

8300

GCSE MATHEMATICS

Foundation tier – Questions by Topic

Probability

Calculating experimental probabilities

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

For questions 1 to 12 you must **NOT** use a calculator.

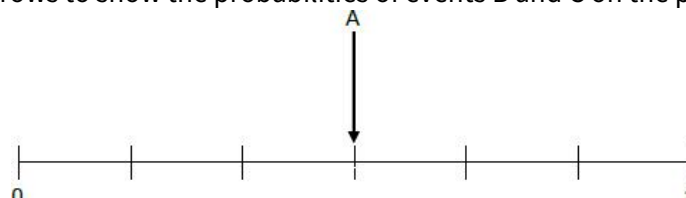


Q1.

Here are three events for an ordinary fair dice.

- A Roll an odd number
- B Roll a number greater than 6
- C Roll a 3

Draw and label arrows to show the probabilities of events B and C on the probability scale.



(Total 2 marks)

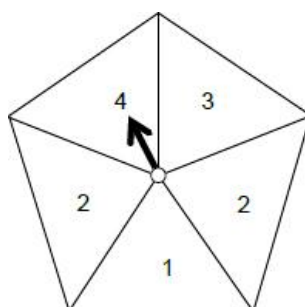
Q2.

There are 10 discs in a bag.
5 are red, 3 are green and the rest are blue
A counter is chosen at random.
Work out the probability that it is blue.

(Total 2 marks)

Q3.

Here is a fair five sided spinner.



(a) Write down the probability of scoring an even number with one spin.

(1)

(b) Work out the probability of scoring a **total** of 8 with two spins.

(3)

(Total 4 marks)

Q4.

Bag A contains 20 green balls and 12 yellow balls.

Bag B contains 15 green balls and 9 yellow balls.

John says,

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

Is he correct?

Yes

☐

No

☐

Give a reason for your answer.

(Total 3 marks)

Q5.

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)



Q6.

Bags X and Y each contain counters.

Bag X
30 counters
Each counter is green, white or yellow

Bag Y
5 counters
3 green and 2 red

- (a) $P(\text{green counter from X}) = P(\text{red counter from Y})$
Work out the number of green counters in X.

(2)

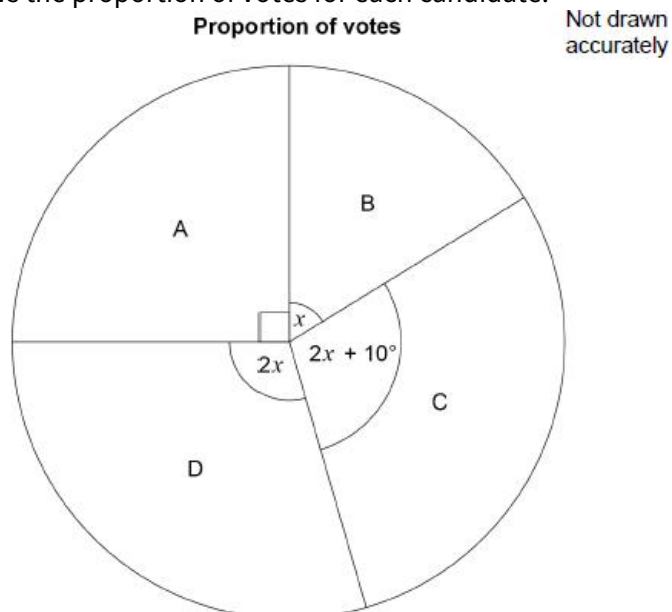
- (b) All 35 counters are put into one bag.
One counter is picked at random.
Work out the probability that the counter is **not** red.

(2)

(Total 4 marks)

Q7.

The four candidates in an election were A, B, C and D.
The pie chart shows the proportion of votes for each candidate.



Work out the probability that a person who voted, chosen at random, voted for C.

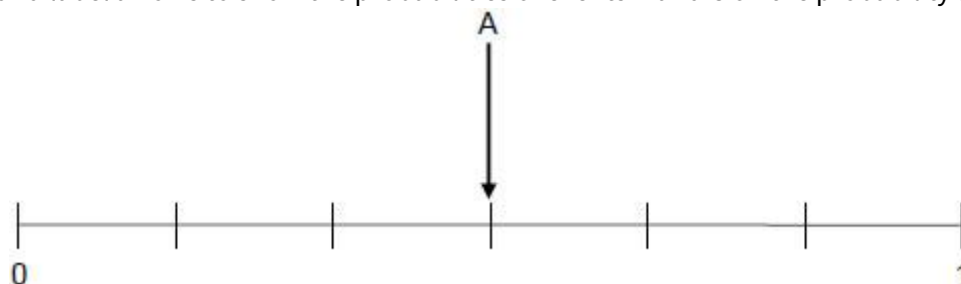
(Total 4 marks)

Q8.

