Section 5: Probability, Statistics, and Graphs

This booklet belongs to:_____**Block:** _____

Section	Due Date	How Did It Go?	Corrections Made and Understood
5.1			
5.2			
5.3			

Self-Assessment Rubric

Category	L-T Score	Learning Target Procedure	Algebraic/Arithmetic Procedure	Communication	Anecdotal Example
Extending	4	Procedural context demonstrates a detailed understanding of the learning targets	Algebraic/Arithmetic process is error free, logic is clear and easy to follow	Written output is clear, easy to follow, and shows depth of understanding	"You could teach this" or "It's an answer key"
	3.5	Procedural context demonstrates a thorough understanding of the learning targets	Algebraic/Arithmetic process contains very minor errors, logic is clear and easy to follow	Written output is clear, easy to follow, and shows depth of understanding	"Almost perfect, one or two little errors"
Proficient	3	Procedural context is clear, demonstrates sound reasoning and thought of the learning targets	Algebraic/Arithmetic process contains minor errors, logic is clear and easy to follow	Written output is clear and organized, and shows depth of understanding	"Good understanding with a few errors"
Developing	2.5	Procedural context is clear, contains errors but demonstrates sound reasoning and thought of the learning targets	Algebraic/Arithmetic process contains errors, logic is clear and easy to follow	Written output is difficult to follow, but shows an understanding of the task	"You know what to do bet not clear how to do it"
	2	Procedural context contains errors. Understanding of the learning targets is developing	Algebraic/Arithmetic process contains numerous errors, difficult to follow	Written output is difficult to follow but shows an understanding of the task	"You are on the right track but key concepts are missing"
Emerging	1	Procedural context is not clear, demonstrates minimal understanding of the learning targets	Algebraic/Arithmetic process contains numerous errors, difficult to follow	Written output is difficult to follow, but shows an understanding of the task	"You have achieved the bare minimum to meet the learning outcome"
Not Yet Meeting Outcomes	IE	Procedural context is not clear, demonstrates minimal understanding of the learning targets	Algebraic/Arithmetic process contains numerous errors, difficult to follow	Written output is difficult to follow or completely absent and lacks clarity	"Learning outcomes are not met at this time"

Learning Targets and Self-Evaluation

L – T	Description	Mark
5 – 1	• Discussion of outliers, sample vs population • Calculating central tendency: Mean/Median/Mode	
5 – 2	• Difference between theoretical and experimental probability • Calculating Experimental probability from data and in games	
5 – 3	• Displays information is pictographs, infographics etc. • Continuous versus discrete data's influence on: line/bar/circle graph	

Comments:

Competency Evaluation

A valuable aspect to the learning process involves self-reflection and efficacy. Research has shown that authentic self-reflection helps improve performance and effort, and can have a direct impact on the growth mindset of the individual. In order to grow and be a life-long learner we need to develop the capacity to monitor, evaluate, and know what and where we need to focus on improvement. Read the following list of Core Competency Outcomes and reflect on your behaviour, attitude, effort, and actions throughout this unit.

- Rank yourself on the left of each column: 4 (Excellent), 3 (Good), 2 (Satisfactory), 1 (Needs Improvement)

		4	3	2	1
Personal Responsibility	• I **listen** during instruction and come ready to ask questions				
	• I am **on time** for class • I am **fully prepared** for the class, with all the required supplies				
	• I am **fully prepared** for Tests				
	• I **follow** instructions keep my Workbook organized and tidy • I am **on task** during work blocks • I **complete** assignments **on time**				
Self-Regulation	• I keep track of my **Learning Targets**				
	• I take **ownership** over my goals, learning, and behaviour • I can **solve problems** myself and know when to ask for help • I can **persevere** in challenging tasks • I **am actively** engaged in lessons and discussions				
	• I only **use my phone** for school tasks				
Classroom Responsibility and Communication	• I am **focused** on the discussion and lessons • I **ask questions** during the lesson and class • I give **my best effor**t and **encourage** others to work well • I am polite and communicate questions and concerns with my peers and teacher in a timely manner • I clean up after myself and leave the classroom tidy when I leave				
Collaborative Actions	• I can **work with others** to achieve a common goal • I make **contributions** to my group • I **am kind** to others, can work collaboratively and **build relationships** with my peers • I **can identify** when others need support and provide it				
Communication Skills	• I present informative **clearly**, in an organized way • I **ask and respond** to simple direct questions • I am an **active listener**, I support and encourage the speaker • I **recognize** that there are different points of view and can disagree respectfully • I do not interrupt or speak over others				
	Overall				
Goal for next Unit – refer to the above criteria. **Please selec**t (underline/highlight) **two areas** you want to focus on					

Section 5.1 – Statistics and Central Tendency

Sample vs Population

- A **population** is the **totality** of all things under consideration
    - Example: All the students in school district 61
- A sample is a **selection of participants** from the population
    - Example: Only students at Mount Doug
- In order for a study to be free of bias, or skewed results, you need a true **RANDOM SAMPLE**.

