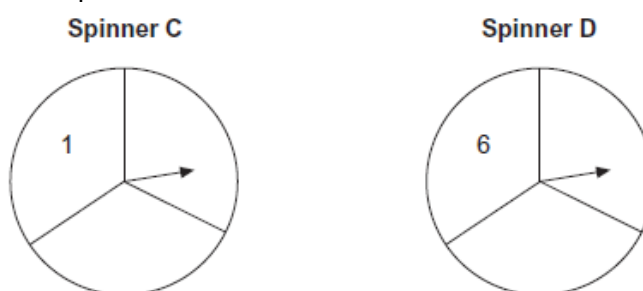
		Spinner A		
		1	2	7
Spinner B	4		4	
	5			
	8			

(2)

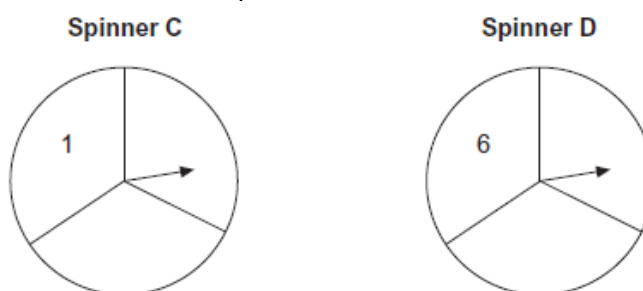
- (b) The same game is played with spinners C and D.
 Using spinners C and D the probability of each score is shown below.

Score	1	2	3	4	5	6
Probability	0	0	$\frac{2}{9}$	$\frac{2}{9}$	$\frac{2}{9}$	$\frac{3}{9}$

Complete the numbers on spinners C and D.
 Practise on these spinners.



Put your final answer on these spinners.



(2)

(Total 4 marks)

Q15.

A bag contains only red counters and blue counters.
There are 6 **more** red than blue.
A counter is chosen at random from the bag.

The probability it is blue is $\frac{1}{4}$

How many **red** counters are in the bag?

(Total 3 marks)

Q16.

A play area has thousands of coloured balls.
They are white, pink or yellow.
Sam picks 10 balls at random.
The table shows some of her results.

	white	pink	yellow
Frequency	4		
Relative frequency		0.1	

(a) Complete the table.

(3)

(b) Sam uses her results to estimate the proportion of white balls in the play area.
How could she make her estimate more reliable?

(1)

(Total 4 marks)

Q17.

An ordinary six-sided dice is rolled 300 times.
It lands on five 120 times.

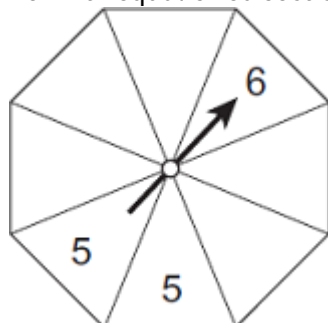


Do you think the dice is fair?
Give a reason for your answer.

(Total 2 marks)

Q18.

Here is a fair spinner with equal-sized sections.



Fill in the missing numbers on the spinner so that
the arrow is equally likely to land on 4 or 5
and the arrow is more likely to land on 3 than 6
and the total of all sections is 32.

(Total 3 marks)

Q19.

Lee works at a leisure centre.

- (a) He surveys a sample of 40 children.

	Can swim	Cannot swim	Total
Children	24	16	40

The council claims that more than $\frac{2}{3}$ of children in the area can swim.

Do Lee's results support this claim? You **must** show your working.

(3)

- (b) He also wants to know the proportion of **all** adults who can swim.

He surveys a sample of 50 adults at the leisure centre.

State one way that Lee can make his sample more reliable.

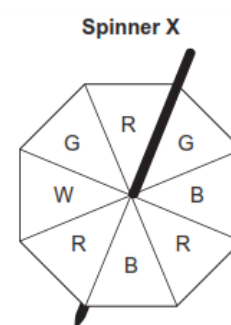
(1)

(Total 4 marks)

Q20.

- (a) Fair spinner X has eight equal sections.

The sections are either red (R), blue (B), green (G) or white (W).



- (i) The spinner is spun.
On which colour is it least likely to land?