Here are three events for an ordinary fair dice.

- A Roll an odd number
- B Roll a number greater than 6
- C Roll an even number less than 3

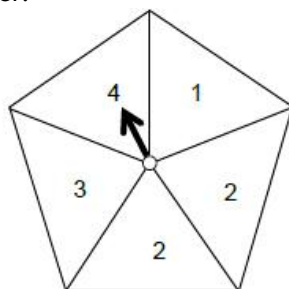
Draw and label arrows to show the probabilities of events B and C on the probability scale.



(Total 2 marks)

Q9.

Joanne has a fair five-sided spinner.



(a) Write down the probability of scoring a 4 with one spin.

(1)

(b) Work out the probability of scoring a **total** of 4 with two spins.

(3)

(Total 4 marks)

Q10.

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)

Q11.

A fishing lake contains thousands of fish.
The fish are Carp, Bream or Roach.
10 fish are caught.
The table shows some of the results.

	Carp	Bream	Roach
Frequency	4		
Relative frequency		0.1	

(a) Complete the table.

(3)

(b) The owner uses the results to estimate the proportion of Carp in the lake.
How can she make her estimate more reliable?

(1)

(Total 4 marks)

Q12.

There are 30 students in a class.
A student is chosen at random.

(a) Is the probability that a boy is chosen equal to the probability that a girl is chosen?

Tick a box.

Give a reason for your answer.

Yes ☐

No ☐

Cannot say ☐

(1)

(b) 7 of the 30 students have blue eyes.

What is the probability that the student chosen has blue eyes?

(1)

(Total 2 marks)

For questions 13 to 49 you may use a calculator.



Q13.

There are 56 cubes in a box.

The cubes are green, red, blue or white.

17 cubes are green.

There are an **equal** number of red, blue and white cubes.

- (a) How many red cubes are in the box?

(2)

- (b) 24 **more** cubes are added to the box.

A cube is picked at random.

The probability that the cube is green is 0.4

How many of the 24 cubes added to the box are green?

(3)

(Total 5 marks)

Q14.

A box contains 36 chocolates.

The chocolates are milk or dark and have hard or soft centres.

$\frac{4}{9}$ of the chocolates have soft centres.

There are twice as many milk chocolates as dark.

5 of the dark chocolates have soft centres.

- (a) Complete the two-way table.

	Hard centre	Soft centre
Milk		
Dark		5

(4)

One chocolate is chosen at random.

- (b) What is the probability that it is a dark chocolate with a soft centre?

(1)

- (c) What is the probability that it has a hard centre?

(1)

(Total 6 marks)

Q15.

There are 1400 students at a college.

A student is chosen at random.

- (a) The probability that the student is taking a GCSE resit is 0.09

How many of the students are taking a GCSE resit?

(2)

- (b) The probability that the student is studying

A-levels is 0.67

Core Maths is 0.48

Show that some students are studying A-levels **and** Core Maths.

(2)

(Total 4 marks)

Q16.

Three groups of people, A, B and C, have taken driving tests.

(a) Here is information about the number of tests taken by the people in A.

Group A

Key:  represents 4 people

One test	  
Two tests	   
Three tests	 

Here is information about the number of tests taken by the people in B.

One test Half the number in A who have taken one test.
Two tests 4 fewer than the number in A who have taken two tests.
Three tests 10 more than the number in A who have taken three tests.

Complete this pictogram for the people in B.

Group B

Key:  represents 4 people

One test	
Two tests	
Three tests	

(3)

(b) In group C there are 25 people.
 17 of these people have passed a test.
 One person is picked at random from C.
 Work out the probability that the person has **not** passed a test.

(2)

(Total 5 marks)

Q17.

Put these probabilities in order, starting with the **least** likely.

