Probability and Stats

This booklet belongs to:_____

LESSON #	DATE	QUESTIONS FROM NOTES	Questions that I find difficult
1.		Pg.	
2.		Pg.	
3.		Pg.	
4.		Pg.	
5.		Pg.	
6.		Pg.	
7.		Pg.	
8.		Pg.	
9.		Pg.	
10.		Pg.	
11.		REVIEW	
12.		**TEST**	

Your teacher has important instructions for you to write down below.

Probability and Statistics

IRP	#	Daily Topic
Data Analysis D1 describe the effect of • Bias • Use of language • Ethics • Cost • Time and timing • Privacy • Cultural sensitivity on the collection of data	1.	Collecting The Data You Want: Questioning and Surveys: Part 1. Pages 4-7
	2.	Collecting The Data You Want: Questioning and Surveys: Part 2. Pages 8-11
D2 select and defend the choice of using either a population or a sample of a population to answer a question	3.	Questioning the Right Group: Pages 12-20 Two days.
	4.	
D4 demonstrate an understanding of the role of probability in society	5.	Using Probability to Make Decisions: Pages 21-28
	6.	Think Before You Predict: Pages 29-32
	7.	What is the Right Sample Size? Pages 33-39
D3 develop and implement a project plan for the collection, display, and analysis of data by formulating a question for investigation: • Choosing a data collection method that includes social considerations • Selecting a population or a sample • Collecting the data • Displaying the collected data in an appropriate manner • Drawing conclusions to answer the question	8.	Chapter Project: Pages 40-52 • 2-3 classes.

Key Terms

Bias	A question that influences or leads those being surveyed in a particular direction.
Cost	The cost of completing the survey cannot outweigh the benefits of obtaining the survey data.
Cultural Sensitivity	Cultural sensitivity has to do with respecting a persons beliefs and traditions. Being aware of others beliefs is difficult at times because we are so engulfed in our own. What is not a big deal to us may be a huge deal to someone else and vice versa.
Ethics	Are the questions socially and morally appropriate? Also, are the results from the survey being used in a responsible way?
Privacy	Do the survey questions respect a person's privacy?
Time and Timing	The time of day, week and month can impact the results of the survey. The amount of time required to complete the survey can also impact the results.
Use of language	Is the question clear? Does the question lead the participants in a particular direction?
Census	A survey that collects data about the entire population.
Population	The entire set of people or things being studied or investigated.
Sample	A part of a specific population being studied or investigated.
Convenience Sample	A sample where members from the entire population are chosen because they are easily accessible.
Simple Random Sample	A sample where every member of the entire population has the same chance of being selected.
Stratified Sample	A sample where the entire population is split into subgroups and then a random sample from each subgroup is selected.
Systematic Sample	A sample where every "nth" person from a population is selected.
Voluntary sample	A sample where members of the population choose to participate.
Cluster sample	A sample where every member of a sub-group of the entire population is selected.
Representative sample	A sample that accurately represents the larger population.
Biased Sample	A sample that does not accurately represent the larger population.
Probability	Probability is the measure of how likely something is to happen. For example the probability of 6-sided die landing on the number 4 is 1/6 since there are 6 sides and only one four.
Experimental probability:	A probability obtained through an experiment. For example, 7 students out of 10 say they like 2% milk. The experimental probability of this experiment is 0.7.
Theoretical probability:	A probability obtained based on what should happen. For example, A coin is flipped 2 times. There are two sides. It should land on heads half of the time. The theoretical probability of a head is 0.5.
Sample Size	The number of items in the sample.

Collecting The Data You Want: Questioning and Surveys

Surveys are used everywhere to gather all kinds of information. Some surveys are used to help business people make decisions about new product lines or to determine the best business hours for their clothing shop to be open. Political, educational and religious groups might use surveys to determine what is important to the people they serve.

Writing good survey questions is very important to ensure that one gets the right information. After all, the information obtained from these surveys is used to make decisions. For this reason it is important that surveys are accurate, clear and efficient.

Complete the survey questions as honestly as you can. Circle the best answer.

Please do not discuss or ask for clarification from you neighbour or your teacher.

1. Who is your favorite hockey team, the LA Kings or the Toronto Maple Leafs?

   Please circle one.

   Kings Leafs

2. What would you prefer to watch, a boring Hollywood movie or an educational movie?

   Please circle one.

   Hollywood movie Educational movie

3. Are you in favor of electing Polly Tysean for Premier if she promises to raise the minimum wage by 50% and reduce the length of summer holidays from two months to two weeks?

   Please circle one.

   In favour Not in favour

4. In January, the school cafeteria asked this question, " How interested are you in adding Slurpees to our winter menu?":

   Please circle one.

   Very interested Neutral Not interested

5. Pierp Resure has a new idea to speed up high school presidential elections. His idea is to place the names of the candidates in 2 columns on one giant piece of paper in the gym. After showing ID, students walk up to the paper and place their name in the column of the candidate they are voting for. It will be easy to see who wins because the longest list will denote the winner. There are two candidates this year.

   Who would you vote for? Please circle one.

   Bes Choyce: Last years Vice President, Students counsel member for 4 years, honor role student, supports the arts, athletics and academics.

   Bul Hee: Bul has told you that he will make your life very uncomfortable if you do not vote for him.

6. Rate the quality of each question above on a scale of 1 to 5 and be prepared to share why.
   (1→Very poor question, 3→Satisfactory question, 5→Very good question)

7. Compare your ratings of the above questions with a partner.

Consider the possible newspaper headlines if 1000 high school students completed the survey questions on the previous page. Read each newspaper headline. Is the headline fair? Answer each question VERBALLY ONLY.

8. **Sorry Vancouver, 70% of BC students say their favorite hockey team is the LA Kings.**

Survey Question:

Who is your favorite hockey team, the LA Kings or the Toronto Maple Leafs?

Please circle one.
Kings Leafs

9. **Step aside Hollywood, 82% of BC students would rather watch an educational movie.**

Survey Question:

What would you prefer to watch, a boring Hollywood movie or an educational movie?

Please circle one.
Hollywood or Educational

10. **Students are paid fairly, no need for pay increases. Tysean Defeated!**

Survey Question:

Are you in favor of electing Polly Tysean for Premier if she promises to raise the minimum wage by 50% and reduce the length of summer holidays to two weeks?

Please circle one.
In favour Or Not in favour

11. **No Slurpees Please! Students make more healthy choices in winter.**

Survey Question:

In January, the school cafeteria asked this question, "How interested are you in adding Slurpees to our winter menu?":

Please circle one.
Very interested, Neutral, Not interested.

12. **Bul "Give me your lunch money" Hee, a Surprise Win!**

Pierp Resure has a new idea to speed up high school presidential elections. His idea is to place the names of the candidates in 2 columns on one giant piece of paper in the gym. After showing ID, students walk up to the paper and place their name in the column of the candidate they are voting for. It will be easy to see who wins because the longest list will denote the winner. There are two candidates this year.

13. **Explain in writing, what is wrong with each survey question above.**

Survey Problem Definitions

Check each box after you have read and understood the definition. If you do not understand the definition place a question mark in the box.

Bias	Cost	Cultural Sensitivity	Ethics	Privacy	Time and timing	Use of Language

Bias:	A question that influences or leads those being surveyed in a particular direction.
Cost	The cost of completing the survey cannot outweigh the benefits of obtaining the survey data.
Cultural Sensitivity	Cultural sensitivity has to do with respecting a persons beliefs and traditions. Being aware of others beliefs is difficult at times because we are so engulfed in our own. What is not a big deal to us may be a huge deal to someone else and vice versa.
Ethics	Are the questions socially and morally appropriate? Also, are the results from the survey being used in a responsible way?
Privacy	Do the survey questions respect a person's privacy?
Time and Timing	The time of day, week and month can impact the results of the survey. The amount of time required to complete the survey can also impact the results.
Use of language	Is the question clear? Does the question lead the participants in a particular direction?

Rewrite each example without any influencing factors.

Bias: A question that influences or leads those being surveyed in a particular direction.

14. Example: What would you prefer to watch, a boring Hollywood movie or an educational movie?

Fix it!

Cost: The cost of completing the survey cannot outweigh the benefits of obtaining the survey data.

15. Example: *Mail every school in BC and ask them to obtain students favorite ice cream flavors.*

Fix it!

Rewrite each example without any influencing factors.

Cultural Sensitivity

Cultural sensitivity has to do with respecting a persons beliefs and traditions. Being aware of others beliefs is difficult at times because we are so engulfed in our own. What is not a big deal to us may be a huge deal to someone else and vice versa.

16. Example: *What is your favorite type of meat? Beef, Chicken, Pork, Lamb or Turkey*

Fix it!

Ethics

Are the questions socially and morally appropriate?
Also, are the results from the survey being used in a responsible way?

17. Example: Sara collects 1000 email addresses of people responding to her "End Poverty Now" Survey. A marketing company offers to buy the email address from her for $200.

Fix it!

Time and Timing

The time of day, week and month can impact the results of the survey. The amount of time required to complete the survey can also impact the results.

18. Example: *In January, the school cafeteria asked this question, "How interested are you in adding slurpees to our winter menu?".*

Fix it!

Privacy

Do the survey questions respect a person's privacy?

19. Example: *Students vote for the school president by writing their names on a big sheet of paper in the gymnasium.*

Fix it!

Use of language

Is the question clear and simple to understand? Does the question lead the participants in a particular direction?

20. Example: *Are you in favor of electing Polly Tysean for Premier if she promises to raise the minimum wage by 50% and reduce the length of summer holidays to two weeks?*

Fix it!

Challenge #1: Describe any factors that may impact data collection.

21. Survey Questions: Which type of computer do you like using? The easy to use Apple computer or a PC.

Possible solution→ next page.