Example:

If I were looking to do a survey of people in Victoria who think we need to improve the BC transit system, I need to make sure my **sample is random**.

- If I asked people at bus stops, will that have a bias on my results?

Absolutely! Since you are asking people at the bus stop, you can assume they ride the bus regularly and therefore have a skewed response regarding BC transit.

How do you get a **Random Sample**?

There are many methods:

- Open the phonebook to a random page
- Put all the people's names in a hat and draw them out
- Use a random selection computer generation program

- Statistics is the **mathematical approach** of **gathering data**
    - **Data** is the **information** gathered in a study, the answers to the questions you pose

- Data is gathered by posing a question to a Sample of individuals, the question can be open-ended, but usually has a **set of choice responses**
- Remember to choose your sample **randomly to limit bias** in the responses

Example of Sample versus Population

Sample: 500 people chosen at random from the Victoria phonebook

Population: The city of Victoria

Gathering the data is where you start, the more data you have the more reflective of a population the results may be.

- Think about if you asked: Do you prefer Pepsi of Coke and randomly selected 2 people
- Your stats would look like this:

$Pepsi$	$Coke$
100%	0%
50%	50%
0%	100%

Not really the best reflection of a population

The more data you have, the accurate your predictions will be.

So gather as much information as you can in order to achieve results that will be Statistically Significant

Central Tendency

- Is the Central of Typical value with respect to the distribution of the statistics
- We will look at and discuss these three:
    - The MEAN – The average of the values you have collected
    - The MEDIAN – The middle term of the list of data, written smallest to largest
    - The MODE – The term that occurs the most in a given set of data

The Median is often used in describing data compared to the Mean in statistics because it is not skewed by outliers that are excessively high and/or low, and may give a better idea of the typical value.

Example: Calculate the Mean, Median, and Mode of the following data set.

$$12, 13, 20, 10, 15, 17, 21, 37, 22, 13, 10, 17, 21, 21, 37$$

Solution: Rewrite the info in ascending order first to find the MEDIAN AND MODE

$$10, 10, 12, 13, 13, 15, 17, 17, 20, 21, 21, 21, 22, 37, 37$$

So now we can see that the **MODE** is: 21 (it appears three times)

So now we can see that the **MEDIAN** is: 17 (7 items on either side of it)

So now we can calculate the **MEAN** is: 19.07 (Add all the terms up and divide by the total number)

Section 5.1 – Practice Problems

What are 3 examples of Sample vs Population.

1.

2.

3.

Using the following sets of Data, calculate the Mean, Median, and Mode

4. Ages of a Sample Group

12	14	19	12	14	15	15	16	15	18

5. Average Temperature over a 30 Day Period

24°	21°	18°	19°	12°	21°	27°	29°	19°	18°
24°	23°	17°	19°	26°	15°	19°	20°	20°	13°
19°	23°	27°	20°	21°	23°	23°	19°	27°	23°

Section 5.2 – Theoretical and Experimental Probability

- Theoretical probability is calculated by

$$\frac{The\ number\ of\ favorable\ outcomes}{The\ number\ of\ possible\ outcomes}$$

- Experimental Probability is calculated by

$$\frac{The\ number\ of\ times\ something\ happened}{The\ number\ of\ times\ we\ tried}$$

.

Example: To understand the difference between the two, let's look at the tossing of a coin. What is the probability of flipping heads?

Theoretical Probability: Requires a sample space diagram

Coin Toss

H	T

$$Probabiltiy\ Flipping\ Heads = \frac{The\ number\ of\ ways\ we\ can\ flip\ Heads}{The\ number\ of\ ways\ we\ can\ flip}$$

$$Probabiltiy\ Flipping\ Heads = \frac{1}{2} = 0.5 = 50\%$$

Experimental Probability: Requires some trials:

$Heads$	13
$Tails$	7
$Total$	20

$$Probability\ of\ Flipping\ Heads = \frac{The\ number\ of\ times\ we\ flip\ Heads}{The\ number\ of\ times\ we\ flipped}$$

$$Probability\ of\ Flipping\ Heads = \frac{13}{20} = 0.65 = 65\%$$

Example: Now, let's look at tossing a coin twice. What is the probability of flipping at least one head?

