Year 9 Probability Workbook

Part 2: Experimenting

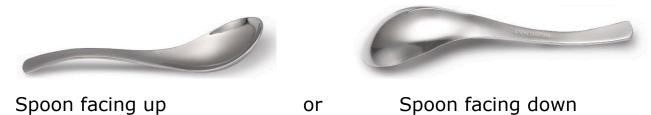
Name:



Written by Liz Sneddon

Experiment 1 (at home)

When you drop a spoon, there are two ways the spoon can land. Either:



Problem

I wonder what the probability of the spoon landing facing up is?

Plan

- 1. Collect a spoon.
- 2. Find a piece of carpet where you can safely (and quietly) do the experiment.
- 3. Hold your arm out and drop the spoon.
- 4. Record whether it landed facing up or down on the tally chart below.
- 5. Repeat this a total of 50 times.
- 6. Clean the spoon and return it to the drawer.

Explain why it is important that you use the same method each time to drop the spoon.

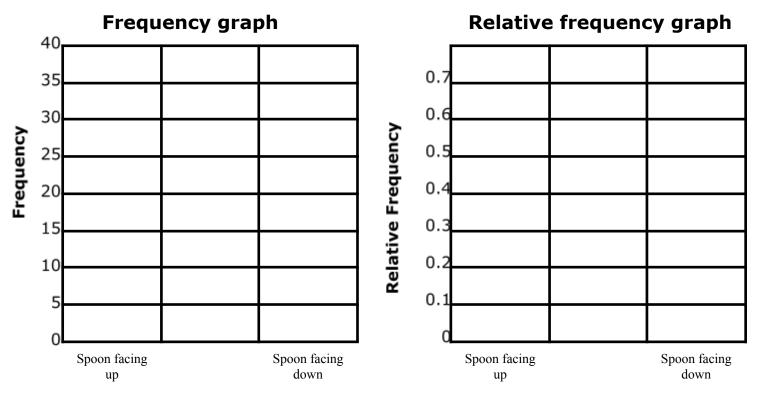
Why is collecting 50 pieces of data a good thing to do? Why not do more or less?

Data

Carry out your investigation and record your data below.

Outcome	Tally	Frequency	Relative Frequency
Spoon facing up			
Spoon facing down			

Draw both a frequency and relative frequency bar graph



Analysis

Mode =

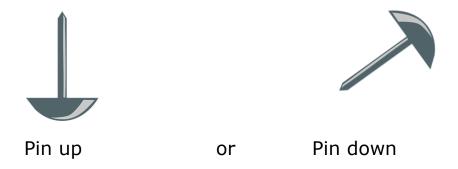
I notice that the most common result is _____

Conclusion

From my experiment the estimated probability of the spoon landing facing up is ______ and the estimated probability of the spoon landing facing down is ______.

Experiment 1 (at school)

When you toss a drawing pin, there are two ways the pin can land. Either:



Problem

I wonder what the probability of the pin landing pin up is?

Plan

Sample space: Pin up and Pin down.

Number of trials: 50

Instructions:

1. Collect a pin from your maths teacher.

2. Find a flat surface to safely do the experiment.

- 3. Hold your arm about 30 cm above the table and drop the pin.
- 4. Record whether it landed pin up on the tally chart below.
- 5. Repeat this a total of 50 times.
- 6. Return the pin to your teacher.

Explain why it is important that you use the same method each time to drop the spoon.

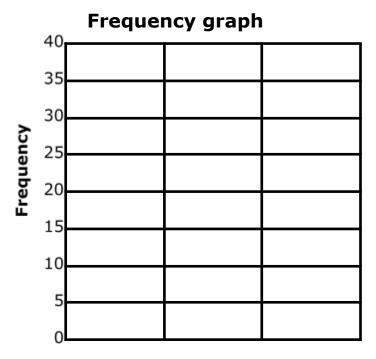
Why is collecting 50 pieces of data a good thing to do? Why not do more or less?

