THIRD SPACE
LEARNING

Probability Distributions - Worksheet

Skill

Group A - Experimental probability and relative frequency

Work out:

1) A coin was flipped 100 times and it showed heads 35 times. Find the relative frequency of the coin showing heads.

2) A dice was rolled 80 times and a 3 was obtained 24 times. What is the probability of getting a 3 on the next roll?

3) A spinner is spun 50 times and the results recorded. Find the relative frequency for each colour.

Colour	Frequency	Relative Frequency
Blue	14	
Red	16	
Green	9	
Yellow	11	

4) A spinner is spun 60 times and the results recorded.

Colour	Frequency
Blue	15
Red	23
Green	22

What is the probability of the spinner landing on red or green?

5) A biassed 6-sided dice is rolled and the results recorded.

Number	Frequency
1	10
2	7
3	15
4	6
5	18
6	14

The dice will be rolled one more time. What is the probability it will land on a prime number?

6) A coin was flipped in an experiment and showed tails on 36 occasions.

The relative frequency of heads was found to be 0.6.

How many times was the coin flipped during the experiment?

Probability Distributions - Worksheet

Group B - Expected frequency

Work out:

1) The probability of a train being late in the morning is 0.15. In a 60 day period, how many mornings would we expect the train to be late?

2) The probability of a spinner landing on blue is 0.3. The spinner is spun 200 times. What is the expected frequency of the spinner landing on blue?

3) The probability of winning a game is 32%. If you play the game 400 times, how many would you expect to win?

4) The probability of a fair dice landing on 6 is $\frac{1}{6}$. If the dice is rolled 150 times, how many times do you expect it to land on 6?

5) The probability of a selecting a red counter from a bag is $\frac{2}{7}$. If the bag contains 280 counters, how many counters would you expect to be red?

6) The probability of winning a game is 65%. If you play the game 80 times, how many times would you expect to not win?

7) The probabilities of selecting a coloured counter from a bag are shown below.

Colour	Red	Blue	White
Probability	0.2	0.45	0.35

If there are 300 counters in the bag, how many are not white?

8) A fair 6-sided dice is rolled 900 times. How many times would you expect to get a multiple of 3?

9) The probabilities of selecting a coloured counter from a bag are shown below.

Colour	Red	Blue	Green
Probability	0.15	0.6	0.25

If there are 120 red counters in the bag, how many green counters are there?

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Probability Distributions - Worksheet

Group C - Probability distributions

Complete the probability distributions:

1) A spinner can land on blue, green or red. The table shows the probabilities for the spinner landing on blue and green. Find the probability of the spinner landing on red.

Colour	Blue	Green	Red
Probability	0.3	0.15	

2) A bag only contains white, red and black counters. The probability of selecting a black counter is 0.5. It is known that there are the same number of white counters as red counters. Complete the table.

Colour	White	Red	Black
Probability			0.5

3) A spinner can land on blue, green or yellow. The table shows the probability of the spinner landing on blue. The probability of the spinner landing on green is twice the probability of it landing on yellow. Complete the table

Colour	Blue	Green	Yellow
Probability	0.4		

4) A bag contains only blue, red and green counters. The probability of selecting a blue counter is 0.2. The number of red counters is 3 times the number of green counters. Complete the table

Colour	Blue	Red	Green
Probability	0.2		

5) The table shows the probability distribution for a spinner.

Colour	White	Red	Blue
Probability	x	$3x$	$2x$

Find the probabilities for each colour.