(1)

- (ii) Write down the probability that the spinner lands on green.
Give your answer in its simplest form.

(2)

- (b) Fair spinner Y has three equal sections.

It is certain to land on red (R).

Label spinner Y.



(1)

- (c) Fair spinner Z has 10 equal sections.

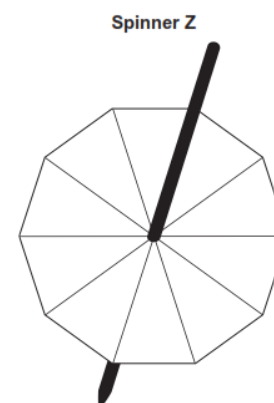
Label spinner Z so that

it has the same four colours as spinner X

white is less likely than on spinner X

white and green are equally likely on spinner Z

red and blue are equally likely on spinner Z.



(2)

(Total 6 marks)

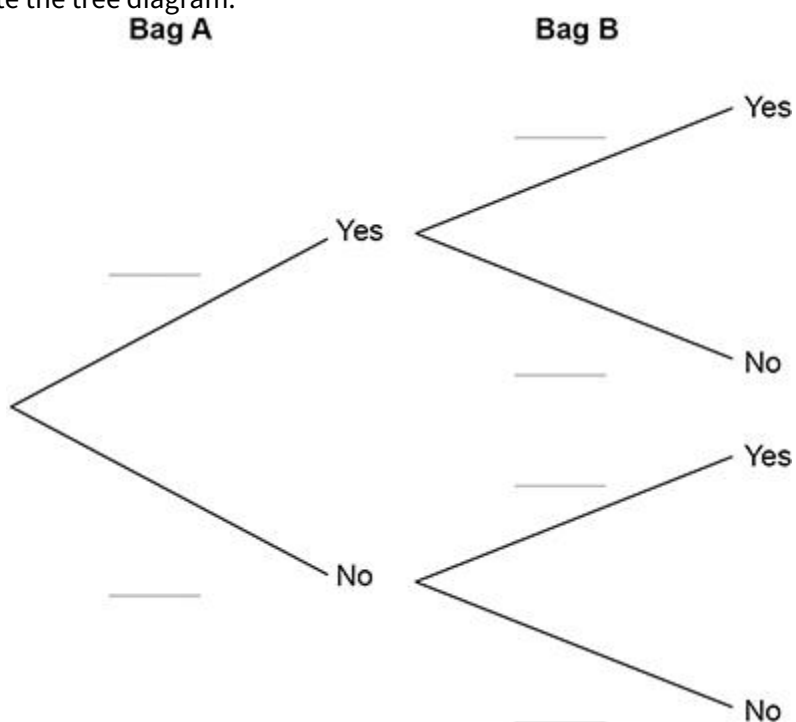
For questions 21 to 23 you must **NOT** use a calculator



In a game, two bags, A and B, contain cards.
Each card is marked Yes or No.
The table shows the number of each type of card in the bags.

	Yes	No
Bag A	3	2
Bag B	1	9

(a) Complete the tree diagram.



(b) To win a prize, a player must pick two cards marked Yes.
450 people each play the game once.
How many people are expected to win a prize?

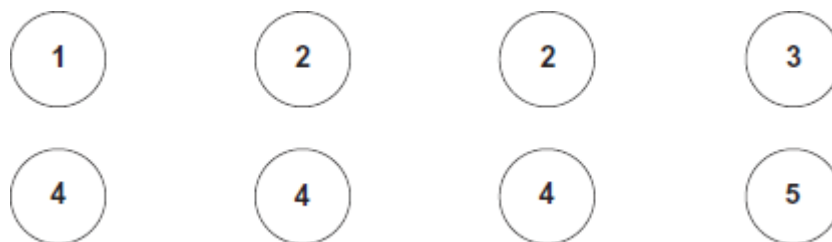
(2)

(3)

(Total 5 marks)

Q22.

Two bags, A and B, contain numbered counters.
 A counter is chosen at random from each bag.
 Here are the 8 counters in bag A.



The table gives the probabilities of the numbers on the counters in bag B.

Number on counter	6	7	8	9
Probability	0.2	0.1	0.4	0.3

Which bag has the greater probability of choosing an **even** number?
 You **must** show your working.