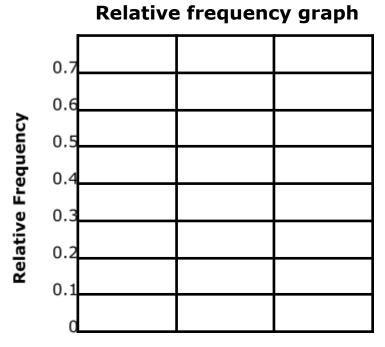
Data

Carry out your investigation and record your data below.

Outcome	Tally	Frequency	Relative Frequency
Spoon facing up			
Spoon facing down			

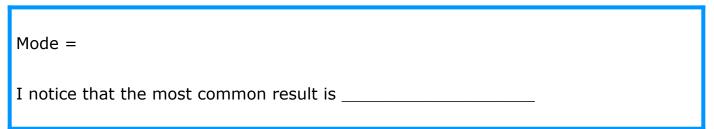
Draw both a frequency and relative frequency bar graph





Spoon facing
upSpoon facing
downSpoon facing
upSpoon facing
up

Analysis



Conclusion

From my experiment the estimated probability of the spoon landing facing up is
and the estimated probability of the spoon landing facing
down is

Experiment 2 (How random are you?)

Problem

I wonder whether a student is as good as making random numbers as a spinner, my calculator and a random number table ?

Plan

Sample space: Random numbers = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Number of trials: 50

Instructions:

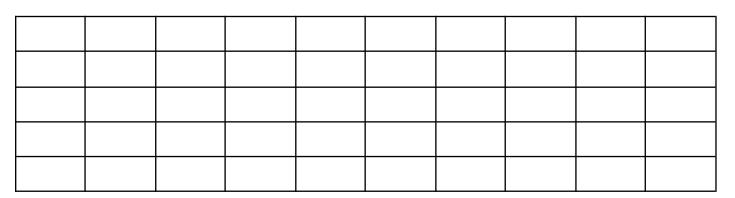
- 1. Get a student to generate 50 random numbers between 1 and 10,
- 2. Record all the results in the matching table below.
- 3. Generate 50 random numbers between 1 and 10 using a spinner,
- 4. Record all the results in the matching table below.
- 5. Generate 50 random numbers between 1 and 10 using a calculator
- 6. Record all the results in the matching table below.
- 7. Generate 50 random numbers between 1 and 10 using a random number table.
- 8. Record all the results in the matching table below.

Data

Student:

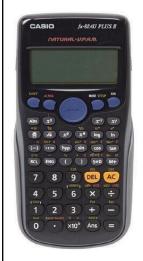
Write down 50 numbers between 1 and 10:

Spinner: **Step 1:** Click <u>here</u> to go to the website Step 2: Step 3: SPIN 3 **SPIN** Change the Click on the 3 number of sides button, and choose to **10** edit **1** spinner a Sides a Sides: 10 **b** Sides Step 4: Step 5: SPIN Click on the Write your result in the table below and repeat **Spin** a Sides : 10 until you have all your button b Sides : 6 data. c Sides : 6 d Sides : 6



Calculator:

Step 1: Turn on your calculator (click <u>here</u> to go a website if you don't have one).



Step 2: We want to enter the formula **RanInt#(1,10)**. To do this press the following sequence of buttons:

ALPHA • 1 SHIFT) 10) =

Each time you press = another random number will be displayed.

RanInt#(1,10)

9

Step 4: Write your result in the table below and repeat until you have 50 values.

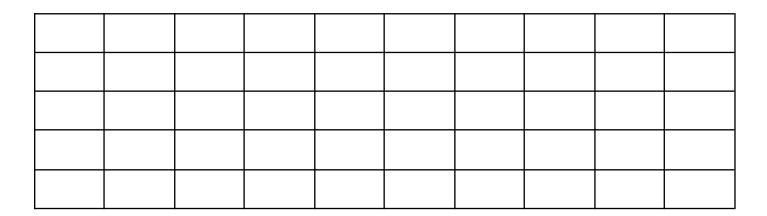


Table of random numbers:

- 1) Choose a random starting point on the random number table.
- 2) Break the numbers into single digit numbers.

E.g. 36518 becomes 3 6 5 1 8

- 3) If the number is a 0, we will make this equal to a random number of 10.
- 4) Write these numbers down below.