22. Shelly walked up to a sales booth at a mall and was asked to fill out a survey. The sales person told her it would only take 20 minutes to fill out.

Possible solution→ next page.

In each situation or survey question, describe any factors that may impact data collection.

23. A survey group is collecting data for 20 different companies. They decide to set up booths in the school cafeteria and tell students that their names will be put in a draw to win an IPHONE every time they fill out a survey.

24. A high school football team wants to know how many people in a 5 km radius of the school will be coming to their home football games. They decide to mail every house in a 5 km radius of their school.

In each situation or survey question, describe any factors that may impact data collection.

25. How much money do you make per year?
a) 0-9999, b) 10000-29000,
c) 30000-59000, d) 60000+

26. A survey about 'Student Enjoyment of School' is given once a year in November.

How would you describe your feelings toward school this year:
a) Very positive b) Positive c) Neutral
d) Negative e) Very negative.

Describe any factors that may impact data collection.

27. Survey Questions: Which type of computer do you like using? The easy to use Apple computer or a PC. Possible solutions will vary: "Bias" **Suggesting that the Apple computer is easy to use is biased because it implies that a PC computer is not easy to use. A better question might be, "What kind of computer would you rather use, An Apple Computer or a PC computer?".**	28. Shelly walked up to a sales booth at a mall and was asked to fill out a survey. The sales person told her it would only take 20 minutes to fill out. Possible solutions will vary: "Time" **Most people will not fill out the survey because it takes too much time. People who do fill it out may rush through it to finish it quickly. This could bias the data collected.**

Challenge #2: Identify any influencing factors and rewrite each question so that it is free from influencing factors.

29. A survey is given to determine what students think of TV.

Don't you think that TV is a waste of time? Yes or No

Possible solution→ next page.

Identify any influencing factors and rewrite each question so that it is free from influencing factors.

30. A survey is given to determine grade nine students favorite type of shoe.

What is your favorite type of shoe? Nike, Adidas, New Balance, other_____

Identify any influencing factors and rewrite each question so that it is free from influencing factors.

31. A survey is given to determine what students think of TV.

Don't you think that TV is a waste of time? Yes or No

Possible solutions will vary: "Use of language and Bias"

The question is leading people to say yes by saying "Don't you think...". This can be easily corrected by changing the question to; "Do you think that TV is a waste of time?".

Some people will say that "waste of time" biases people to think about TV in a negative way prior to answering the question. A better question might be; "What do you think of TV?".

a) Important b) Neutral c) Not important

Remember, there are so many possibilities for creating better questions.

32. A survey is given to determine who supports Polly Tysean for Mayor.

Do you support ending homelessness by voting for Polly Tysean?

33. A survey is given to determine whether people support a particular business.

Will you be coming to our Grand Opening Sunday morning? Yes or No.

Write a survey question and a headline.

- Write a survey question with influencing factors about any of the following themes: Music, Sports, Cell phones, Video games, Internet, Food, High School or Work.
- For each survey question create a possible newspaper headline that could be supported by answers to your survey question.

34. Survey Question #1

Topic:

Survey Question:

Intended influencing factor:

- Bias,
- Use of language,
- Ethics,
- Cost,
- Time and timing,
- Privacy,
- Cultural sensitivity

Newspaper headline:

35. Survey Question #2

Topic:

Survey Question:

Intended influencing factor:

- Bias,
- Use of language,
- Ethics,
- Cost,
- Time and timing,
- Privacy,
- Cultural sensitivity

Newspaper headline:

Questioning the Right Group

Cueped High School wants to know whether they should have a Valentines Dance this year. The school population is 2000 students. Due to time and money, they will only be able to survey 100 students.

In the last lesson we focused on asking unbiased questions. This ensures that we do not influence the data collected. We know not to ask questions like, "Do you think it is a bad idea to have a dance on the most depressing day of the year?". A better question might be, "If the school has a valentines dance, 'Would you come'?". Yes, No, Maybe?

The second question is not biased. However, this does not guarantee that the data collected will not be biased. What if the people selected are biased? For example, if the 100 people chosen never go to school dances, the results from surveying them would be biased. Their view does not represent the entire school, but if we survey them and act on the data collected, there will be no dance.

36. If the dance committee can only survey 100 people, create some methods to help select 100 people that might speak the mind of the entire school. List as many strategies as you can.

Populations and Samples of Populations

Definition.

Population:	The entire set of people or things being studied or investigated.
Sample:	A part of a specific population being studied or investigated.

*Companies often survey a sample rather than the entire population when:

- It would take too much time or cost too much money to survey the entire population.
- Choosing the right sample group can save a lot of time and money.
- There is a down side. If a sample is not accurate, it can lead to misleading data.

Identify whether a given situation represents the use of a sample or a population.

	Population or sample?	If it is a sample, what is the population?
37. Miss Weir surveyed her only math 9 class to determine if the test should be on Friday or Monday.		
38. The chess club is surveyed to determine whether the school should sell hotdogs at lunch.		
39. Your PE class is surveyed to determine how many people are coming to the school play.		
40. A fast-food franchise asks its employees what they think about the company reward programs.		
41. The chess club is surveyed to determine whether hotdogs should be supplied at the next chess club meeting.		
42. Mr. Fast asks his soccer team to fill out a survey about yesterdays practice.		
43. A grocery store surveyed shoppers last Tuesday about the freshness of their produce.		

44. Challenge #3: List the pros and cons of surveying a sample rather than the population.	45. Challenge #4: Google wants to know what people think of their new web colours. Identify the population and then decide whether you would survey the population or a sample of the population. Justify your reasoning.

For each example, identify the population and then decide whether you would survey the population or a sample of the population. Justify your reasoning.

46. Google wants to know what people think of their new web colours.

Population OR Sample of the Population? Why?

Answers will vary: The population would include everyone who uses Google and the internet. A sample makes most sense because the entire population is way too big. A larger sample would likely give accurate feedback.

47. A realtor wants to know if her clients are satisfied with her services in 2009.

Population OR Sample of the Population? Why?

48. The school principal wants to know if teachers think the announcements are loud enough.

Population OR Sample of the Population? Why?

49. NBC wants to know what television viewers think of their new fall line up.

Population OR Sample of the Population? Why?

50. An auto body shop wants to know what customers think of their customer service.

Population OR Sample of the Population? Why?

51. The mayor wants to know what the citizens in his city think about hosting the Commonwealth games.

Population OR Sample of the Population? Why?

Can a sample be a population? Can a population be a sample?

52. Jaycee and Jick are having a disagreement. Jick says that a group of grade 9 boys is a sample of a population but Jaycee says they are the population. Who is right? Can they both be right? Explain.

Sampling Definitions

To understand the statistical terms, we will make reference to the following example to define and explain the terms on this page. Your high school wants to know whether or not the school is interested in having a Valentines Dance.

Read each definition and decide whether you understand each term.

	Definition.	Example.	Understand
53. Census	A survey that collects data about the entire population.	The census is the survey that would require every student to answer the question "Do you want a dance?".	Yes or No
54. Population:	The entire set of people or things being studied or investigated.	Every individual in the school makes up the population.	Yes or No
55. Sample*:	A part of a specific population being studied or investigated.	A group of students.	Yes or No

Sampling Techniques

	Definition.	Example.	Understand
56. Convenience Sample	A sample where members from the entire population are chosen because they are easily accessible.	Survey students in the cafeteria if they want a dance.	Yes or No
57. Simple Random Sample	A sample where every member of the entire population has the same chance of being selected.	Use the school computer to choose 100 students at random.	Yes or No
58. Stratified Sample	A sample where the entire population is split into subgroups and then a random sample from each subgroup is selected.	Choose 25 boys and 25 girls from each grade to answer the survey.	Yes or No
59. Systematic Sample	A sample where every "nth" person from a population is selected.	Use an alphabetical list of the entire school and choose every 50^{th} student to fill out a survey.	Yes or No
60. Voluntary sample	A sample where members of the population choose to participate.	Set up a survey booth in the hallway at lunch and allow students who are interested to answer the question.	Yes or No
61. Cluster sample	A sample where every member of a sub-group of the entire population is selected.	Ask all the grade 12 girls whether they want a dance.	Yes or No

Quality of the Sample

	Definition.	Example.	Understand
62. Representative sample	A sample that accurately represents the larger population.	Choosing a group of students that accurately speaks the mind of the school in general.	Yes or No
63. Biased Sample	A sample that does not accurately represent the larger population.	Selecting the "I Hate Dancing" club would probably not represent the feelings of the entire school.	Yes or No

Sampling Techniques

Definition:

Convenience Sample	A sample where members from the entire population are chosen because they are easily accessible.
Simple Random Sample	A sample where every member of the entire population has the same chance of being selected.
Stratified Sample	A sample where the entire population is split into subgroups and then a random sample from each subgroup is selected.
Systematic Sample	A sample where every "nth" person from a population is selected.
Voluntary sample	A sample where members of the population choose to participate.
Cluster sample	A sample where every member of subgroup of the entire population are selected.

Challenge #5: Read each situation and determine what sort of sampling was used.

64. Facebook wants to know what Iphone users think of their new application. They send all users an email message and wait for user responses.

Circle one:
Convenience, Simple Random, Stratified,
Systematic, Voluntary OR Cluster

65. Hubees Burgers wants to know what people think of their burgers. They survey all customers Friday night between 5pm to 7pm.

Circle one:
Convenience, Simple Random, Stratified,
Systematic, Voluntary OR Cluster

Challenge #6: Read the survey question and the headline. Could the headline represent the sample but not the population? Describe how this could happen.