Theoretical Probability: Requires a sample space diagram

Coin:

First Toss \ Second Toss	H	T
H	H, H	H, T
T	T, H	T, T

$$Probabiltiy\ Flipping\ at\ least\ one\ \ Head = \frac{The\ number\ of\ ways\ we\ can\ flip\ at\ least\ one\ Heads}{The\ number\ of\ ways\ we\ can\ flip}$$

$$Probabiltiy\ Flipping\ Heads = \frac{3}{4} = 0.75 = 75\%$$

Experimental Probability: Requires some trials:

Heads, Heads	4
Heads, Tails	3
Tails, Heads	7
Tails, Tails	6
Total	20

$$Probability\ of\ Flipping\ at\ least\ on\ Head = \frac{The\ number\ of\ times\ we\ flip\ at\ least\ one\ Head}{The\ number\ of\ times\ we\ flipped}$$

$$Probability\ of\ Flipping\ Heads = \frac{14}{20} = 0.7 = 70\%$$

Example: Now let's look at rolling a die.

Theoretical Probability: Requires a sample space diagram

Die Rdl					
1	2	3	4	5	6

$$Probabiltiy\ of\ rolling\ \ a\ 5 = \frac{1}{6} = 0.16666 = 16.7\%$$

$$Probabiltiy\ of\ rolling\ \ an\ even\ number = \frac{3}{6} = 0.5 = 50\%$$

$$Probabiltiy\ of\ rolling\ \ a\ 3\ or\ 1 = \frac{2}{6} = 0.33333 = 33.3\%$$

Experimental Probability: Requires some trials:

Number on Die	Outcomes
1	4
2	5
3	8
4	1
5	3
6	4

$$Probabiltiy\ of\ rolling\ \ a\ 5 = \frac{3}{25} = 0.12 = 12\%$$

$$Probabiltiy\ of\ rolling\ \ an\ even\ number = \frac{10}{25} = 0.4 = 40\%$$

$$Probabiltiy\ of\ rolling\ \ a\ 3\ or\ 1 = \frac{12}{25} = 0.48 = 48\%$$

Section 5.2 – Practice Problems

Using two dice. First fill in the sample space with all the possible outcomes of a roll with two dice.

Die #1 \ Die #2	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

What is the Theoretical Probability of the following:

1. Rolling any doubles:
2. Rolling sum of 6:
3. Rolling sum of 4:
4. Rolling Double 5's:
5. Rolling sum of 7:
6. Rolling sum of 3:

Using the table what is the experimental probability of the following:

7. Probability of rolling a sum of 5:
8. Probability of rolling a sum of 8:
9. Probability of rolling a sum of 4:
10. Probability of rolling a sum that is an even number:
11. Probability of rolling a sum that is an odd number:
12. Probability of rolling a sum that is a Prime Number:

Sum of Dice	*Frequency*
2	4
3	7
4	5
5	3
6	9
7	12
8	10
9	8
10	2
11	7
12	4

Section 5.3 – Graphing

- Graphing provides us with a way of visualizing **DATA**
- We will discuss a few here and put more focus on Bar/Line/Circle Graphs

The first three we will look at are:

Pictographs: A way of showing data using images

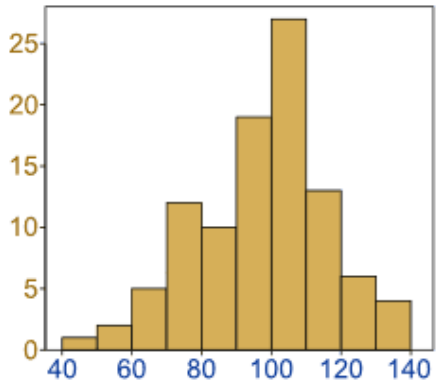
Pictographs have been used since the beginning of human civilization. Examples have been found as early as $3000BC$ in Egypt and Mesopotamia.

Favorite cookie

Cookie	Number of students
Peanut butter	●●●●●
Chocolate chip	●●●●
Ginger snap	●●
Animal cracker	●●●
Each ● = 2 cookies	

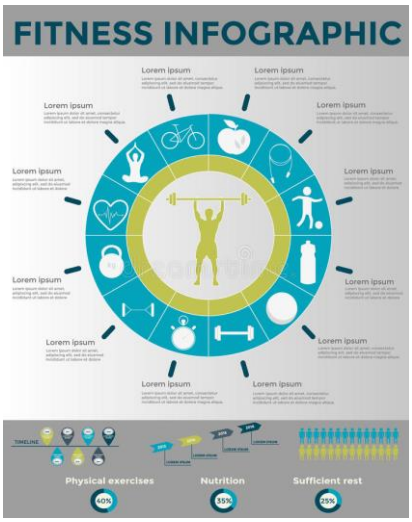
Histograms: Similar to a Bar Graph, made up of bars of info that represent continuous data, broken into bars that represent groups of ranges

Histograms, as a bar graph, is a way of showing information that represents continuous data without having to use a line graph.