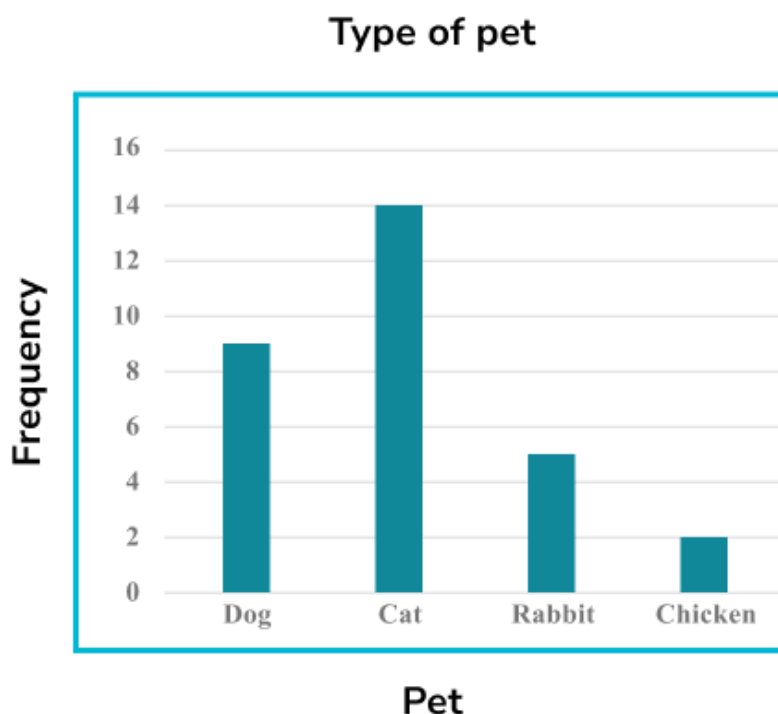**6)** The table shows the probability distribution for a spinner.

Colour	White	Green	Red	Blue
Probability	$x + 0.2$	x	$x + 0.1$	$2x + 0.1$

Find the probabilities for each colour.

Probability Distributions - Worksheet

Applied

1)   The bar chart shows the type of pets owned by a class of children.

Type of pet

(a)   A child in the school is chosen at random. Use the bar chart to find the probability of that child having a rabbit as a pet.

(b)   If the school has 270 children, how many would you expect to own a dog?

2)   There are 30 days in June. Sarah wanted to find the probability of it raining in June where she lived. She researched the number of days rain fell in June in her town over a 5 year period. The results are shown in the table.

Year	1	2	3	4	5
Days of rain in June	8	12	10	7	8

(a)   Use the information to find the best estimate of the probability that it will rain in June.

(b)   Estimate the number of days you would expect it to rain in June.

Probability Distributions - Worksheet

3)   A fairground game involves throwing a ball into 3 different sized boxes.
The boxes each have an opening in the shape of a square as shown.
Box A has side length $15cm$, box B has side length $10cm$ and box C has
side length $5cm$. The game is designed so that the ball will always land
in one of the boxes.
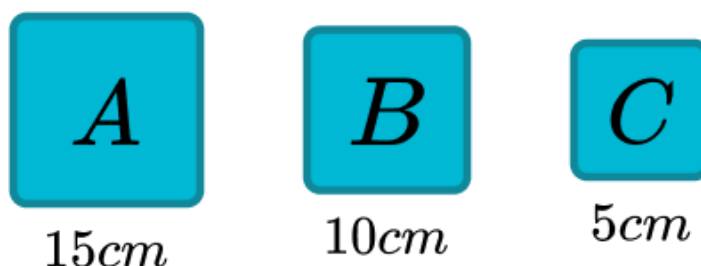
The probabilities of successfully throwing the ball into boxes A, B or C
are in the ratio of the areas of their openings.

(a)   Find the probability of successfully throwing the ball into box B.

(b)   A player has 70 balls. How many should they expect to get into box C?

4)   A probability distribution of a bag of counters numbered $1, 2, 3, 4,$ and 5
is such that the probability of selecting each number is proportional to
its value.
This is shown in the table below.

Counter number	1	2	3	4	5
Probability	k	2k	3k	4k	5k

(a)   Find the value of k.

(b)   Find the probability of selecting a square numbered counter from the
bag.

Probability Distributions - Exam Questions

1)   A bag contains only white, yellow and red counters. There are three times as many yellow counters as white counters and twice as many red counters as yellow counters.

A counter is selected at random. Fill in the table to show the probability distribution for the bag of counters.

Colour	White	Yellow	Red
Probability			

(4 marks)

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2)   Ben flipped a coin 20 times and recorded the results.

Side	Frequency
Heads	16
Tails	4

(a)   Ben says, "the coin must be biassed because I got a lot more heads than tails". Explain why Ben's statement might be wrong.

………………….

(1)

(b)   Fred takes the same coin and flips it another 80 times and records the results.