(Total 2 marks)

Q23.

- (a) A school has 400 boys and 500 girls.

The probability that a boy is vegetarian is 0.1

The probability that a girl is vegetarian is 0.2

Estimate the total number of vegetarians in the school.

(3)

- (b) There are ten prefects in the school.

Four of the prefects are vegetarian.

Two of the prefects are chosen at random to have lunch with a visitor.

Show that the probability that they are **both** vegetarian is $\frac{2}{15}$

(2)

(Total 5 marks)

For questions 24 to 28 you may use a calculator.

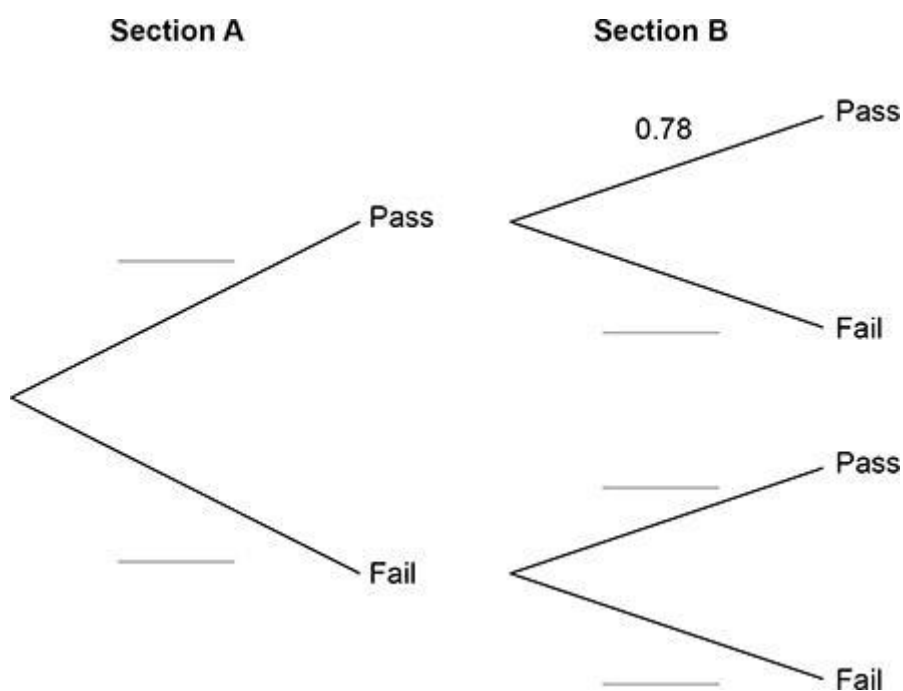


Q24.

A test consists of two sections, A and B.

- 85% of people pass section A.
- 78% of people who **pass** section A also **pass** section B.
- 36% of people who **fail** section A also **fail** section B.

(a) Complete the tree diagram.



(2)

- (b) 40% of people who fail **at least** one section take the test again.
 5000 people take the test.
 How many of these 5000 people are expected to take the test again?

(4)

(Total 6 marks)

Q25.

The expected number of visitors to a park each day depends on the temperature.

Temperature	Expected number of visitors each day
Less than 21°C	700
21°C or more	900

On each of the 30 days in June

the park is open

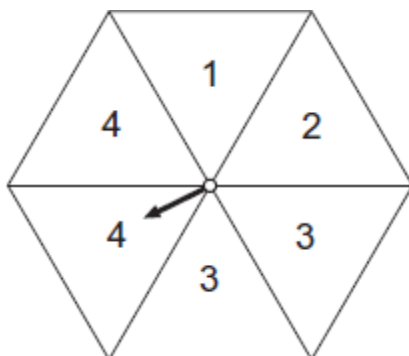
the probability that the temperature is less than 21°C is 0.4

Work out the **total** number of expected visitors to the park in June.

(Total 3 marks)

Q26.

- (a) The arrow on this spinner is equally likely to land on each section.



The arrow is spun 72 times.

How many times do you expect the arrow to land on 4?

(2)

- (b) An arrow on a different spinner is spun 250 times.
Some of the results are shown below.