Infographic: Graphic representation of information, data, knowledge etc. They play a critical role in marketing and advertising.

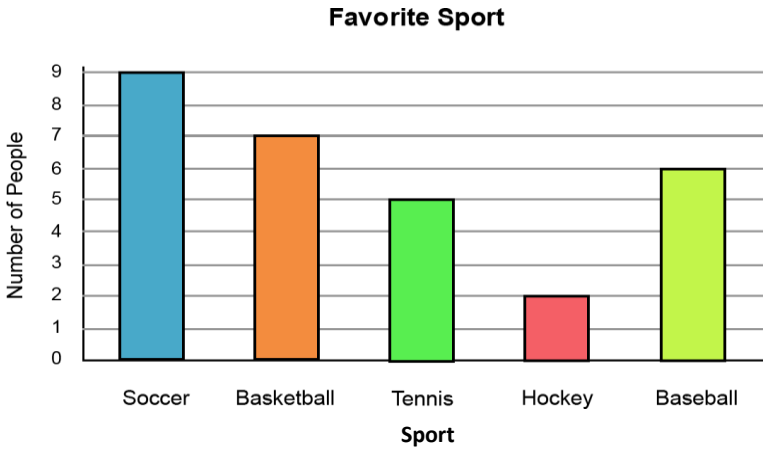
Infographics focus heavily on images to catch attention and portray information clearly, they still involve written information, but the images help to get the message out



The next three graphs we will look at in more detail.

Bar Graph: A graph of data, discrete in its topics, that represents the data using bars

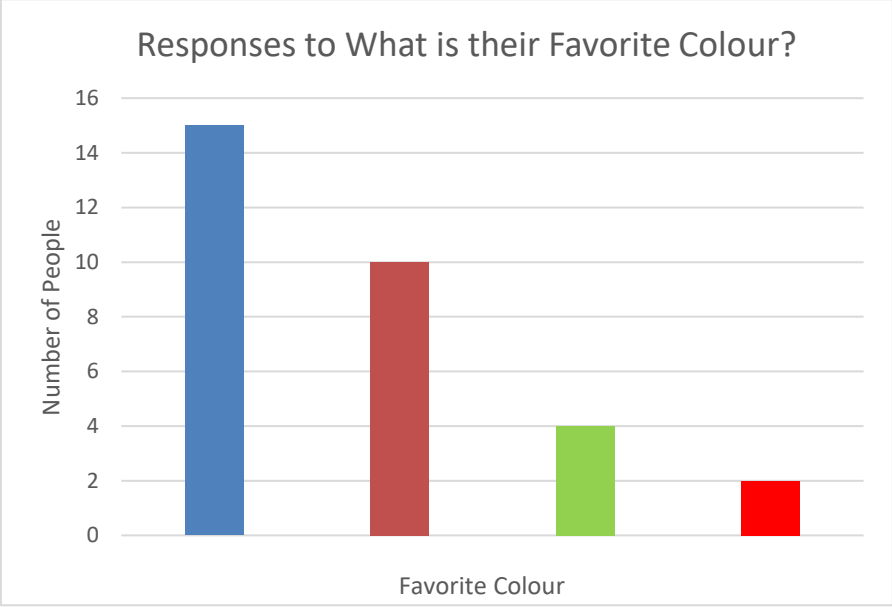
- You can see the Bar's represent discrete data (different concrete possibilities)
- The graph has a title and the axis are labeled



Example: Graph the following data as a bar graph

Solution:

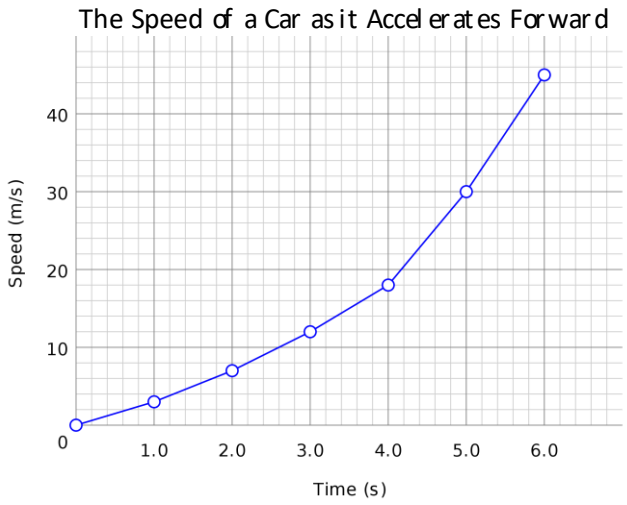
# of people	Favorite Colour
2	Red
15	Blue
10	Purple
4	Green