Side	Frequency
Heads	32
Tails	48

Use the information to complete the table for the probability distribution for the coin.

Side	Head	Tail
Probability		

(4 marks)

Probability Distributions - Exam Questions

3)   The table shows the probability distribution for a bag containing only red, yellow, blue and green counters.

Number	Red	Yellow	Blue	Green
Probability	0.25	0.05	0.3	0.4

The spinner is spun 400 times. How many times would it be expected to land on blue or yellow?

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(3 marks)

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4)   The table shows the probability of winning cash prizes from an arcade game.

Prize	0p	10p	50p	£1
Probability	0.5	0.3	0.15	0.05

It costs 20p to play the game. Abbie plays the game 300 times. Calculate the profit or loss that Abby will make, stating clearly whether it is a profit or loss.

....

(5 marks)

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Probability Distributions - Answers

	Question	Answer
	Skill Questions	
Group A	**1)** A coin was flipped 100 times and it showed heads 35 times. Find the relative frequency of the coin showing heads.	**1)** 0.35
	2) A dice was rolled 80 times and a 3 was obtained 24 times. What is the probability of getting a 3 on the next roll?	**2)** 0.3 or $\frac{24}{80}$ or $\frac{3}{10}$
	3) A spinner is spun 50 times and the results recorded. Find the relative frequency for each colour. **3)** Question table: 	Colour	Frequency	Relative Frequency	 	Blue	14		 	Red	16		 	Green	9		 	Yellow	11			**3)** 	Colour	Frequency	Relative Frequency	 	Blue	14	0.28	 	Red	16	0.32	 	Green	9	0.18	 	Yellow	11	0.22	
	4) A spinner is spun 60 times and the results recorded. 	Colour	Frequency	 	Blue	15	 	Red	23	 	Green	22	 What is the probability of the spinner landing on red or green?	**4)** $\frac{45}{60}$ or $\frac{3}{4}$ or 0.75

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Probability Distributions - Answers

Group A contd	**5)** A biassed 6-sided dice is rolled and the results recorded.	**5)** $\frac{40}{70}$ or $\frac{4}{7}$
	<table><tr><th>Number</th><th>Frequency</th></tr><tr><td>1</td><td>10</td></tr><tr><td>2</td><td>7</td></tr><tr><td>3</td><td>15</td></tr><tr><td>4</td><td>6</td></tr><tr><td>5</td><td>18</td></tr><tr><td>6</td><td>14</td></tr></table>	
	The dice will be rolled one more time. What is the probability it will land on a prime number?	
	6) A coin was flipped in an experiment and showed tails on 36 occasions. The relative frequency of heads was found to be 0.6. How many times was the coin flipped during the experiment?	**6)** 90
Group B	**1)** The probability of a train being late in the morning is 0.15. In a 60 day period, how many mornings would we expect the train to be late?	**1)** 9
	2) The probability of a spinner landing on blue is 0.3. The spinner is spun 200 times. What is the expected frequency of the spinner landing on blue?	**2)** 60
	3) The probability of winning a game is 32%. If you play the game 400 times, how many would you expect to win?	**3)** 128
	4) The probability of a fair dice landing on 6 is $\frac{1}{6}$. If the dice is rolled 150 times, how many times will it land on 6?	**4)** 25
	5) The probability of a selecting a red counter from a bag is $\frac{2}{7}$. If the bag contains 280 counters, how many would you expect to be red?	**5)** 80
	6) The probability of winning a game is 65%. If you play the game 80 times, how many times would you expect to **not** win?	**6)** 28

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Probability Distributions - Answers

Group B contd	**7)** The probabilities of selecting a coloured counter from a bag are shown below.	**7)** 195

Colour	Red	Blue	White
Probability	0.2	0.45	0.35

If there are 300 counters in the bag, how many are **not** white?

8) A fair 6-sided dice is rolled 900 times. How many times would you expect to get a multiple of 3?

8) 300

9) The probabilities of selecting a coloured counter from a bag are shown below.

9) 200

Colour	Red	Blue	Green
Probability	0.15	0.6	0.25

If there are 120 red counters in the bag, how many green counters are there?