72%

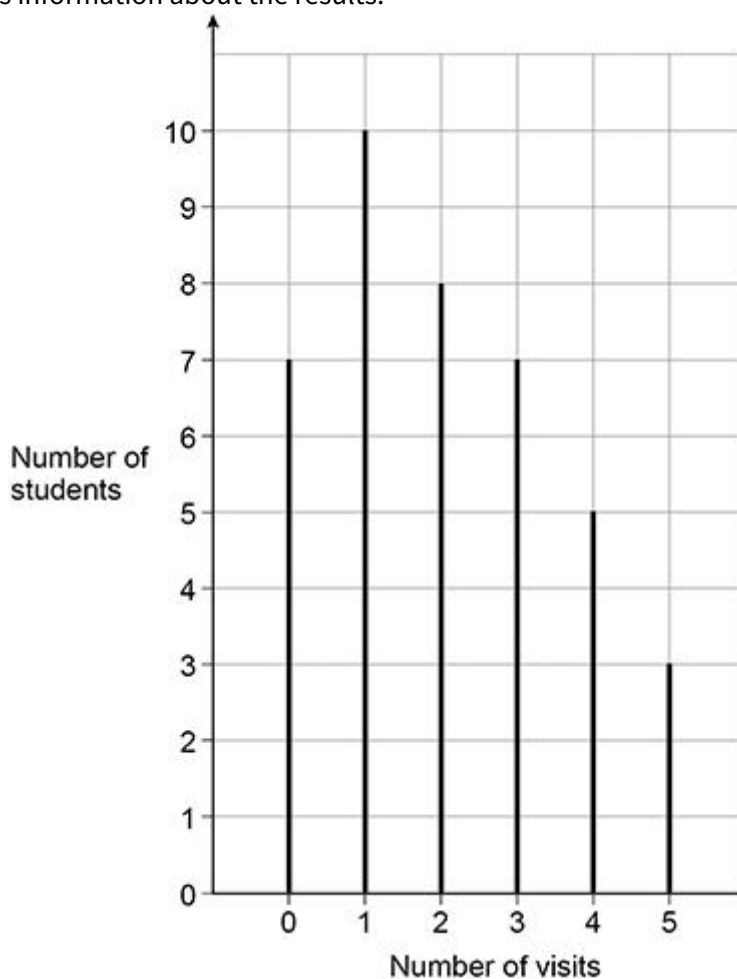
0.705

$\frac{7}{10}$

(Total 2 marks)

Q18.

40 students were asked the number of visits they made to a gym one week.
The chart shows information about the results.



- (a) Write down the modal number of visits. (1)
- (b) Work out the mean number of visits.
Give your answer as a decimal. (3)
- (c) One of the 40 students is chosen at random.
Work out the probability that the student visited the gym **at least** once. (2)

(Total 6 marks)

Q19.

Here are the results after 250 spins of a coin.

Heads	128
Tails	122

The coin is spun an extra 50 times.

After all 300 spins, the relative frequency of Heads is 0.49

For the **extra 50 spins**, work out number of Heads : number of Tails

(Total 3 marks)

Q20.

Rosie makes phone calls to try to sell broadband.
Today, she made 120 calls.
The table shows the results.

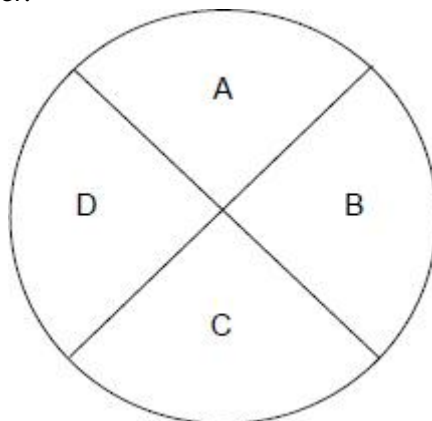
Result of call	Frequency
Not answered	33
Answered but sale not made	81
Answered and sale made	6

- (a) Write down the relative frequency that a call was **not answered**. (1)
- (b) During the **rest of the week**, Rosie will make 500 calls.
Using the results in the table, how many sales does she expect to make during the **rest of the week**? (2)

(Total 3 marks)

Q21.

Here is a fair 4 section spinner.



- (a) Steven is going to spin the spinner eight times.
He says,
“I will get two of each letter.”
Give a reason why he could be wrong. (1)

- (b) Charlotte spins the spinner 50 times.
Her results are shown below.

Letter	A	B	C	D
Frequency	20	13	10	7

Work out the relative frequency of not spinning a vowel.

(2)
(Total 3 marks)

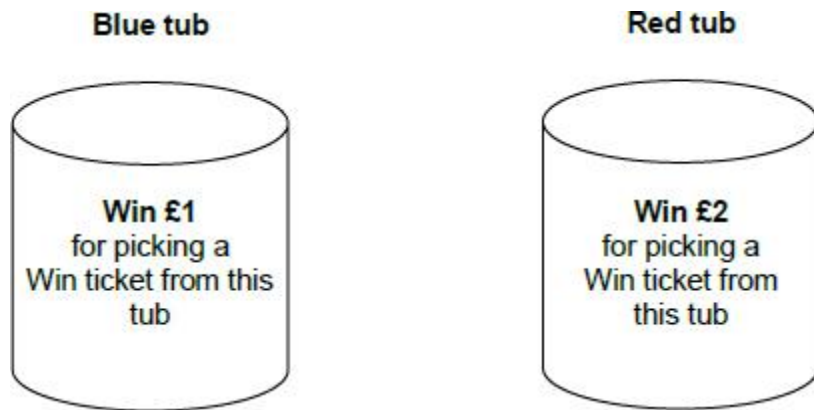
Q22.