66. **28% OF EQUALITY HIGH SCHOOL STUDENTS ARE BOYS.**

Survey Question:
- Please state your gender.
  Please circle one:
  Male or Female

Sampling Technique: Voluntary
- Lunchtime survey.
- 100 students surveyed.
- Surveyed in the hall.

Challenge #7: For each example, which sampling technique would you use. Explain.

67. Google wants to know what people think of their new web colours.

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

68. The principal wants to know what students think about the effectiveness of announcements

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

Read each situation and determine what sort of sampling was used.

69. Facebook wants to know what Iphone users think of their new application. They send all users an email message and wait for user responses.

Convenience, Simple Random, Stratified, Systematic, Voluntary OR Cluster

This is a voluntary survey because the only responses they get will be from people who choose to reply to their email.

70. Hubees Burgers wants to know what people think of their burgers. They survey all customers Friday night between 5pm to 7pm.

Convenience, Simple Random, Stratified, Systematic, Voluntary OR Cluster

This survey could be a convenience or a cluster survey.
Convenience: People are at the restaurant on Friday night so survey them.
Cluster: There are seven nights of the week, choose one and survey them.

71. Elliott High School has 40 different sports teams. 3 members from each team are asked questions about sports coverage on the school website.

Circle one:
Convenience, Simple Random, Stratified,
Systematic, Voluntary OR Cluster

72. After a concert at GM place, ticket numbers are drawn randomly and ticket holders are given back stage access.

Circle one:
Convenience, Simple Random, Stratified,
Systematic, Voluntary OR Cluster

73. A marketing company wants to gather information about what people in Vancouver think about hosting the Olympics. They call the first name at the top of every column in the phone book.

Circle one:
Convenience, Simple Random, Stratified,
Systematic, Voluntary OR Cluster

74. There are 7 Mama's Doughnuts Franchises in Dee City. The owner lives out of town and wants to know what employees think about Mama's Policies. He selects store number 3 and surveys all employees there.

Circle one:
Convenience, Simple Random, Stratified,
Systematic, Voluntary OR Cluster

Do you think the headline represents the entire population? If no, explain how sample could represent the sample but not the population.

75. **28% OF EQUALITY HIGH SCHOOL STUDENTS ARE BOYS.**

Survey Question:
- Please state your gender.
  Please circle one:
  Male or Female

Sampling Technique: Voluntary
- Lunchtime survey.
- 100 students surveyed.
- Surveyed in the hall.

Answers will vary: It is doubtful that the school population is 28% male. However, it is possible that boys are less likely to fill out a voluntary survey than girls. A better headline might read; "Boys are less likely to fill out a survey than girls".

76. **85% OF STUDENTS WANT TO PLAY IN THE CHESS TOURNAMENT NEXT WEEKEND.**

Survey Question:
- Are you interested in playing in a chess tournament next weekend?
  Please circle one:
  Yes, No, Maybe

Sampling Technique: Cluster
- Sample size was 20 students
- All students in room 122 on Tuesday at lunch.

77. **56% OF SELLFONE HIGH SCHOOL STUDENTS OWN A MOBILE PHONE.**

Survey Question:
- Do own a cell phone?
  Please circle one:
  Yes or No

Sampling Technique: Stratified
- The school was split into 8 groups.
- Boys and girls at each grade level
- 50 students from each subgroup were selected at random.

78. **90% OF CUSTOMERS THINK THAT THE SERVICE AT JOES IS EXTREMELY FAST.**

Survey Question:
- How would you rate the speed of service at Joes Diner
  Please circle one:
  Extremely fast, Fast, Average, Slow, Extremely slow.

Sampling Technique: Convenience
- All customers on Monday between1pm-5pm

For each example, which sampling technique would you use. Explain.

79. Google wants to know what people think of their new web colours.

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

Answers will vary: Perhaps a Voluntary survey. It could be a quick survey right on their search engine where users choose a number between one and five. A one is very bad and a five is very good. It would be simple to administer and easy for Google to get data quickly.

80. CBC wants to know what television viewers think of their new fall line up.

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

81. The principal wants to know what students think about the effectiveness of announcements

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

Answers will vary: Perhaps a cluster survey. Every English class in period three on Wednesday is surveyed. Period three probably has many English classes at all grade levels. This would probably give a good cross section of the school population.
Remember answers will vary. Just ensure that you can defend your choice.

82. The mayor wants to know what the citizens in his city think about hosting the Commonwealth games.

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

83. The principal of the school wants to know what people think about installing night-lights for the soccer fields.

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

84. An auto body shop wants to know what customers think of their customer service.

Convenience, Simple Random, Stratified, Systematic, Voluntary, Cluster

Analyze the situation.

85. Liam, Hayden and Emma each conduct a survey about whether students are interested in a school ski/snowboard trip.

Liam surveys 50 guys from the PE classes. 60% are interested.
Emma surveys 50 girls from the dance classes. 10% are interested.
Haydon surveys 50 students in the cafeteria. 20% are interested.

- Which student's data do you think is more representative of the school population? Explain.
- What would be your best guess as to what percent of the school is interested? Explain.

Read each situation and determine what sort of sampling was used. Describe another sampling technique that also may be effective. Justify your reason.

86. Mr. Jarillion teaches four math 9 classes. He chooses his first period math 9 class to complete a survey about what grade nines think about the difficulty of math 9. Circle one: Convenience, Simple Random, Stratified, Systematic, Voluntary OR Cluster	87. The Premier wants to know what nurses think about how to improve health care in BC. 5 nurses are selected at random from each hospital in BC to complete a survey. Circle one: Convenience, Simple Random, Stratified, Systematic, Voluntary OR Cluster
Alternative Sample:	Alternative Sample:

Using Probability to Make Decisions

(Class participation required. Answers will vary.)

Challenge #8: Complete the questions in the table.

88. If every school day is increased by 11 minutes, spring break can be lengthened by one week. Are you in favour of increasing the length of each school day so that spring break will be one week longer?

YES or NO

89. What is the theoretical probability* of answering yes?

$T.P. = \frac{Yes}{2\ Options} = \frac{\quad}{\quad} = 0.5$

90. According to the theoretical probability, how many students in **your** class would vote yes?

91. Do you think this is accurate? Explain?

92. How many students voted yes in your class?

93. Use your class results to create an experimental probability* of answering yes?

$E.P. = \frac{Yes\ Votes}{Total\ Votes} = \frac{\quad}{\quad} = 0.\_\_\_\_$

94. How many students attend your school?

95. According to the experimental probability from your class, how many students in your school would vote yes?

96. Do you think your class is representative of the entire school? Do you think the experimental probability is accurate? Explain?

97. If the school was going to give this survey, describe which sampling method you would choose.

*See the next page for the definitions of theoretical and experimental probability.

Theoretical and Experimental Probability

Notes:

*Probability Definitions

Probability	Probability is the measure of how likely something is to happen. For example the probability of 6-sided die landing on the number 4 is 1/6 since there are 6 sides and only one four.
Experimental probability:	A probability obtained through an experiment. For example, 7 students out of 10 say they like 2% milk. The experimental probability of this experiment is 0.7.
Theoretical probability:	A probability obtained based on what should happen. For example, A coin is flipped 2 times. There are two sides. It should land on heads half of the time. The theoretical probability of a head is 0.5.
Sample Size	The number of items in the sample.
Biased Sample	A sample is biased if it is not representative of the larger population.

Challenge #9: Theoretical Probability.

98. A coin is flipped once. Determine the probability of the coin landing on heads.

99. A multiple-choice question has options A, B, C & D. Determine the probability of randomly guessing the correct answer.

100. An unbiased coin is flipped ten times and lands on heads seven out of ten times. What is the chance that the next flip will be a head?

101. An unbiased coin is flipped 18 times. How many times should it land on heads.

102. Lucas manipulated a coin so that it lands heads 800 out of 1000 times. If the coin is flipped 30 times, how many heads should occur?

103. Harry flipped a coin 10 times and it landed on heads 7 times. Is the experimental probability biased? Is the coin biased?

Write a definition for each term.

104. Theoretical probability
105. Experimental probability

Theoretical Probability.

106. A coin is flipped once. Determine the probability of the coin landing on heads. Possible explanation→ 50% A coin has two sides and one is head. The probability is $\frac{1}{2}$, 0.5 or 50%	107. A multiple-choice question has options A, B, C & D. Determine the probability of randomly guessing the correct answer. Possible explanation→ 25% There are 4 options and only one is correct. The probability is $\frac{1}{4}$, 0.25 or 25%	108. An unbiased coin is flipped ten times and lands on heads seven out of ten times. What is the chance that the next flip will be a head? Possible solution strategy→50% The past does not influence a coin. A coin still has one head and two side so the probability would still be $\frac{1}{2}$, 0.5 or 50%
109. An unbiased coin is flipped 18 times. How many times should a head occur. Possible explanation→ 9 heads The probability of a head is 0.5 or 50%. If a coin is flipped 18 times, 50% of the results should be heads. 18 X 0.5 = 9 heads	110. Lucas weighted a coin so that it lands heads 800 out of 1000 times. If the coin is flipped 30 times, how many heads should occur? Possible explanation→ 24 heads The probability of heads is 800/1000 or 0.8 or 80%. This means that 80% of 30 flips should also be heads. 30 X 0.8 = 24 heads	111. Harry, flipped a coin 10 times and it landed on heads 7 times. Is the experimental probability biased? Is the coin biased? Possible explanation→Yes & No The experimental probability is biased because it should be 5. The coin is probably not biased. Fluctuations are normal especially when the sample size is so small. If 700 heads occurred in 1000 flips, the coin is most likely biased.

Use the following data to answer the questions below.

Grade 9	Boys	Girls	Total
Mr. Harris	10	15	25
Mr. Barker	20	5	25
Mr. Crawford	12	13	25
Mrs. Swonnel	10	15	25

Challenge #10:

112. Mr. Harris chooses a student from his class to win a prize. What is the probability that the student is a boy?	113. A student is chosen at random. Determine the probability that a boy from Mr. Harris' class is selected.