- This unit we will be making Bar Graphs by hand and using the Computer

Line Graph: A graph that shows data, represented continuously, which means there isn't a break in the data

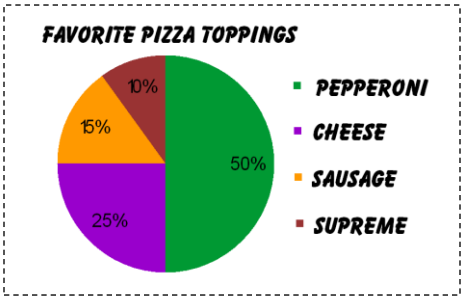
- You can see the $x-axis$ represents time, which can be pin-pointed to any point. That is what we mean by continuous data.
- If the line graph is in fact continuous we can interpolate and extrapolate for the graph



Circle Graphs: The hardest to produce by hand. The data needs to be analyzed and broken down into a percentage, then the percentage needs to be multiplied by 360 so that we have partitions of the $360°$ circle. We start with an arbitrary radius and measure the corresponding angles from there.

Example: Given the following information, make a circle graph to display it.

$\#\ of\ People$	15	10	4	2	7
$Pets$	Dog	Cat	$Bird$	$Lizard$	$Other$



Solution:

Total Number of People Surveyed: 38

Need a percentage of $360°$

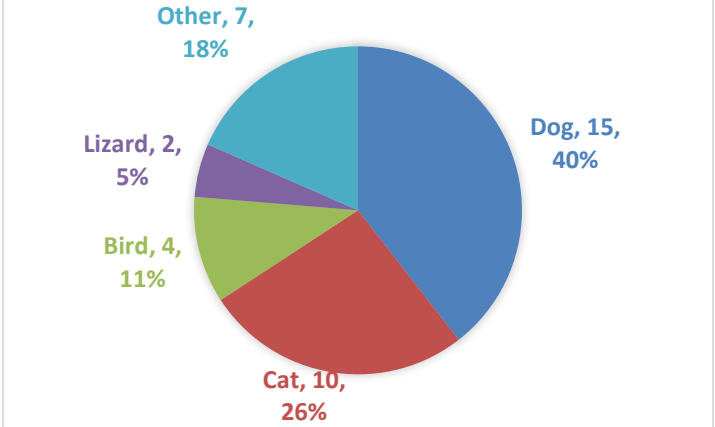
Dog: $\frac{15}{38} = 0.395 = 40\% \rightarrow 0.395 * 360 = 142°$

Cat: $\frac{10}{38} = 0.263 = 26\% \rightarrow 0.263 * 360 = 95°$

Bird: $\frac{4}{38} = 0.105 = 11\% \rightarrow 0.105 * 360 = 38°$

Lizard: $\frac{2}{38} = 0.053 = 5\% \rightarrow 0.053 * 360 = 19°$

Other: $\frac{7}{38} = 0.184 = 18\% \rightarrow 0.184 * 360 = 66°$



Section 5.3 – Practice Problems

The following can and should be made of separate pieces of paper.

1. Create a Pictograph of your choice

2. Create an Infographic of your choice

3. Using the following data create both a Bar Graph and Circle Graph by hand

Students were asked what their favorite course was in school. The answers were as follows.

Math	*Physics*	*Science*	*AutoBody*	*Band*	*Woodwork*	*Criminology*
6	4	8	10	7	3	5

Answer Key

Section 5.1

1. $Answer\ will\ Vary$
2. $Answer\ will\ Vary$
3. $Answer\ will\ Vary$
4. $Mean$: 15
   $Median$: 15
   $Mode$: 15
5. $Mean$: 21°
   $Median$: 20.5°
   $Mode$: 19°

Section 5.2

1. $\frac{1}{6}$
2. $\frac{5}{36}$
3. $\frac{1}{12}$
4. $\frac{1}{36}$
5. $\frac{1}{6}$
6. $\frac{1}{18}$
7. $\frac{3}{71}$
8. $\frac{10}{71}$
9. $\frac{5}{71}$
10. $\frac{34}{71}$
11. $\frac{37}{71}$
12. $\frac{33}{71}$

Section 5.3

See Website Copy