 36518
 36777
 89116
 05542
 29705
 83775

 46132
 81380
 75635
 19428
 88048
 08747

 31841
 77367
 40791
 97402
 27569
 90184

 84180
 93793
 64953
 51472
 65358
 23701

 78435
 37586
 07015
 98729
 76703
 16224

 41859
 94198
 37182
 61345
 88857
 53204

 13019
 07274
 51068
 93129
 40386
 51731

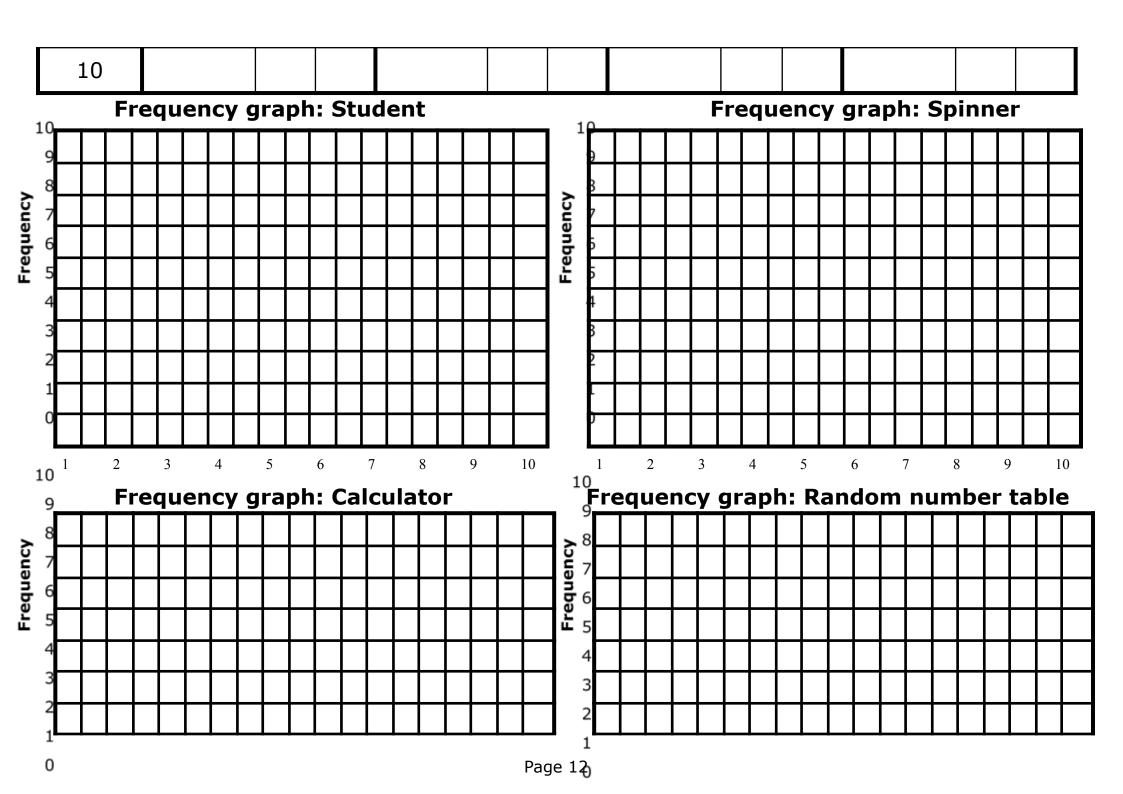
 82448
 72430
 29041
 59208
 95266
 33978

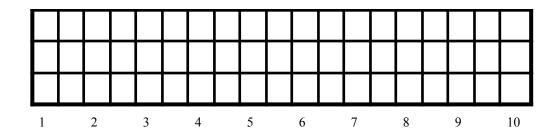
 25432
 96593
 83112
 96997
 55340
 80312

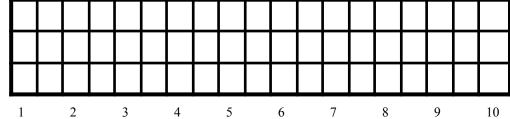
 69226
 38655
 03811
 08342
 47863
 02743

Write down 50 numbers between 1 and 10:

	Stu	den	t	Spinr		Spinner		Calculator		Table		
Outcome	Tally	Fr eq ue nc y	Re lat ive Fr eq ue nc	Tally	Freq uen cy	Rela tive Freq uen cy	Tally	Freq uenc y	Rela tive Freq uen cy	Tally	Freq uen cy	Rela tive Freq uen cy
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												







Analysis

Find the mode for each tool and write in the table below.