Use the following data to answer the questions below.

Grade 9	Boys	Girls	Total
Mr. Harris	10	15	25
Mr. Barker	20	5	25
Mr. Crawford	12	13	25
Mrs. Swonnel	10	15	25

114. Mr. Harris chooses a student from his class to win a prize. What is the probability that the student is a boy?

Possible explanation→ 40%
There are 25 students in Mr. Harris' class. 10 of whom are boys.
$\frac{10}{25}$ or 0.4 or 40%

115. Mr. Barker chooses a student from his class to win a prize. What is the probability that the student is a boy?

116. A student is chosen at random. Determine the probability that a girl from Mr. Crawford's class is selected.

117. A student is chosen at random. Determine the probability that a boy from Mr. Harris' class is selected.

Possible explanation→10%
There are 10 boys in Mr. Harris' class and a total of 100 students. $\frac{10}{100}$ or 0.1 or 10%

118. All the students are entered in a draw to win a pizza lunch. What is the probability that a student from Mr. Barker's class wins?

119. All the students are entered in a draw to win a pizza lunch. What is the probability that a boy wins?

120. All the girls' names are put in a hat to win prize. Determine the probability that a girl from Mrs. Swonnels' class wins.

121. A student is chosen at random. Determine the probability that a girl from either Mr. Barkers' class or Mr. Crawfords' class.

122. A student is randomly selected. Determine the probability that the student is not in Mrs. Swonnels' class.

Experimental Probability Experiment

(Please wait for your teacher or begin the next page)

Theoretical probability:

123. A coin is flipped once, what is the theoretical probability of a head?	124. A coin is flipped 10 times, how many times should it land heads? _____/10, Theoretical probability:	125. A coin is flipped 50 times, how many heads should occur? _____/50, Theoretical probability:	126. A coin is flipped 500 times, how many heads should occur? _____/500, Theoretical probability:

Experimental probability:

Experimental Probability: You will need a coin to complete these questions.	Experimental Probability
127. Flip a coin once. How many heads resulted? Based on this result what is the experimental probability of a head? 128. Based on the experimental probability, how many heads would occur in 1000 flips? 129. Prediction accuracy→ 1, 2, 3, 4, 5 (1- Very accurate and 5- Very inaccurate)	Experiment #1. $\frac{\quad}{1} =$
130. Flip a coin 10 times, how many times did it land on heads? 131. Based on the experimental probability, how many heads would occur in 1000 flips? 132. Prediction accuracy→ 1, 2, 3, 4, 5 (1- Very accurate and 5- Very inaccurate)	Experiment #2. $\frac{\quad}{10} =$
133. Flip a coin 50 times, how many times did it land on heads? $\#1 = \frac{\quad}{10}$, $\#2 = \frac{\quad}{10}$, $\#3 = \frac{\quad}{10}$, $\#4 = \frac{\quad}{10}$, $\#5 = \frac{\quad}{10} = \frac{\quad}{50}$ 134. Based on the experimental probability, how many heads would occur in 1000 flips? 135. Prediction accuracy→ 1, 2, 3, 4, 5 (1- Very accurate and 5- Very inaccurate)	Experiment #3. $\frac{\quad}{50} =$
136. Flip a coin 500 times. Use your data and the data of 9 other classmates. Your 50 flips:_____ Classmates: _____/50, _____/50, _____/50, _____/50, _____/50, _____/50, _____/50, _____/50, _____/50 $= \frac{\quad}{500}$ 137. Based on the experimental probability, how many heads would occur in 1000 flips? 138. Prediction accuracy→ 1, 2, 3, 4, 5 (1- Very accurate and 5- Very inaccurate)	Experiment #4. $\frac{\quad}{500} =$

139. Which experiment(s) lead to the most accurate predictions? Why do you think this happened?

Experiment #1 Prediction→ /1000	Experiment #2 Prediction→ /1000	Experiment #3 Prediction→ /1000	Experiment #4 Prediction→ /1000

140. Is experimental probability always accurate? Explain.

Challenge #11:

141. The local police station is gathering data about speeding last Sunday afternoon. They recorded the speeds of 11000 drivers. 2557 drivers sped. Calculate the experimental probability to the nearest tenth of a percent.

142. If you conducted a survey the next morning, how many drivers would you expect to be speeding out of 500?

143. Can you think of any ways in which the data might be biased?

144. A survey was conducted and found that 60% of boys watch at least one basketball game on TV each year. If 300 boys were selected at random, predict how many would watch at least one basketball game?

145. The probability that a carton of juice is under filled is 1.5%. The school purchased 1200 juice boxes for the school vending machines. Predict how many juice boxes will be under filled?

146. A 6-sided die is weighted so that it lands on the number 3 40% of the time. If the die is rolled 250 times, predict how many 3s should occur?

147. What assumptions did you have to make to calculate the above problems?

Using experimental probabilities to make predictions.

148. The local police station is gathering data about speeding last Sunday afternoon. They recorded the speeds of 11000 drivers. 2557 drivers sped. Calculate the experimental probability to the nearest tenth of a percent.

Possible explanation:

$\frac{Speeders}{Total\ Drivers} = \frac{2557}{11000} = 0.23245$ or 23.2%

149. If you conducted a survey the next morning, how many drivers would you expect to be speeding out of 500?

Possible explanation:

You would expect 23.2% of the cars to be speeding. $500 \times 0.232 = 116$ **This is an approximation since the probability was rounded.**

150. Can you think of any ways in which the data might be biased?

Answers will vary: **The data could be biased for many reasons. 1. Drivers may have seen the police, or were alerted by other drivers to slow down. 2. The data could be biased because of the day. People may drive differently at different times of the day, week and year. People probably are in more of a rush Monday morning than they are Sunday afternoon.**

151. 1125 shoppers were asked in the month of December if they would make a donation to the food hamper. 765 said yes. Calculate the experimental probability.

152. The store uses the experimental probability from the previous question to estimate how many of their 15000 spring and summer shoppers will make a donation to the food bank in July. Make the prediction for them.

153. Do you think this data might be biased? Yes or No. Explain.

154. A school gathered data to determine how many students were late for class. They found that in the month of September, 4% of students were late for class. If the school has a population of 900 students, predict how many students would be late on any given day.

155. A first period English class has 28 students and a second period science class has 28 students. How many students will be late for each class in November?

156. Can you think of any ways in which the data might be biased?

Challenge #12:

Noen Durants practiced his foul shots in basketball after school on Tuesday. He completed 15 separate sets of 10 shots at a time.

157. Here are the results of his first 5 sets of ten: 9,9,10,8 & 9. Calculate the average.

158. Use the average to predict how many baskets he will sink out of 150 shots.

Using averages to make predictions.

Noen practiced his foul shots in basketball after school on Tuesdays. He completed 15 separate sets of 10 shots each for a total of 150 shots.

159. Here are the results of his first 5 sets of ten: 9,9,10,8 & 9. Calculate the average.

Possible explanation:

$$Average = \frac{9+9+10+8+9}{5}$$

$$Average = 9$$

160. Use the average to predict how many baskets he will sink out of 150 shots.

Possible explanation:
He sinks 9/10 or 90% of his shots. A reasonable prediction would be that he sinks close to 90% of his next 150 shots.
150 X 0.9= 135.

161. Here are the results of his next set of 5 sets of ten: 7,9,6,3 & 8. Calculate the average.

162. Use this average to predict how many baskets he will sink out of 150 shots.

163. Here are the results of his last 5 sets of ten: 7,6,3,2 & 1. Calculate the average.

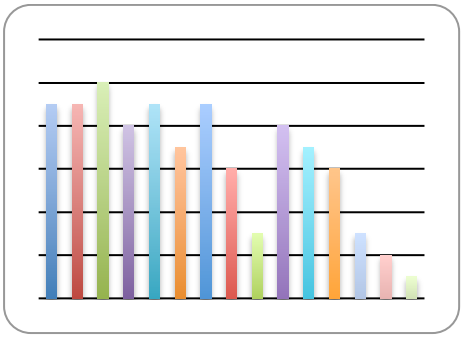
164. Use this average to predict how many baskets he will sink out of 150 shots.

165. Which sample do you think is the most accurate? Explain?

166. Use all 15 sets of ten to calculate the true average. (Round you answer to 1 decimal place.)

167. Which sample gives an average closest to the actual average?

168. Noen told some college scouts his foul shot average after 15 sets. The scouts told Noen that the data may be biased and that they will not accept his data. Do you agree? Explain.



Think Before You Predict

(Class participation and partner sharing suggested)

169. The class average on Mr. Braidlaw's last math test was 68%. How well would you say his class did on the test?

170. A student is randomly chosen from Mr. Braidlaw's class, what would you predict her test percentage to be? Explain your reasoning.

171. Is it possible to have a class average of 68% where most students have more than 86%? Explain.

Read these definitions: Statisticians use the following words to help them interpret data.

Mean: The average number.	**Median:** The middle number.	**Mode:** The most common number.
The mean can be found by adding up all the items and then dividing by the number of items. • The mean of 2,4,6 is 4. • The mean of 1,2,9 is 4.	The median is the middle number when all the items are arranged from smallest to biggest. • The median of 1,2,3,7,12 is 3. • The median of 3,7,1,2,12 is 3. • The median of 2,2,4,4 is 3	• The mode of 1,1,7,8,9 is 1. • The mode of 1,1,7,9,9 is 1 & 9. • 1,2,3,4 has no mode.