Group C	**1)** A spinner can land on blue, green or red. The table shows the probabilities for the spinner landing on blue and green. Find the probability of the spinner landing on red.	**1)** 0.55

Colour	Blue	Green	Red
Probability	0.3	0.15	

2) A bag only contains white, red and black counters. The probability of selecting a black counter is 0.5. It is known that there are the same number of white counters as red counters. Complete the table.

2)

Colour	White	Red	Black
Probability	0.25	0.25	0.5

Colour	White	Red	Black
Probability			0.5

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Probability Distributions - Answers

Group C contd	**3)** A 3-sided spinner can land on blue, green or yellow. The table shows the probability of the spinner landing on blue. The probability of the spinner landing on green is twice the probability of it landing on yellow.Complete the table 	**3)**

3) A 3-sided spinner can land on blue, green or yellow. The table shows the probability of the spinner landing on blue. The probability of the spinner landing on green is twice the probability of it landing on yellow.Complete the table

Colour	Blue	Green	Yellow
Probability	0.4		

3)

Colour	Blue	Green	Yellow
Probability	0.4	0.4	0.2

4) A bag contains only blue, red and green counters. The probability of selecting a blue counter is 0.2. The number of red counters is 3 times the number of green counters. Complete the table

Colour	Blue	Red	Green
Probability	0.2		

4)
$$1 - 0.2 = 0.8$$
$$0.8 \div (3 + 1) = 0.2$$

Colour	Blue	Red	Green
Probability	0.2	0.6	0.2

5) The table shows the probability distribution for a spinner.

Colour	White	Red	Blue
Probability	x	$3x$	$2x$

Find the probabilities for each colour.

5) $x + 3x + 2x = 1$
$$6x = 1$$
$$x = 1 \div 6 = \frac{1}{6}$$

Colour	W	R	B
Probability	$\frac{1}{6}$	$\frac{3}{6} = \frac{1}{2}$	$\frac{2}{6} = \frac{1}{3}$

6) The table shows the probability distribution for a 4 sided spinner.

Colour	White	Green	Red	Blue
Probability	$x + 0.2$	x	$x + 0.1$	$2x + 0.1$

Find the probabilities for each colour.
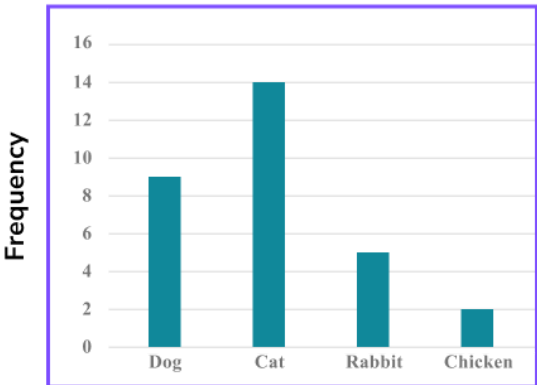
6) $5x + 0.4 = 1$
$$5x = 0.6$$
$$x = 0.12$$

Colour	White	Green	Red	Blue
Probability	0.32	0.12	0.22	0.34

Probability Distributions - Answers

	Question	Answer
	Applied Questions	
1)	The bar chart shows the type of pets owned by a class of children. **Type of pet**	
a)	A child in the school is chosen at random. Use the bar chart to find the probability of that child having a rabbit as a pet.	**a)** $\dfrac{5}{30} = \dfrac{1}{6}$
b)	If the school has 270 children, how many would you expect to own a dog?	**b)** $270 \times \dfrac{9}{30} = 81$
2)	There are 30 days in June. Sarah wanted to find the probability of it raining in June where she lived. She researched the number of days rain fell in June in her town over a 5 year period. The results are shown in the table.	