Mode:

Student	Spinner	Calculator	Table

Describe the modes for each tool.	
What else do you notice about the 4 tools? Think about the probabilities, the shape, and any other features. Discuss the similarities and differences.	
	-

Conclusion

Compare how random each of the tools are. Do you think they are all good at generating random numbers, or are any of the tools biased? Explain your reasons.

Which is the most random? Explain your reasons.

Experiment 3 (Dice)

Problem

I wonder whether the probability of getting each number on the die is equally likely?

Plan

Write a plan for how you can carry out this experiment. Each trial needs to be carried out in exactly the same conditions.

Sample space:
Number of trials: 60
nstructions:
)

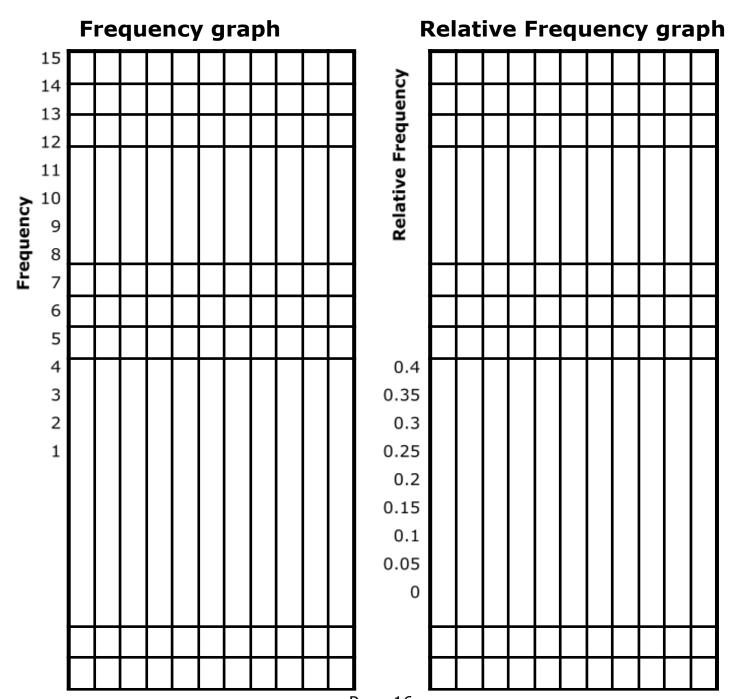
Data

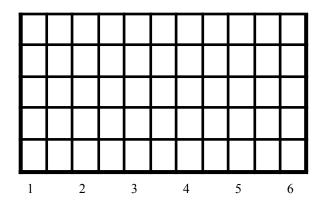
Carry out your experiment and record your data.

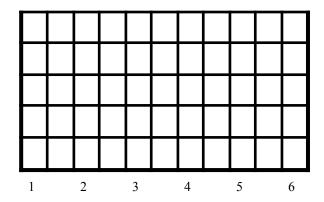
Analysis

Complete the tally table and graphs below.