Write down the probability of rolling a 5 on an ordinary fair dice.
Give your answer as a fraction.

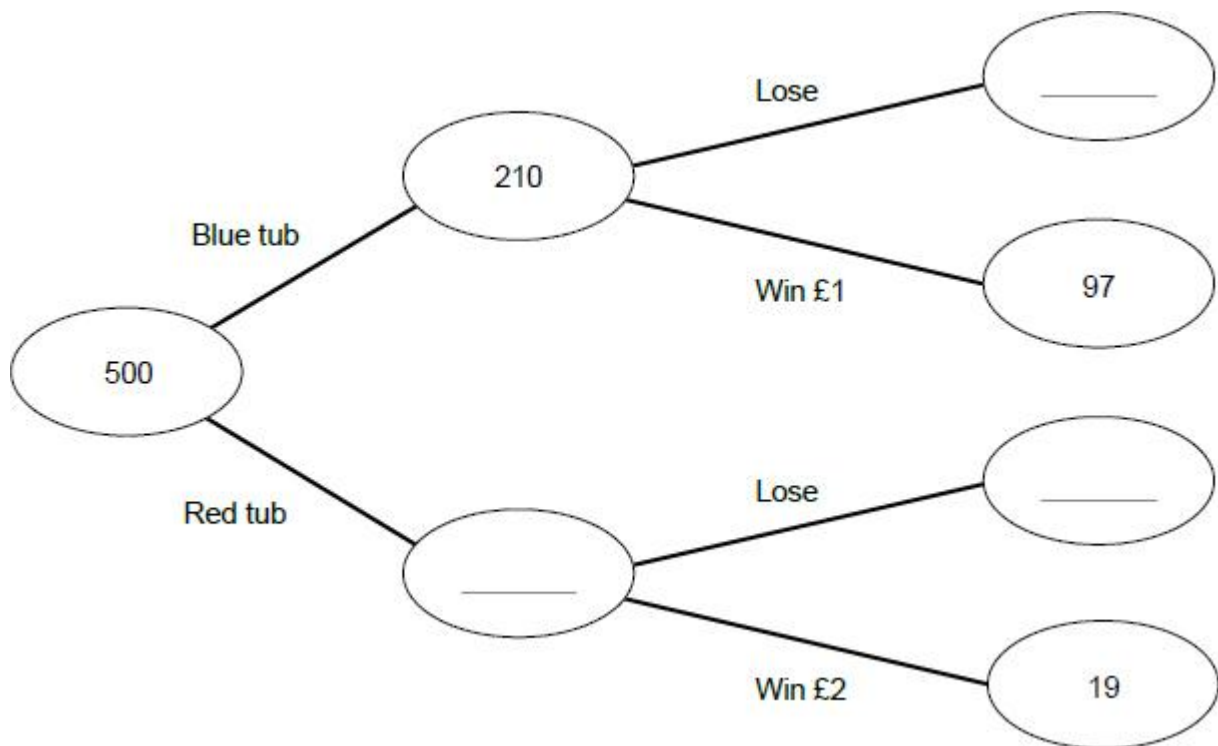
(Total 1 mark)

Q23.

Here is a game at a school fair.



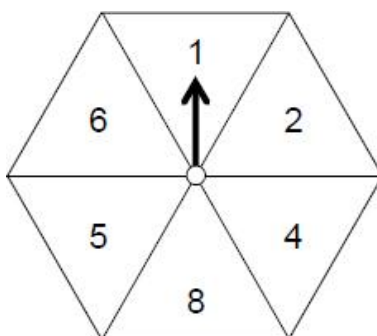
500 people play the game at the fair.
The frequency tree shows some of the outcomes.



- (a) Complete the frequency tree. (2)
- (b) A player has one go at the game.
Use the frequency tree to estimate the probability that the player wins some money. (2)
- (Total 4 marks)**

Q24.

- (a) A fair spinner has 6 equal sections.



The arrow on the spinner is spun.

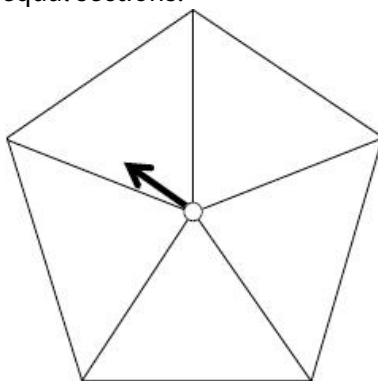
Complete each of the following sentences with the correct probability.

The probability that the arrow will land on an 8 is _____

The probability that the arrow will land on an odd number is _____

(2)

- (b) This fair spinner has five equal sections.