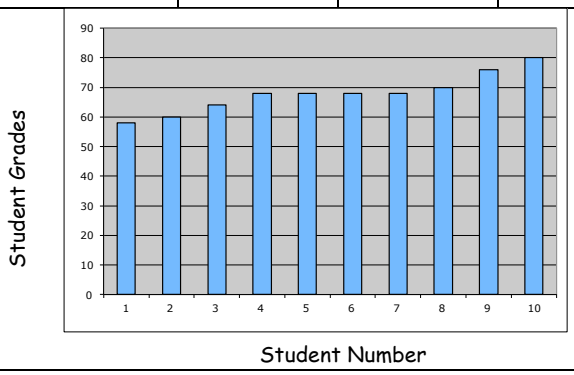
Determine the mean, median and mode for the following sets of numbers.

	5,5,5,5,5	0,5,5,5,10	0,2,3,10,10
Mean (The average.)	172.	173.	174.
Median (The middle.)	175.	176.	177.
Mode (The most.)	178.	179.	180.

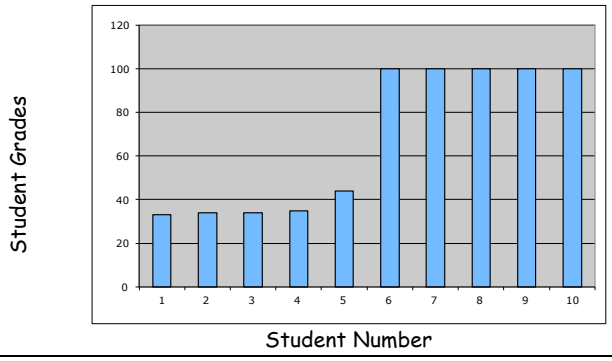
Why is the class average 68%?

181. (VERBAL) With a partner, explain why each class might have the following test results.

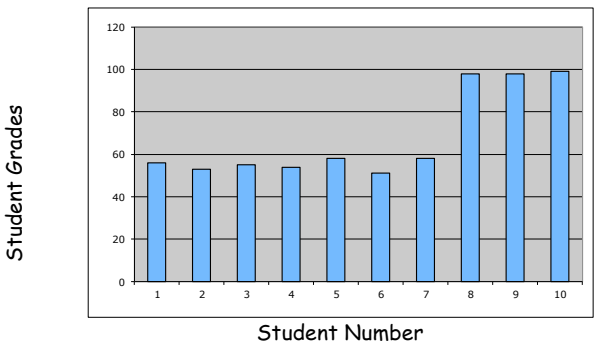
Period 1	Class average	Median	Mode
	68%	68%	68%



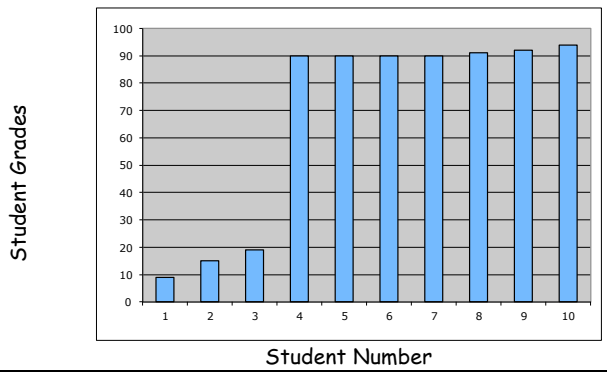
Period 2	Class average	Median	Mode
	68%	71%	100%



Period 3	Class average	Median	Mode
	68%	54%	98%



Period 4	Class average	Median	Mode
	68%	90%	90%



182. How helpful is the class average in describing how a group of students is doing? Explain.

183. Can you think of another way to report the data? Is it better? Explain

Probability Predictions: Are They Accurate?

Predictions based on probabilities are used to make all sorts of social and business decisions. It is important that people make sure their probabilities are not biased. A prediction based on probability is useless if the probability is not accurate. There are many factors that can bias a probability:

- Biased questions will lead to biased probabilities.
- Biased sample groups will lead to biased probabilities.
- Small sample sizes increase the chance of biased probabilities.

Before making a prediction, one should consider the following assumptions

Bias Factor	Example.	I understand.
184. Biased Questions	What is your favorite kind of ice cream? Vanilla or strawberry. The data collected might create probabilities like 60% of the population like strawberry best and 40% like vanilla best. Problems: • There are only two options. • One of the options needs to be neither. • One of the options needs to be, I don't eat ice cream.	Yes or No
185. Biased Samples	Who do hockey fans cheer for at G.M. Place in Vancouver? Surveying Calgary Flames hockey fans at a Canucks home game would lead to biased probabilities.	Yes or No
186. Small sample sizes	If the sample size is too small, the probabilities will not be accurate. • Determine the probability of heads. Flipping a coin once will lead to a probability of 0% or 100%. Flipping a coin 1000 times will lead to probabilities much closer to 50%.	Yes or No

Challenge #13:

187. Jordan surveyed 5 senior citizens at Tim Hortons. He went home and told his parents that he thinks 80% of people in their town do not have jobs. According to his survey, how many people would not be working if the population of their town was 40000.

188. Do you think it is accurate? Explain.

189. Sara wants to have school dances every month. She conducts a survey and determines that 100% of people surveyed said they would come to a dance once a month.

190. Do you think it is accurate? Explain.

191. Jordan surveyed 5 senior citizens at Tim Hortons. He went home and told his parents that he thinks 80% of people in their town do not have jobs. According to his survey, how many people would not be working if the population of their town was 40000.

Possible explanation→0.8 X 40000= 32000 unemployed people.

192. Do you think it is accurate? Explain.

Answers will vary: No. 1. It is quite normal for senior citizens not to work but seniors do not represent the entire population. 2. Even if the sample was 5 random people, the sample is way too small. It would be highly unlikely that a sample of 5 people could represent the entire population.

193. Sara wants to have school dances every month. She conducts a survey and determines that 100% of people surveyed said they would come to a dance once a month.

194. Do you think it is accurate? Explain.

Answers may vary. Not likely. I would want to know who she surveyed and how many people she surveyed. If she surveyed 10 people from her dance class, it is understandable that 100% of the people surveyed would vote for more dances.

What makes experimental probability more accurate?

A cell phone company tested a random sample of their new cell phones before they are packaged for sale. Judy, Frank and Jerry all conduct their own surveys.

195. Judy found that 1 in 10 phones had noticeable scratches. If 5000 phones have already been packaged, how many of these phones would you predict to have scratches?

196. Do you think all the phones should be checked for scratches before shipping them to stores? Explain.

197. Frank found that 1 in 100 phones had noticeable scratches. If 5000 phones have already been packaged, how many of these phones would you predict to have scratches?

198. Do you think all the phones should be checked for scratches before shipping them to stores? Explain.

199. Jerry found that 1 in 1000 phones had noticeable scratches. If 5000 phones have already been packaged, how many of these phones would you predict to have scratches?

200. Do you think all the phones should be checked for scratches before shipping them to stores? Explain.

201. Who do you think has the most accurate data? Judy, Frank or Jerry? Explain.

202. Is it possible that none of the samplers made mistakes? Explain.

203. What can be done to increase the accuracy of experimental probabilities?

What is the Right Sample Size?

204. The population of BC is about four million people and the number of males is 1955011. Three separate groups of ten people are randomly selected. Which group best represents the larger population? Circle the best answer:

a) 4/10 are males b) 5/10 are males c) 6/10 are males

205. Let's suppose that the number of males was unknown in BC. Use the best group above to estimate the number males if the population is 4 million.

206. Would you say that the number you chose is representative of the population? Explain.

207. How close is the prediction to the actual population of males in BC?

208. What could you do to increase the accuracy of your prediction?

Use the data from this table to complete the questions below.

	Sample #1	Sample #2	Sample #3	Sample #4
Number of randomly selected people	10	100	1000	10000
Number of boys	5 Boys	48	489	4888
Experimental probability	0.5	0.48	0.489	0.4888
Prediction for the number of males if the population is 4 million.	2 000 000	1 960 000	1 956 000	1 955 200
Actual population	1955011	1955011	1955011	1955011
Difference	44989	4989	989	189

209. Which sample above gives the most accurate prediction of the actual number of males living in BC? Why do you think it is more accurate?

210. If it costs your company $10 in time and resources for every person surveyed, which sample size would you choose and why?

211. Describe how data can be misinterpreted or misused to make false or inaccurate predictions.

Challenge #14: Examine the following statements. Each person is telling the truth. Explain how opposing predictions could be true.

212. Survey Question: Have you every struck out before? Jordan says he has never struck out in baseball. How many times would you expect him to strike out in the future?

A. Jordan is really good at baseball.	B. Jordan is really bad at baseball.

213. List some questions that would clarify this situation.

Challenge #15: Read each question and describe a possible solution that could lead to the collected data. Be creative.

214. In a recent survey, 80% of people surveyed did not use a toothbrush regularly. According to this survey, how many people out of 150000 would not use a toothbrush regularly?

215. Do you think this is accurate? Describe situations that could lead to this data.

Examine the following statements. Each person is telling the truth. Explain how opposing predictions could be true.

216. Survey question: Have you every struck out before? Jordan says he has never struck out in baseball. How many times would you expect him to strike out in the future?

A. Jordan is really good at baseball.	B. Jordan is really bad at baseball.
He never strikes out. He must be really good at baseball.	**He states that he has never struck out. He does not state that he has ever been up to bat. It is possible that he would be really bad at baseball.**

217. List some questions that would clarify this situation.

Have you every played baseball before? Have you ever played on a team before? In the last 20 times you were up to bat, how many times did you strike out?

218. Survey question: How many penalty shots have you missed this year? Ricky is the captain of his AAA hockey team and has been involved in many penalty shot situations in many games. He boasts to his teammates that he has never missed a penalty shot in any game. This statement would suggest that Ricky would score 100% of penalty shots he takes.