Outcomes	Tally	Frequency	Relative frequency



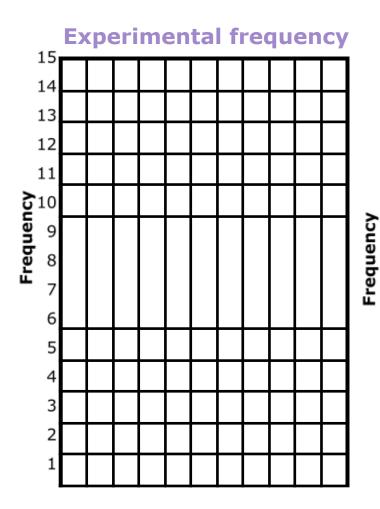


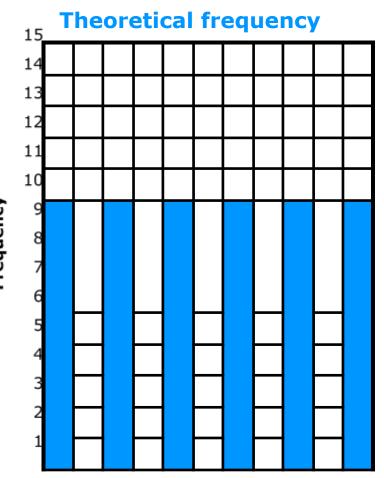


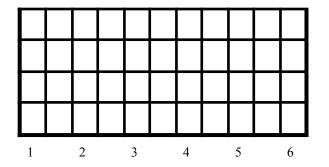
Identify the mode and probabilities and describe these below in context.

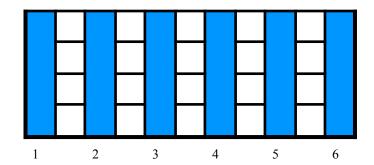
Comparing experimental and theoretical

Now let's compare your **experimental result** with the **theoretical distribution**. I have drawn the **theoretical distribution** for you. Redraw your **frequency** graph on the left-hand side of the grid below.









Conclusion

Draw a conclusion about your experimental results (answer your investigation question).

Compare the graphs of your experimental data with the theoretical data. Are all the bars in your **experimental graph** the same height as the **theoretical model**? Are they identical? Why/why not? Explain your reasons.

Experiment 4 (Two Coins)

You will need two coins (or click on this link to go to an online coin tossing website. Click on the settings cog to select 2 coins, then click on the coins and it will do a toss).

Problem

When I toss **two coins**, I wonder whether the probability of getting one Head is the same as getting two Tails?

Plan

Write a plan for how you can carry out this experiment. Each trial needs to be carried out in exactly the same conditions, and you want to do at least 50 trials.

Sample space:
Number of trials:
Definition of one trial: one trial is when I toss coins
Instructions:
1)

Data

Carry out your experiment and record your data.

Analysis

Complete the tally table and graphs below.

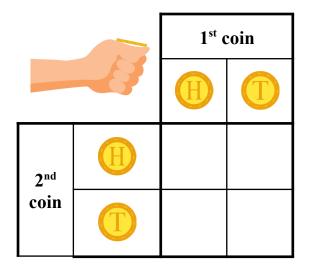
Outcomes	Tally	Frequency	Relative frequency
Two heads			
One head			
No heads			



Relative Frequency	
	1
Identify the made and probabilities and describe these below in contact	
Identify the mode and probabilities and describe these below in context.	

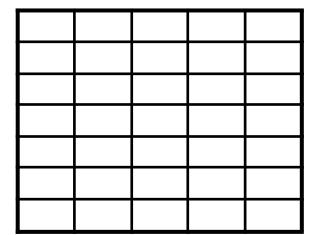
Comparing experimental and theoretical

Complete the sample space table and calculate the theoretical probabilities.

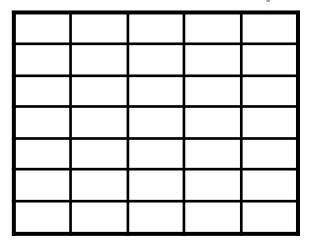


Now let's compare your **experiment result** with the **theoretical distribution**. Redraw your **relative frequency** graph on the left-hand grid below.

Experiment Relative freq.



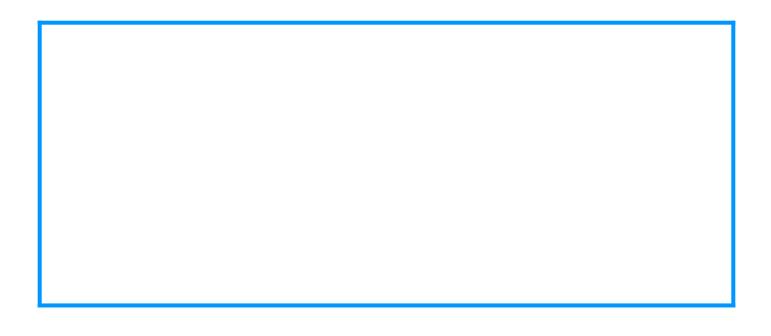
Theoretical Relative freq.