Write a number on each section so that

the probability that the arrow lands on 4 is $\frac{3}{5}$
the total of the numbers is 21

(2)

(Total 4 marks)

Q25.

John chooses a number at random from the digits 1 to 4

Matt also chooses a number at random from the digits 1 to 4

- (a) Write down the probability that the **total** of the two numbers chosen is 10

(1)

- (b) Work out the probability that the **total** of the two numbers chosen is more than 6

(3)

(Total 4 marks)

Q26.

- (a) An ordinary fair dice is thrown.

Work out the probability of getting a 4 or a 5

(2)

- (b) Work out the probability of **not** getting a 2

(1)

(Total 3 marks)

Q27.

A fair ordinary dice is rolled once.

- (a) Write down the probability of rolling a 2
- (b) Work out the probability of rolling an even number.

(1)

(2)

(Total 3 marks)

Q28.

16 people were asked to name their favourite fruit juice.
Here are the results.

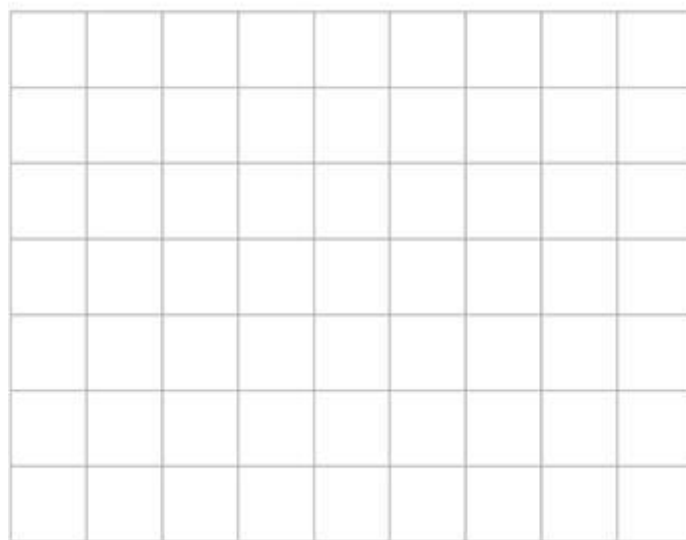
Favourite juice	Frequency
Apple	6
Grapefruit	1
Orange	4
Mango	5

- (a) One of the people was picked at random.
Work out the probability that their favourite juice was orange **or** mango.

(1)

- (b) On the grid, draw a bar chart to represent the results.

Favourite juice



(3)

(Total 4 marks)

Q29.

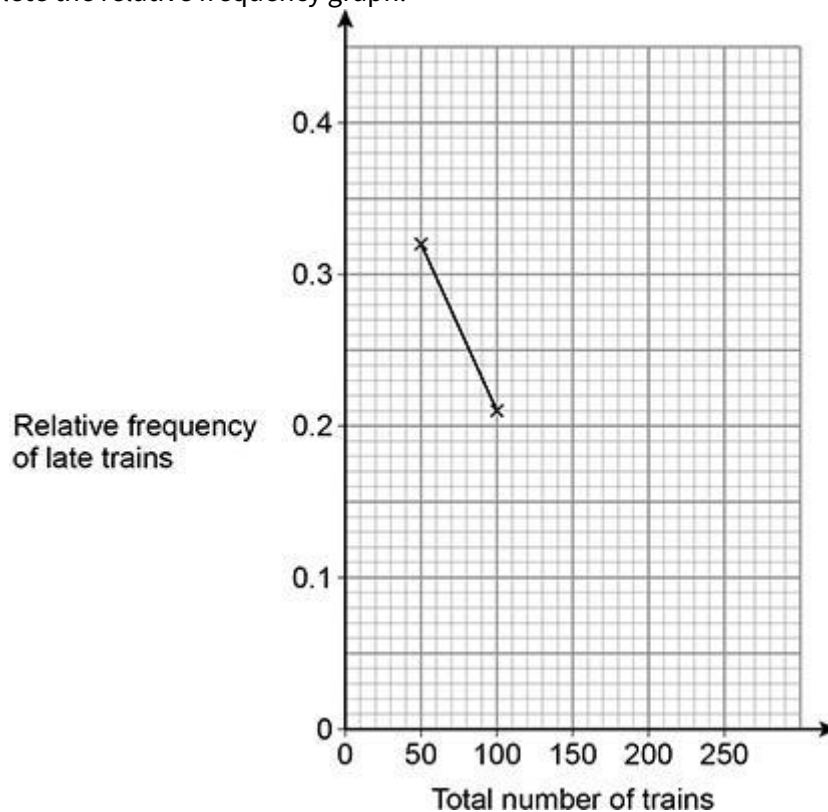
250 trains arrived at a station.