A. Ricky has scored a lot of penalty shots.	B. Ricky has not scored any penalty shots.

219. List some questions that would clarify this situation.

Examine the following statements. Each person is telling the truth. Explain how opposing predictions could be true.

220. Julie has written 7 tests this year and says that she has scored 100% on every test that she studied for. This statement gives the impression that Julie has 100%.

A. Julie has a really good mark in math.	B. Julie has a really bad mark in math.

221. List some questions that would clarify this situation.

Read each question and describe a possible solution that could lead to the collected data.

222. In a recent survey, 80% of people surveyed did not use a toothbrush regularly. According to this survey, how many people out of 150000 would not use a toothbrush regularly?

Possible solution strategy→ 0.8 X 150000= 120000 people don't brush their teeth regularly.

223. Do you think this is accurate? Describe situations that could lead to this data.

Explanations will vary: This data does not sound accurate. Perhaps a very small sample was chosen. If only 5 people were surveyed, it would be possible for the data to be biased. Or perhaps a sample was chosen where people do not use a toothbrush because they have false teeth. The most likely explanation is a small biased sample was used.

224. In a recent survey, 10% of the people surveyed had a driver's license. According to this survey, how many people have driver's license if the city's population is 70000?

225. Do you think this is accurate? Describe situations that could lead to this data.

Read each question and describe a possible solution that could lead to the collected data.

226. In a recent survey, 50% of those surveyed thought the only thing the school cafeteria should sell is chocolate milk. According to this survey, how many people in a school of 850 would share this belief?

227. Do you think this is accurate? Describe situations that could lead to this data.

228. Analyze the survey. Modify the survey to reduce the bias.

An independent marketing firm wants to know what beverages students purchase at their high school cafeteria.

Survey question:
What beverage do you buy at the school cafeteria?
a) 2% milk b) pop c) juice d) bottle water

Sample size and sample technique:
20 students were randomly surveyed in the hallway after school. Here are the results.
15% chose milk
40% chose pop
5% chose juice
40% chose bottle water

The marketing company used the data to answer the following questions.

A. The school has 1200 students. How many students would buy juice?

B. How many students would buy 2% milk?

C. Do you think this data is biased? Y/N

229. Make suggestions for how the marketing company can improve their data collection process.

Using Experimental Probability to Make Business Decisions

A marketing company is conducting a survey to decide whether or not to launch a new line of rugby jerseys to sell to Huddyville High School students. The school has a **population of 2000 students**.

- The marketers have limited time and cannot survey the entire school.
- Instead they survey 5 **sample populations**.
- The marketers need to sell at least 500 rugby jerseys to make it make a profit.

Use the survey results to answer the questions below.

Sample population	I would buy a rugby jersey.	I would not buy a rugby jersey.	Total
20 randomly selected rugby players.	18	2	20 students
20 randomly selected math students.	7	13	20 students
20 randomly selected dance team members.	3	17	20 students
20 randomly selected mechanics students.	9	11	20 students
20 randomly selected poetry club members.	2	18	20 students

Determine the probability and percentage that a random member from each group will buy a rugby jersey.

	Rugby	Math	Dance	Mechanics	Poetry
Experimental Probability	230.	231.	232.	233.	234.
Projected # of sales for the entire population of 2000.	235.	236.	237.	238.	239.

240. Which sample do you think will give the most unbiased results? Why?

241. INVESTMENT QUESTION: You will lose your money if less than 500 are sold and you will double your money if they sell more than 500. Would you invest $1000 in this company? Why?

242. The marketers do not have the time to survey all of the students. The marketers want to make the right decision.

- 18 out of 20 randomly selected **r**ugby players say they will buy a rugby jersey.
- 7 out of 20 randomly selected **m**ath students.
- 3 out of 20 randomly selected **d**ance team members.
- 9 out of 20 randomly selected **me**chanics students.

Rank each sample group in terms of how well each group represents the greater population of spending habits. i.e. Which sample has the best cross section of the school's population.

Sample Group	Rank	Explain why you ranked each group as you did.
	Best	
	Worst	

243. Think about your own school. Describe another population that would be better than all of these samples.

244. If you are the marketer, what are the advantages of using a sample population rather than the entire population?	245. If you are the marketer, what are the disadvantages of using a sample population rather than the entire population?

Chapter Project:

1. Topic Choice
2. Create a self-assessment tool (rubric)
3. Write the questions
4. Sampling method chosen
5. How will you display your data?
6. Complete and Self-Assess

PROJECT: DATA COLLECTION, DISPLAY & ANALYSIS

Choosing a Topic

Sample Topics	Brainstormed Topics
• A new teen centre is to be built next to your school. What activities would be of interest to local teens and what facilities would be needed? • Your student council is considering starting a lunch hour intramural league. Would there be enough interest and what activities should be included? • Your school cafeteria is reinventing its menu under the "Healthy Schools" guidelines. What groups of students use the cafeteria and what choices should be offered? • Extending the length of each school day by 11 minutes will result in 5 more days off in the school year. Where should your school use those days?	• • •

Topic Choice: What are you going to survey?

Rubrics:
You may have come across a rubric already in some other class, or possibly even this one. A rubric is an efficient way to evaluate something that is subjective, or open to opinion.

Creating a rubric:

Example: A teacher wants to evaluate a student's descriptive paragraph in English class.

Step 1: The teacher should list the *criteria* she will be evaluating.
Step 2: The teacher should identify a *graduated scale* describing what she considers "good work" all the way to "not-so-good work".
Step 3: The teacher evaluates the student according to each criteria.

*Note: In an example like this, the student should have access to the rubric to understand how she is being evaluated.

Scale / Criteria	1 Below Expectations	2 Meeting Expectations	3 Exceeding Expectations
Clear Topic Sentence	Unclear what the paragraph will be about.	Reader has some idea what the paragraph will discuss.	Very clear and well structured.
Well organized	Ideas are not in a logical order so the paragraph does not make sense.	Ideas are in somewhat logical order.	Ideas flow from one to the next in a logical order.
Concluding Sentence	Conclusion is missing.	Conclusion is present but does not tie ideas together.	Concluding sentence ties all ideas together.
Correct spelling and grammar	More than 3 errors.	1-3 errors	No errors

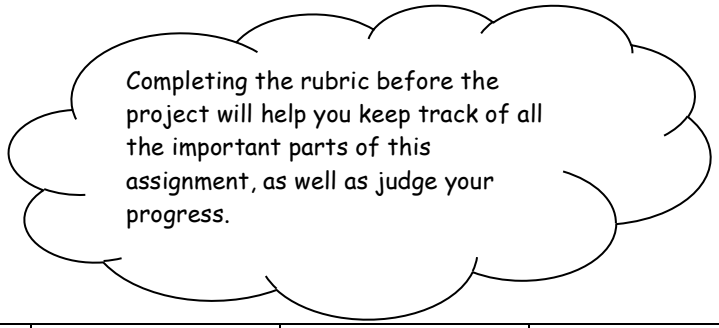
Create a rubric

This will help you monitor the progress of your project and self-evaluate it at the end.

What criteria are important to the success of your DATA COLLECTION & ANALYSIS project? (Think about the steps you will take to complete the project)

Criteria	What aspects of this criteria will produce the rubric scale?
• **Choosing a Topic.**	• **An appropriate topic has been chosen.** • **Topic can be surveyed.**
• **Write good questions.**	• **Questions produce data that I can use.** • **Questions have been written without bias.** • **Questions are not confusing to readers.** • **Questions are ethical.**
•	
•	
•	
•	

Complete the rubric below to use with your data project.



Scale / Criteria	1	2	3	4
Topic choice	No topic chosen or topic cannot be surveyed.		Topic chosen, survey will be possible.	
Write good questions				Questions are clear, address the topic, will produce data required, are unbiased and ethical. (3-5 questions)

Topic Choice:

What are you going to survey?

Writing the questions.

Develop 3-5 "good" survey questions.

These should be designed to collect data to help you answer the question you set out to answer.

1.

2.

3.

4.

5.

Have two classmates read and critique your questions, then sign below.

I have read the above questions and feel they address the topic and are clear and unbiased.

Signature 1

Signature 2

Create a Survey

Using the questions developed on the previous page, create a survey that you can distribute to your sample.

- Use a computer to make the survey easy to read and complete.
- Catchy title to inspire interest!

ROUGH DRAFT:

TITLE_____

QUESTION 1

QUESTION 2

QUESTION 3

QUESTION 4

QUESTION 5

Please return to…

Choosing the sampling method.

The *population* I will *sample* is _____.

To collect data for my project I will use the _____ sampling method.

Explain your choice of sampling method:

Have two classmates read your explanation for choice of sampling method.

I have read the above explanation and feel this is an appropriate choice.

_____ Signature 1

_____ Signature 2

Reminder	
Convenience sample: Members of the population are chosen because they are easily accessible.	Voluntary Sample: Members of the population chose to participate.
Simple random sample: Every member of the population has an equal chance of being selected.	Stratified sample: Entire population is subdivided, then a simple random sample is chosen from each division.
Systematic Sample: The population is ordered in some way then every "nth" person is selected.	Cluster Sample: Only the members of a subgroup are selected.