Conclusion

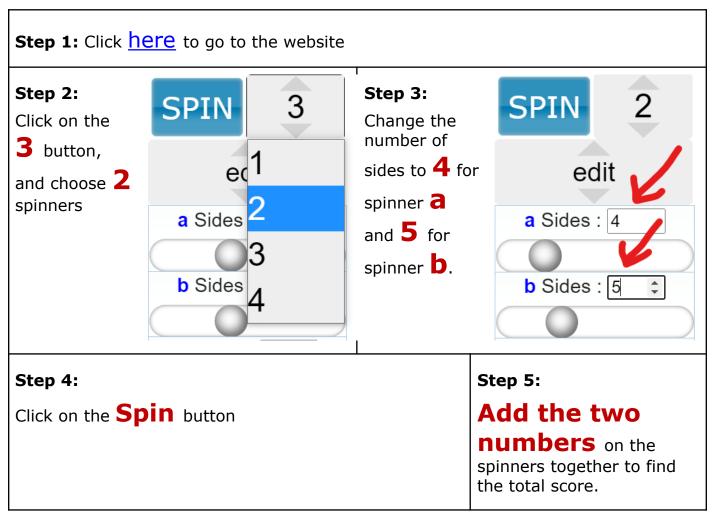
Draw a conclusion about your experimental results (answer your investigation question).

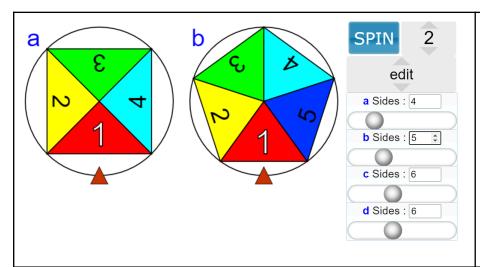
Then compare the graphs of your experimental data with the theoretical data.



Experiment 5 (Two spinners)

Setting up:





Step 6:

Write your result in the table below and repeat until you have enough data.

Problem

When I spin the two spinners above, I wonder what the probability of the total numbers are (when I add them both together)?

Plan

Write a plan for how you can carry out this experiment. Each trial needs to be carried out in exactly the same conditions, and you want to do at least 50 trials.

Sample space:						
a E b C s		1 st spinner				
2	4					
2 nd						
spinner						

Number of trials:

Definition of one trial: one trial is ...

Instructions:

1)

Data

Carry out your experiment and record your data.

				-

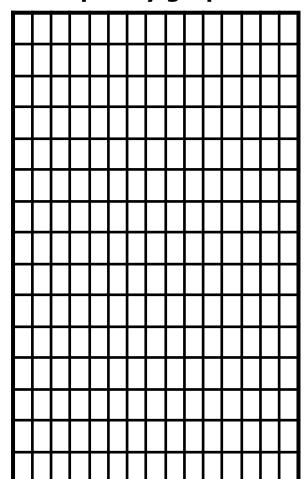
Analysis

Summarise your data below.

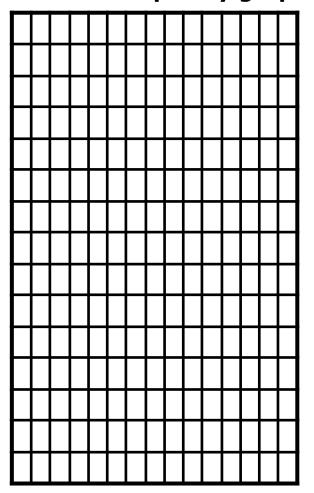
Outcomes	Tally	Frequency	Relative frequency

Draw the graphs of your data below.