Number shown	1	2	3	4	5
Frequency	25	53	62		

The relative frequency of landing on a 4 is the same as the relative frequency of landing on a 5

Work out the relative frequency of landing on a 4

(3)

(Total 5 marks)

Q27.

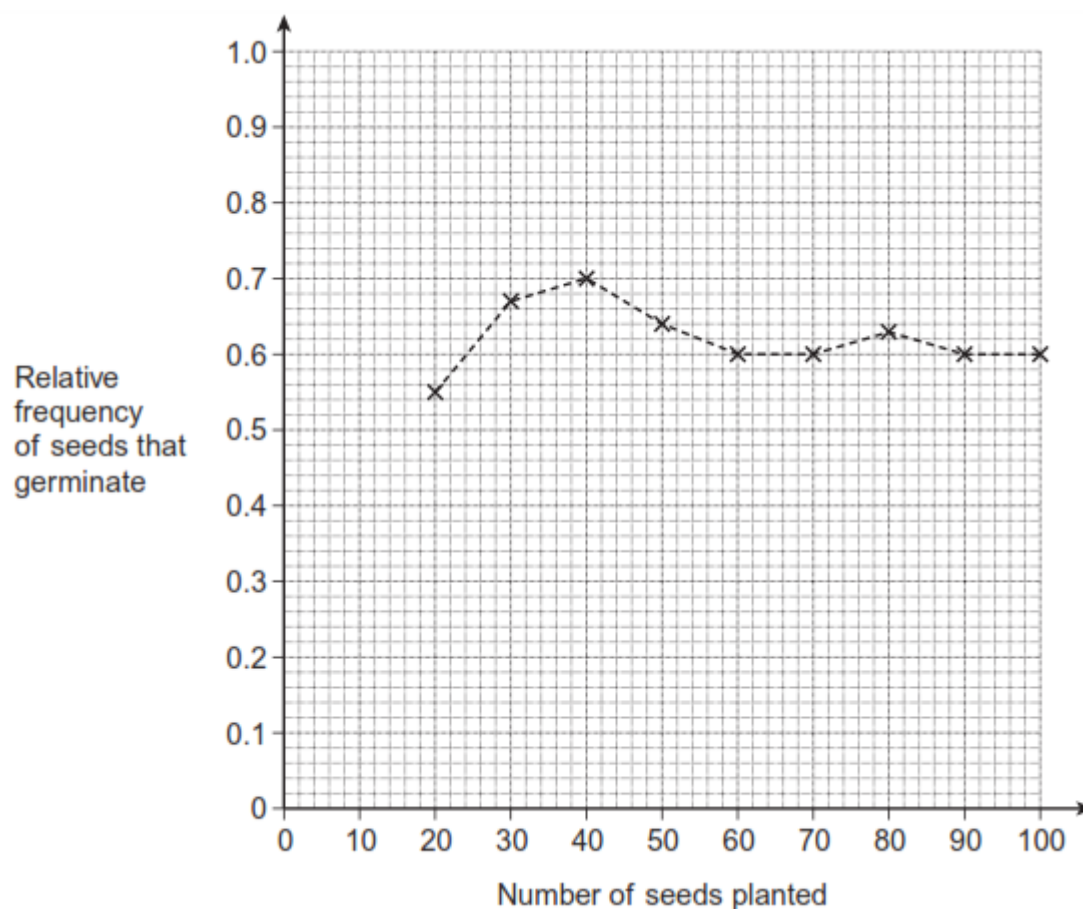
Put the numbers 1, 2 or 3 on each card so that when a card is picked at random

- the probability of picking a 2 is greater than $\frac{1}{2}$
- the probability of picking a 1 is twice the probability of picking a 3.

(Total 2 marks)

Q28.

A gardener plants ten seeds each week from the same seed packet.
The graph shows the relative frequency of seeds that germinate.



- (a) Nine seeds out of the ten planted in the first week germinate.
 (i) Write down the relative frequency of seeds planted in the first week that germinate. (1)
 (ii) Plot your relative frequency on the graph. (1)
- (b) How many of the seeds planted in week 2 germinate? (2)
- (c) There are 130 seeds in the seed packet.
 The label on the packet states:
- On average 80 of the seeds will germinate.
- Is this statement fair?
 Show how you decide. (2)
- (Total 6 marks)**