Year	1	2	3	4	5
Days of rain in June	8	12	10	7	8

	Question	Answer
a)	Use the information to find a probability that it will rain in June.	**a)** $8 + 12 + 10 + 7 + 8 = 45$ $5 \times 30 = 150$ Probability $= \dfrac{45}{150}$ or 0.3
b)	Estimate the number of days you would expect it to rain in June .	**b)** $30 \times 0.3 = 9$

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Probability Distributions - Answers

3)	A fairground game involves throwing a ball into 3 different sized boxes. The boxes each have an opening in the shape of a square as shown. Box A has side length $15cm$, box B has side length $10cm$ and box C has side length $5cm$. The game is designed so that the ball will always land in one of the boxes.	Area A = $15^2 = 225$ Area B = $10^2 = 100$ Area C = $5^2 = 25$ Total Area = $225 + 100 + 25$ $= 350$

A B C

$15cm$ $10cm$ $5cm$

The probabilities of successfully throwing the ball into boxes A, B or C are in the ratio of the areas of their openings.

a) Find the probability of successfully throwing the ball into box B.

a) $\frac{100}{350} = \frac{2}{7}$

b) A player has 70 balls. How many should they expect to get into box C?

b) $70 \times \frac{25}{350} = 5$

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4) A probability distribution of a bag of counters numbered 1, 2, 3, 4, and 5 is such that the probability of selecting each number is proportional to its value.
This is shown in the table below.

Counter number	1	2	3	4	5
Probability	k	2k	3k	4k	5k

a) Find the value of k.

a) $k + 2k + 3k + 4k + 5k = 1$
$15k = 1$
$k = \frac{1}{15}$

b) Find the probability of selecting a square numbered counter from the bag.

b) P(Square number)
$= P(1 \, or \, 4)$
$= \frac{1}{15} + \frac{4}{15}$
$= \frac{5}{15}$ or $\frac{1}{3}$

Probability Distributions - Mark Scheme

		Question	Answer	
		Exam Questions		
1)		A bag contains only white, yellow and red counters. There are twice as many red counters as yellow counters and three times as many yellow counters as white counters. A counter is selected at random. Fill in the table to show the probability distribution for the bag of counters.	Process of forming a ratio or equation linking amounts of white, yellow and red counters, eg W:Y:R = 1:3:6 **oe** P(white) = 0. 1 **oe** P(yellow) = 0. 3 **oe** P(red) = 0. 6 **oe**	**(1)** **(1)** **(1)** **(1)**

Colour	White	Yellow	Red
Probability			

Colour	White	Yellow	Red
Probability	0.1	0.3	0.6

		Question	Answer	
2)		Ben flipped a coin 20 times and recorded the results.		

Side	Frequency
Heads	16
Tails	4

	(a)	Ben says, "the coin must be biassed because I got a lot more heads than tails". Comment on Ben's statement.	**(a)** 20 times is not enough trials **oe**	**(1)**
	(b)	Fred takes the same coin and flips it another 80 times and records the results.	**(b)** Total number of heads $= 16 + 32 = 48$ Total number of tails $= 4 + 48 = 52$ P(heads) $= \frac{48}{100}$ **oe** P(tails) $= \frac{52}{100}$ **oe**	**(1)** **(1)** **(1)** **(1)**

Side	Frequency
Heads	32
Tails	48

Use the information to complete the table for the probability distribution for the coin.

Side	Head	Tail
Probability		

Side	Head	Tail
Probability	**0.48**	**0.52**

Probability Distributions - Mark Scheme

3)	The table shows the probability distribution for a bag containing only red, yellow, blue and green counters.	$0.05 + 0.3 = 0.35$	(1)
		0.35×400	(1)
		140	(1)

Number	Red	Yellow	Blue	Green
Probability	0.25	0.05	0.3	0.4

The spinner is spun 400 times. How many times would it be expected to land on blue or yellow?

| 4) | The table shows the probability of winning cash prizes from an arcade game. | $20 \times 300 = 6000, 6000p$ or £60 | (1) |

Prize	0p	10p	50p	£1
Probability	0.5	0.3	0.15	0.05

It costs 20p to play the game. Abbie plays the game 300 times.

Calculate the profit or loss that Abby will make, stating clearly whether it is a profit or loss.

10p: $300 \times 0.3 \times £0.10 = £9$ **or**
50p: $300 \times 0.15 \times £0.50 = £22.50$ **or**
£1: $300 \times 0.05 \times £1.00 = £15$ **(1)**

$£9 + £22.50 + £15$ **(1)**
winnings £46.50   **(1)**

$£60 - £46.50 = £13.50$
Loss **and** £13.50   **(1)**