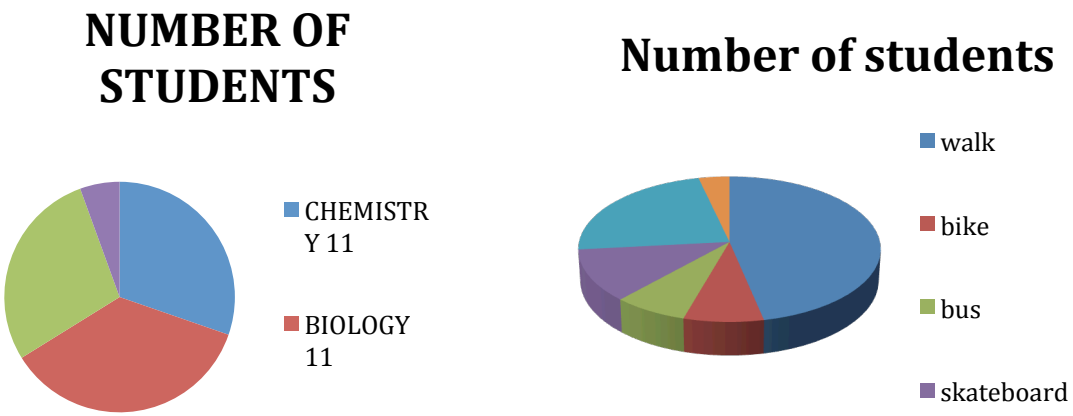
Interpreting and displaying the data.

Displaying Data

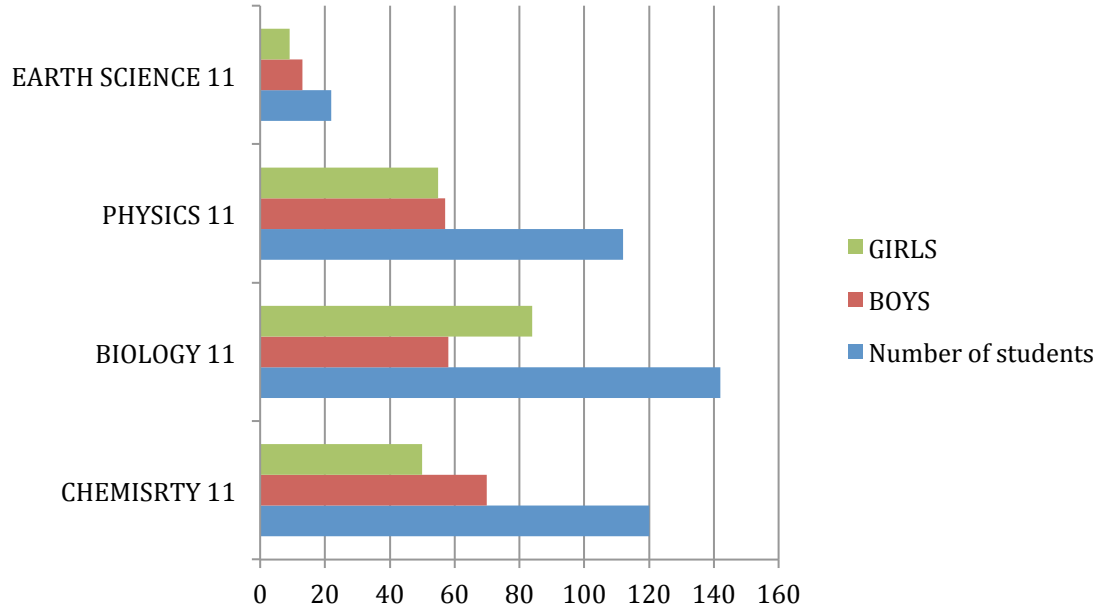
Once you collect your data, you will choose a method to display it. This will help you, and others, quickly interpret the results.

Below are some examples created in Microsoft Word.

Pie graphs:



Bar Graphs:



DATA:

Once you have given your survey, you will need to work with the data so that it can be analyzed and displayed. This will allow you to interpret the results, answer any questions you set out to investigate, make inferences and possibly decisions.

Organize your data in the space below, for instance, as a table. Use only the data that will help you answer the topic questions in your study.

DISPLAY the DATA:

What method(s) of displaying the data will you use?

PIE GRAPH BAR GRAPH SCATTERPLOT TABLE OTHER_____

Create a display for your results using technology or some other method.
(To be used with you presentation)

DATA EVALUATION:

What trends do you notice in the data? Have you made any assumptions?

Do you have enough data to answer the questions that you set out with for this topic?

Do you notice any bias in the data collected?

What conclusions can you make based on the results of your survey?

Presentation:

Your teacher will give you detailed instructions for the presentation guidelines.

Consider:

- What media will you use: Poster, PowerPoint, Oral Presentation, Written Report,
- Title
- Introduction that clearly identifies the topic of study.
- What was the population being studied?
- How was the sample of the population collected?
- How was the data collected?
- How was the data evaluated or analyzed?
- Displaying the data.
- Explain the results (refer to your display), and any bias.
- What can you conclude from your results?
- Can you think of suggestions for further study that could add to these findings?

Assessment:

Have several classmates evaluate your presentation using the rubric you designed earlier.

Self-Assessment:

Use the rubric you developed to evaluate your project and answer the following questions.

What score would you give your project presentation? (Ask your teacher for guidelines here)

Would you have choose the same sampling method if you were to repeat this survey? Why or why not?

What else may have you done differently?

Probability and Statistics Answer Key

(AMV): Answers may vary.

1. Personal opinion
2. Personal opinion
3. Personal opinion
4. Personal opinion
5. Personal opinion
6. All the questions are poor. Answers and opinions will vary. 1st Assumes your favorite team is either the Kings or the Leafs. 2nd uses the word 'boring' which is manipulative. 3rd Gives confusing options. 4th Wrong time of the year to suggest slurpees. 5th Privacy is essential in elections.
7. Compare with a partner.
8. (AMV): The headline is possible, given the survey question. The two options force people to pick teams that are not their favorites. The head is not fair.
9. (AMV): No one wants to watch a boring movie. The word boring would force most people to choose the educational video. The question is unfair.
10. (AMV): Not voting for Poly does not mean that students do not want a raise. It may mean that they don't want their summer holidays reduced. The survey is unclear. The headline is not fair.
11. (AMV): Most people don't want slurpees in the winter, not because of health but because it is cold. This survey question would be better asked in the warmer times of the year. The headline misinterpreted the data.
12. This election strategy is inappropriate. Elections must be kept private. This system is not respectful of people's privacy. It also allowed someone to bully his or her way to the presidency.
13. Reread above questions.
14. (AMV): What would you prefer to watch, a Hollywood movie or an educational movie? Or, What would you prefer to watch, a really good Hollywood movie or a really good educational movie?
15. (AMV): Emailing the schools eliminates the cost of postage. Or, Mail randomly selected schools across the province to reduce postage costs and time to tabulate results. Or, Email selected schools across the province to save postage and time.
16. (AMV): Do you eat meat? If yes, which of the following is your favorite? Beef, Chicken, Pork, Lamb or Turkey? It is important to respect that some people do not eat meat.
17. (AMV): Sara needs to say no to the request of the marketing company. People have not given her permission to pass their email addresses to a third party.
18. (AWV): In what months of the school year would you purchase slurpees from the cafeteria? September-October, November-February, March-April, May- June, Never?
19. (AMV): Elections need to respect people's privacy. Traditional systems of secret ballots are simple and private.
20. (AMV): Do you support raising minimum wage? Yes or No? Do you support reducing summer holidays to two weeks? Yes or no? Polly Tysean supports both. Will you be voting for Polly? Yes or no? This method gives people the chance to comment on each idea without being confused by other issues.
21. Answered on the next page or two.
22. Answered on the next page or two.
23. Students may rush the surveys and not give good data because they want to fill in as many surveys as they can. It is also possible that this system works very well.
24. The cost of this survey would be very expensive and it would take a lot of time to find all the addresses. It may be quicker to drop off flyers. It would be easy for the football team to make that part of their fitness training. They could run to every home.
25. Some people are not comfortable sharing their financial details. People should be given the chance to choose e) private.
26. This kind of survey will have dramatically different responses if it is given in September, November or June. The time of the year could influence how people respond.
27. Answered on the page.
28. Answered on the page.
29. Answered on the next page or two.
30. (AMV): There are so many brands of shoes as well as many types of shoes (running, hiking, casual, dress shoes….). Naming three brands may influence people to choose these brands more than other brands. Also, the three brands are all running shoes, which may lead people to only consider running shoe brands rather than all types. A sample, question might be; "What is your favorite brand of running shoes?" Or, "What is your favorite brand of shoe to wear to school?".
31. (AMV): The question is leading people to say yes by saying "Don't you think…" This can be easily corrected by changing the question to; 'Do you think that TV is a waste of time?' Some people will say that "waste of time" biases people to think about TV in a negative way prior to answering the question. A better question might be; 'What do you think of TV?'
    a) Important b) Neutral c) Not important
32. (AMV): Answering no to this question would not give clear data. Are they saying No to ending homeless, no to voting for Polly or both? This question may be better split into two parts? Are you in favour of ending homelessness? Do you plan to vote for Polly Tysean at the next election?
33. (AMV): Many people have commitments Sunday mornings like church or sporting events. These people may support the business but are unable to support the

business on Sunday mornings. This business may want to have a grand opening on another day. A possible survey question might be; "Will you be attending our grand opening celebration during the week of November 30th to December 4th?".