The number of trains that were late was recorded after every 50 trains.

The table shows some information about the results.

Total number of trains	50	100	150	200	250
Total number of late trains	16	21	36	38	55
Relative frequency of late trains	0.32	0.21			

(a) Complete the relative frequency graph.



(3)

(b) Write down the best estimate of the probability that a train arriving at the station is late.

(1)

(Total 4 marks)

Q30.

The table shows information about some CDs.

Type	Rock	Pop	Jazz
Number of CDs	2	x	$2x + 5$

A CD is chosen at random.

The probability it is **rock** is $\frac{1}{20}$

Work out the probability it is jazz.

(Total 4 marks)

Q31.

There are 720 boys and 700 girls in a school.

The probability that a boy chosen at random studies French is $\frac{2}{3}$

The probability that a girl chosen at random studies French is $\frac{3}{5}$

(a) Work out the number of students in the school who study French.

(3)

(b) Work out the probability that a student chosen at random from the whole school does **not** study French.

(2)

(Total 5 marks)

Q32.

What is the probability of rolling a 5 on an ordinary fair dice?

Circle your answer.

$$\frac{1}{6}$$

$$\frac{1}{5}$$

$$\frac{5}{6}$$

$$\frac{1}{2}$$

(Total 1 mark)

Q33.

Jack makes a game for a school fair.

Players can win money by picking a 'Win' ticket from a tub.

A player chooses a tub by picking a blue disc or a red disc out of a bag.

Blue tub



Red tub



400 people play the game at the fair.

The frequency tree shows some of the outcomes.

(a) Complete the frequency tree.

(2)

(b) A player has one go at Jack's game.

Use the frequency tree to estimate the probability that the player wins some money.

(2)

(c) Jack makes a profit of £25 from his game.

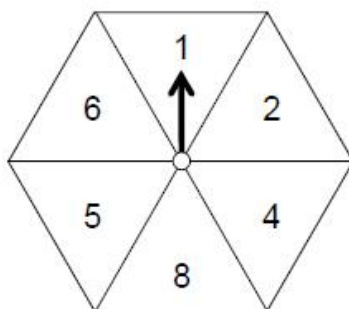
Work out how much Jack charges players to have a go at his game.

(3)

(Total 7 marks)

Q34.

- (a) A fair spinner has 6 equal sections.



The arrow on the spinner is spun.

Complete each of the following sentences with the correct probability.

The probability that the arrow will land on a factor of 8

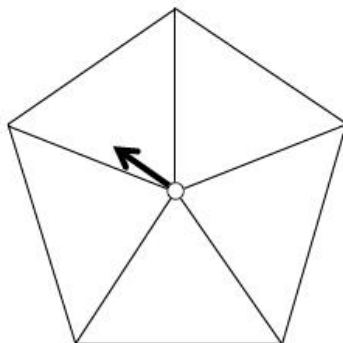
is

The probability that the arrow will land on a prime number

is

(2)

- (b) This fair spinner has five equal sections.



Write a number on each section so that

the probability that the arrow lands on 3 is $\frac{2}{5}$

the range of the numbers is 3

the sum of the numbers is 21

(2)

(Total 4 marks)

Q35.

- (a) Which of these values could represent a probability?
Circle your answer.

-0.2

1.1

0.8

$\frac{6}{5}$

(1)

- (b) A fair ordinary dice is rolled once.
Circle the probability of rolling a 3 or a 4

$\frac{1}{6}$

$\frac{2}{6}$

$\frac{3}{6}$

$\frac{4}{6}$

(1)

(Total 2 marks)

Q36.

A coin is rolled onto a grid of squares.

It lands randomly on the grid.

To win, the coin must land completely within one of the squares.

Meera and John each roll the coin a number of times and record their results.

	Number of wins	Number of losses
Meera	6	44
John	28	72

- (a) Work out **two** different estimates for the probability of winning.

(2)

- (b) Which of your estimates is the better estimate for the probability of winning?

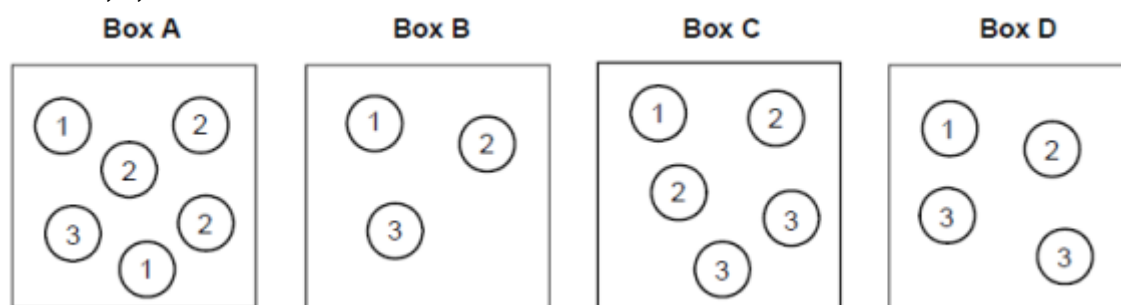
Give a reason for your answer.