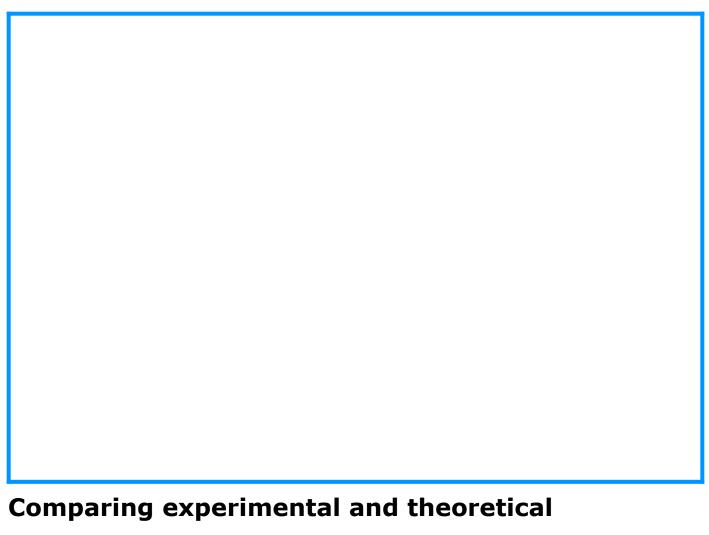
Frequency graph



Relative Frequency graph



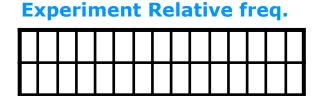
Identify the mode and probabilities and describe these below in context.

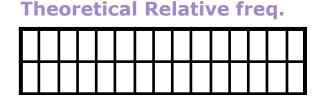


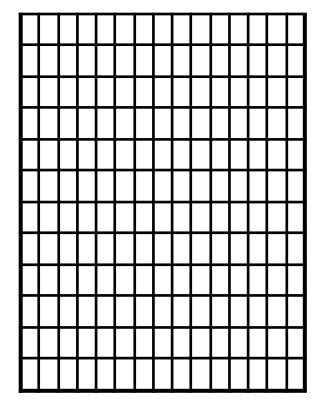
Use the sample space table you created previously to calculate the **theoretical probabilities**.

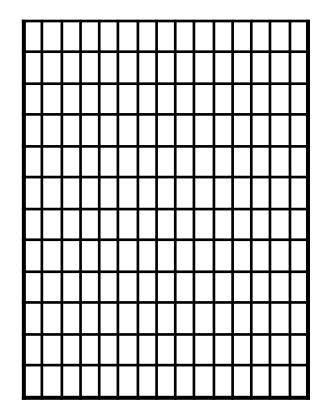
```
P(Total of ___) =
```

Draw your **relative frequency** graph for both the **experiment result** and the **theoretical distribution**.









Conclusion
Draw a conclusion about your experimental results (answer your investigation question).
Then compare the graphs of your experimental data with the theoretical data.

Key ideas:

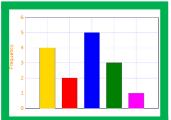
In each experiment there are some key ideas I want students to identify.

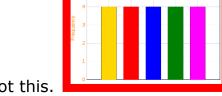
Experiment 1

- How to carry out an experimental investigation using the PPDAC cycle.
- Knowing that sometimes we will have a situation where we don't know what
 the theoretical probabilities are, so we collect data and run experiments to
 estimate the probability.
- Making sure students know that the **number of trials** (or sample size) has to be **at least 50**.
- Making students think about using a consistent method to collect data in order to control the amount of variation.

Experiment 2

Understanding that random should look like





- this,
 Use probability tools: spinner, random number table, calculator random
- number generator
 Comparison of different methods (leading towards comparing experimental
- and theoretical probabilities in later experiments).
- Students see that even when generating random numbers there is **ALWAYS** variation in data.

Experiment 3

- Learning to write their own instructions to collect data (and thinking about how to control variation).
- Comparing experimental results with theoretical model.

Experiment 4

- Students learning to **define** what **one trial** is.
- Calculate theoretical probabilities and compare to experimental results.

Experiment 5

- Two **different** spinners and **adding outcomes** together to form a total. Then plotting the **distribution of the total**.
- Full comparison of experimental versus theoretical models.