34. (AWV): Personal
35. (AWV): Personal
36. (AWV): Personal→Formal strategies will be discussed over the next few pages.
37. Population
38. Sample. The population would be all the kids in the school.
39. Sample. The population would be all the kids in the school.
40. Sample. The population would be all employees working for all the franchises.
41. Population
42. Population
43. Sample. The population would be all customers who shop there.
44. Answered on the next page.
45. Answered on the next page.
46. Answered on the page.
47. Population. A realtor could easily send emails to all clients in 2009. It would be a sample if not everyone responds.
48. Population. There are usually not more than 100 teachers in a school. This survey could be completed during a staff meeting.
49. Sample. It would be too time consuming to survey all viewers.
50. Sample→ They may choose to check with all the customers during a specific month.
51. Sample→ Post a survey on the city website or in the newspaper. Only a sample of the population would respond.
52. They both could be right. Grade nine boys could be a sample of the population if the survey was asking what kind of food should they sell in the cafeteria. Grade nine boys could be the population if the survey was questioning who would be trying out for the grade nine boys basketball team.
53. Ask for help if you need it.
54. Ask for help if you need it.
55. Ask for help if you need it.
56. Ask for help if you need it.
57. Ask for help if you need it.
58. Ask for help if you need it.
59. Ask for help if you need it.
60. Ask for help if you need it.
61. Ask for help if you need it.
62. Ask for help if you need it.
63. Ask for help if you need it.
64. Answered on the next page.
65. Answered on the next page.
66. Answered on the next few pages.
67. Answered on the next few pages.
68. Answered on the next few pages.
69. Answered on the page.
70. Answered on the page.
71. Stratified. A small group from each subgroup was chosen.
72. Simple Random
73. Systematic
74. Cluster
75. Answered on page.
76. The sample size is very small. Perhaps all the people in room 122 are part of the chess club.
77. This sounds reasonable. In a 9-12 school, 400 kids were surveyed. This should give a reasonably accurate prediction.
78. Monday between 1- 5 is not usually busy time. The service at this time of week and day may be very different than a Friday or Saturday night.
79. Answered on page.
80. (AWV): Voluntary→ Create a comments survey on their website. Anyone who comes to the website can choose to comment on their fall line up. Stratified→ People in different provinces may feel differently. They may want to survey randomly selected people in each province.
81. Answered on page.
82. (AWV): Voluntary→ Set up a survey on the city website. Stratified→ Mail a randomly selected group of residents in each area of town.
83. (AWV): Stratified→ There are distinct groups who will be impacted by the lights. Staff, students, parents, community soccer clubs and residents of who will see the lights at night. Survey a selection of members from each group.
84. (AWV): Convenience→ Survey all customers during the month of April. Stratified→ Survey the first 5 customers every day.
85. (AWV): Haydon's data may be more accurate. The cafeteria attracts a wider range of people than a boys PE class or a dance class. The Boys PE class is all boys and the dance class is all girls. Perhaps combining all the data together and calculating the average might be the best way to do it. →30% of the school might be interested (60%+10%+20% and divide that by 3.)
86. This is a cluster survey since all members are surveyed in one subgroup. It could also be a convenience survey since it may have been most convenient to survey his first block class. Alternative sample→ (AWV) Stratified. Randomly select 5 students from each class to fill out the survey.
87. Stratified Survey: since 5 nurses are chosen from each subgroup (hospital). An alternative method would be a voluntary survey. This way only those who have ideas for improvement would respond.
88. Personal.
89. $\frac{1}{2}$ or 0.5 or 50%. There are 2 choices and you have to pick one.
90. 50% of the class. If there were 30 kids in the class, 15 would vote yes.
91. (AWV) Not likely. Many kids would probably like an extra week off.
92. (AWV) Perhaps 24 vote yes.
93. (AWV) Probability 24/30 = 0.8 or 80%
94. (AWV) 800?

95. (AWV) If the population were 800, 640 student would vote yes. (80% of 800 is 640)
96. (AWV)
97. (AWV)
98. 0.5 or 50%
99. 0.25 or 25%
100. 0.5 or 50%. Probability is not influenced by what has already happened.
101. 9
102. 24
103. See Question 111.
104. A probability obtained based on what should happen.
105. A probability obtained through an experiment.
106. Answered on the page.
107. Answered on the page.
108. Answered on the page.
109. Answered on the page.
110. Answered on the page.
111. Answered on the page.
112. 0.4 or 40%
113. 0.1 or 10%
114. Answered on the page.
115. 0.8 or 80%
116. 0.13 or 13%
117. Answered on the page.
118. 0.25 or 25%
119. 0.52 or 52%
120. 15/48= 0.3125 or 31.25%
121. 0.18 or 18%
122. 0.75 or 75%
123. 0.5 or 50%
124. 5
125. 25
126. 250
127. (AWV) Could be 1 or 0
128. (AWV) Either 1000 or 0
129. Very inaccurate
130. (AWV) anything could happen.
131. (AWV)
132. (AWV)
133. (AWV)
134. (AWV)
135. (AWV)
136. (AWV)
137. (AWV)
138. (AWV)
139. (AWV) In general, larger samples lead to more accurate predictions.
140. No. In the case of flipping a coin once, it was way off.
141. See 148.
142. See 149.
143. See 150.
144. 180
145. 18
146. 100
147. We assumed that the experimental probability was accurate and that the sample represented the entire population.
148. Answered on page.
149. Answered on page.
150. Answered on page.
151. 0.68 or 68%
152. 10200
153. (AWV) Yes. People tend to be more generous at Christmas time. People may not be as generous during the summer.
154. 36
155. 1.12 and 1.12
156. (AMV) Yes. 1. Students are more likely to be on time in September than they are in later months. It is likely that the percentage of late students in November is higher than 4%. 2. In the case of 1st and 2nd period, students tend to be late more often for 1st period than 2nd period. It is doubtful that both 1st and 2nd period would have the same number of late students.
157. 9
158. 135
159. Answered on page.
160. Answered on page.
161. 6.6
162. 99
163. 3.8
164. 57
165. (AMV) It is hard to say. Each set is so different. Maybe the middle one because it is in between the really good average and the really bad average.
166. 6.466667→6.5
167. The middle set.
168. (AMV) Yes. He needs a much larger sample than 150 to calculate his average. Also, scouts would be more impressed with foul shot averages during games rather than practice.
169. (AMV) Personal.
170. (AMV) Hard to say. The average does not tell you anything about an individual. She could have 0%, 100% or any score in between.
171. (AMV) Yes. Really low scores could lower the class average to 68%.
172. 5
173. 5
174. 5
175. 5
176. 5
177. 3
178. 5
179. 5
180. 10
181. (A) Personal.
182. (AMV) The class average is limited. Really high or low scores can bias the average.
183. (AMV) You could eliminate the higher and lowest score and then take the average. You could take the average of the mean, median or the mode.
184. Ask for help if you are unsure.
185. Ask for help if you are unsure.
186. Ask for help if you are unsure.
187. See #191
188. See #192
189. See #193
190. See #194
191. Answered on page.
192. Answered on page.

193. Answered on page.
194. Answered on page.
195. 500 scratched phones.
196. (AMV) Yes. Returns can be very expensive for a company both in process and also in unhappy customers. It may be wise to fix the problem before it goes out.
197. 50 phones.
198. (AMV) Maybe. Personal preference.
199. 5
200. (AMV) No. It may be more economical to deal with refunds than it would be to pay people to open all the packaging to find the scratched phones.
201. (AVW) Jerry is probably more accurate because his sample is bigger.
202. (AMW) Yes. It is possible that Judy only looked at 10 phones and Frank only looked at 100 phones and Jerry only looked at 1000 phones. If the first phone was scratched for each person, it is possible that 1/10 and 1/100 and 1/1000 are possible outcomes.
203. Experimental probabilities can be increased by increasing the sample size
204. (b) Since 1955011 is about 50% of 4 million.
205. 2 million males.
206. Yes and no. It is the best option of the three. However 2 million is almost 45000 more than the actual number. A bigger sample size would be better.
207. It is off by 44989.
208. Increase the sample size.
209. Sample 4. It is the largest sample.
210. (AMV) This totally depends on your budget and how important accuracy is to your company.
211. (AMV) If a sample is too small or biased, the data will lead to experimental probabilities that do not represent the population.
212. (AMV) You would expect that he would not strike out very much. If he says he has never struck out, it seems reasonable to think that he would be good at baseball. However, it is possible that he has never struck out because he has never played baseball. It is possible that he has no baseball skill at all.
213. (AMV) Have you ever played on a baseball team before? If yes for how many years? Have you ever struck out before? In you last 100 at bats, how many times did you strike out?
214. See #222.
215. See #223.
216. Answered on page.
217. Answered on page.
218. (AMV) He has never missed. This implies he is really good at penalty shots. If Ricky was the goalie, it is possible that he has been involved in a lot of penalty shot situations but has never actually taken or missed a shot.
219. (AMV) Have you ever taken a penalty shot in a hockey game? If so, on average how many penalty shots would you score out of 100 shots?
220. (AMV) A) She gets 100% on tests she studies for. She must be good at math. B) She says she gets 100% on tests that she studies for. It is possible that she only studied for one test, which would mean she only got 100% on one test and poor marks on every other test.
221. (AMV) What is your current mark in math class? What mark did you get on each test this year? Do you study for every test?
222. Answered on page.
223. Answered on page.
224. 7000 out of 70000
225. (AMV) No. Perhaps only high school students were surveyed. Or perhaps the sample size was really small. Perhaps people riding the bus were poled.
226. 425
227. (AMV) No. Perhaps the sample size was really small and the people surveyed really like chocolate milk.
228. A) 60, B) 180, C) Y
229. (AMV) 1st the Sample is too small. They should sample a much larger population. They should sample students who actually go to the cafeteria. Keep track of all the purchases made by students for a one month period. The actual data will be more helpful than what people say they buy.
230. 90%
231. 35%
232. 15%
233. 45%
234. 10%
235. 1800
236. 700
237. 300
238. 900
239. 200
240. (AMV) Math. This class has the most random cross section since everyone has to take math.
241. (AMV) Personal. I would invest because using the experimental probability would suggest that 700 kids would buy. Also, if you take the average of all 5 groups, the experimental probability would 39%. This would lead to 780 sales.
242. (AMV) Possible order→ Math, mechanics, Dance, Rugby.
243. (AMV)
244. Takes less time and less money.
245. Samples can be biased and ultimately not accurate.