(1)

(Total 3 marks)

Q37.

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.

(2)

- (b) Which two boxes give the **same** chance of picking a 1?

(1)

(Total 3 marks)

Q38.

A bag contains counters that are red, blue, green or yellow.

	red	blue	green	yellow
Number of counters	9	$3x$	$x - 5$	$2x$

A counter is chosen at random.

The probability it is **red** is $\frac{9}{100}$

Work out the probability it is green.

(Total 4 marks)

Q39.

In a game, players roll two ordinary, fair six-sided dice.
The numbers rolled are added to get a score.

(a) Complete the table of possible scores.

		Dice 2					
Dice 1	+	1	2	3	4	5	6
	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	
	4	5	6	7	8		
	5	6	7	8			
	6	7	8				

(1)

(b) What is the most likely score?

(1)

(c) To win a prize a player must score 8.

Work out the probability of winning a prize.

(2)

(Total 4 marks)

Q40.

(a) In a statistical experiment a fair, ordinary dice is rolled.

Tick a box to show the correct ending to the sentence below.

When this statistical experiment is repeated you will

always get the same outcome

☐

usually get the same outcome

☐

usually get a different outcome

☐

always get a different outcome

☐

(1)

(b) Tick a box to show the correct ending to the sentence below.

An estimate of probability based on a statistical experiment is more reliable with

more trials

☐

fewer trials

☐

more time between trials

☐

less time between trials

☐

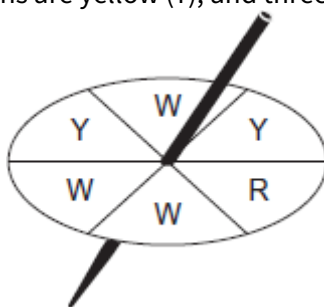
(1)

(Total 2 marks)

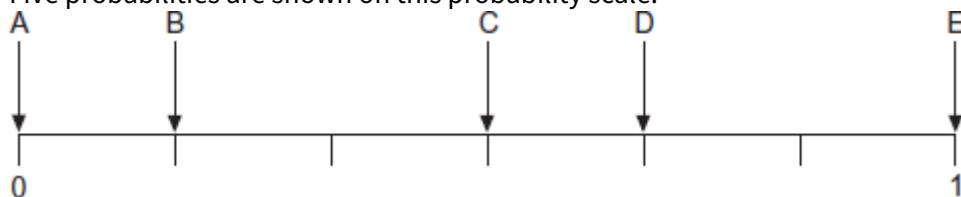
Q41.

Here is a fair 6-sided spinner.

One section is red (R), two sections are yellow (Y), and three sections are white (W).



Five probabilities are shown on this probability scale.



(a) Circle the letter that matches each of these events.

(i) The spinner lands on red.

A B C D E

(1)

(ii) The spinner lands on white.

A B C D E

(1)

(iii) The spinner does **not** land on yellow.

A B C D E

(1)

(iv) The spinner lands on purple.

A B C D E

(1)

(b) The spinner is used in a game.

Red scores 5 points.

Yellow scores 2 points.

White scores 1 point.

Raj and Ben each have 10 spins.

The person with the most points wins the game.

Raj scores 22 points.

The table shows the results for Ben.

Colour	Frequency
Red	3
Yellow	1
White	6

Who wins the game?

You **must** show your working.

(3)

(Total 7 marks)

Q42.

150 boys and 160 girls sit an examination.

The table shows some of the probabilities that they came with or without a calculator.

	With calculator	Without calculator
Boy	0.92	0.08
Girl	0.95	

- (a) What is the probability that a girl came **without** a calculator?
Write your answer in the table.

(1)

- (b) How many of the 150 boys came **with** a calculator?

(2)

(Total 3 marks)

Q43.

Cards with the letters L, M and P are placed next to each other.

- (a) List all the possible orders of the letters.

One has been done for you.

L	M	P

(2)

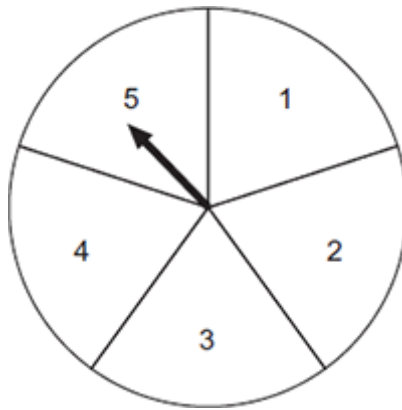
- (b) The three cards are placed next to each other at random.
What is the probability that L is the middle letter?

(1)

(Total 3 marks)

Q44.

Matt made this spinner.
He spins the arrow 200 times.



- (a) How many times would you expect the arrow to stop on the number 5 if the spinner is fair?

(2)

- (b) The table shows the number of times the arrow stops on each number.

Stops on	1	2	3	4	5
Number of times	32	41	65	27	35

Do you think the spinner is fair?

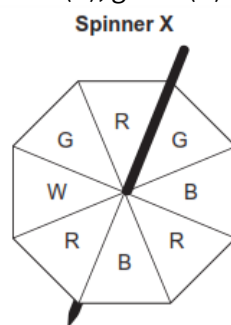
Give a reason for your answer.

(2)

(Total 4 marks)

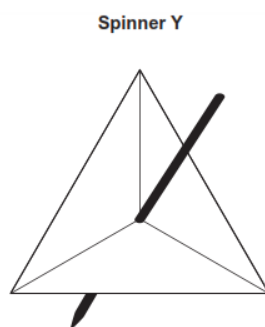
Q45.

- (a) Fair spinner X has eight equal sections.
The sections are either red (R), blue (B), green (G) or white (W).

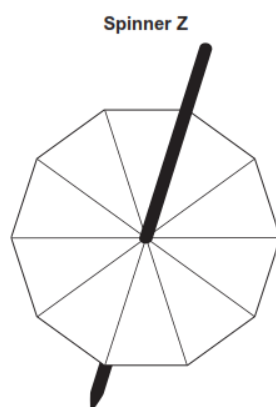


- (i) The spinner is spun.
On which colour is it least likely to land? **(1)**
- (ii) Write down the probability that the spinner lands on green.
Give your answer in its simplest form. **(2)**

- (b) Fair spinner Y has three equal sections.
It is certain to land on red (R).
Label spinner Y.



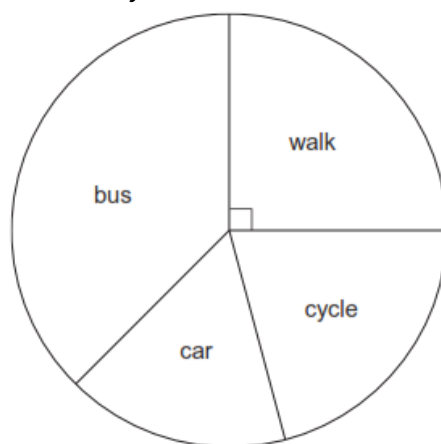
- (c) Fair spinner Z has 10 equal sections.
Label spinner Z so that
it has the same four colours as spinner X
white is less likely than on spinner X
white and green are equally likely on spinner Z
red and blue are equally likely on spinner Z. **(1)**



(2)
(Total 6 marks)

Q46.

The pie chart shows information about how year 10 students travel to a school.



- (a) A student from year 10 is chosen at random.
Mark, with the letter, the probabilities of each of the following on the scale below.
The first one has been done for you.

A: The student walks to school.

B: The student does **not** walk to school.

C: The student travels to school by train.



- (b) 40 students travel to school by car.
How many year 10 students are there? (2)
- (c) There are 252 students in year 11.
The same proportion of students walk to school as in year 10.
Work out the number of year 11 students that walk to school. (3)

(2)
(Total 7 marks)

Q47.

- (a) Tick the correct column for each statement.

Statement	Never True	Sometimes True	Always True
An impossible event has a probability of -1			
An event which is unlikely has a probability of 0.75			
An event which is certain has a probability of 1			

- (b) Put these probabilities in order starting with the lowest. (3)

0.3 $\frac{1}{3}$ 33%

(2)
(Total 5 marks)

Q48.

- (a) A bag contains 3 red, 5 white and 8 blue counters.
One counter is chosen at random.
What is the probability of choosing a blue counter?
(2)
- (b) A different bag contains only black counters, pink counters and white counters.
When one counter is chosen at random, each colour is equally likely.
Write down **two** possible values for the total number of counters in this bag.
(2)
- (c) Another bag contains only green counters and yellow counters.
There are more than 10 counters in the bag.
When one counter is chosen at random, the probability of choosing a
green counter is $\frac{3}{4}$.
Write down **two** possible values for the total number of counters in this bag.
(2)

(Total 6 marks)**Q49.**

At the school fayre, I play a game 20 times.
Each go costs 50p.
Each time I win I receive £1.50

The probability of winning is $\frac{1}{5}$.
How much money do I expect to lose?

(Total 3 marks)