






Student Handbook

Grade 9 Math

Unit 9: Statistics and Probability

Short Term Forecast Updated: Fri, Oct 21 2011 8:33 AMT

	Friday Afternoon	Friday Evening	Friday Overnight	Saturday Morning	Saturday Afternoon
	 Cloudy with showers	 Variable cloudiness	 Cloudy periods	 Isolated showers	 Mainly sunny
Temp.	16°C	14°C	10°C	10°C	13°C
Wind	SW 15km/h	W 20km/h	SW 25km/h	W 20km/h	W 20km/h
Relative Humidity	100%	77%	75%	52%	100%
P.O.P.	40%	20%	20%	40%	10%
Rain	less than 1mm	-	-	less than 1mm	-

Reference: www.theweathernetwork.com

Name: _____

9.1 Probability in Society

Theoretical Probability

The **theoretical probability** of an event occurring is:

$$\frac{\text{number of outcomes favourable to that event}}{\text{number of possible outcomes}}$$

Usually we refer to theoretical probability as the *probability*.

A die is labelled from 1 to 6.

The theoretical probability of rolling a number greater than 4 is:

When a die is rolled, there are 6 possible outcomes.

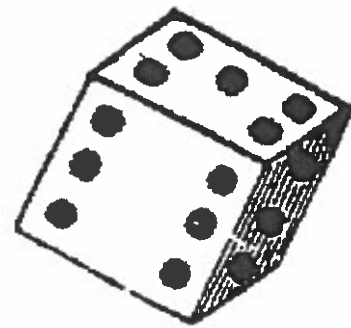
They are: 1, 2, 3, 4, 5, 6

A number greater than 4 is: 5 or 6

So, there are 2 favourable outcomes.

The probability of rolling a number greater than 4 is:

$$\frac{\text{number of outcomes favourable to that event}}{\text{number of possible outcomes}} = \frac{2}{6}, \text{ or } \frac{1}{3}$$



Experimental Probability

Experimental probability is the likelihood that something occurs based on the results of an experiment. The **experimental probability** of an event occurring is:

$$\frac{\text{number of times the outcome occurs}}{\text{number of times the experiment is conducted}}$$

It can be written as a fraction, decimal, or percent.




When a paper cup is slid off the edge of a table, it can land open end up, open end down, or on its side. Here are the results of 50 trials.

The experimental probability of landing on its side was:

$$\frac{\text{number of times cup landed on its side}}{\text{total number of trials}} = \frac{24}{50}$$
$$= 0.48, \text{ or } 48\%$$

The experimental probability of landing open end down was:

$$\frac{\text{number of times cup landed open end down}}{\text{total number of trials}} = \frac{16}{50}$$
$$= 0.32, \text{ or } 32\%$$

Outcome	Frequency
	24
	10
	16

We can use probability to help us make decisions.

Sometimes the decisions we make are influenced by our state of mind or by our gut feeling. When we make a decision in this way, we make a **subjective judgment**.

For example, I think I did well on the test because I wrote in red pencil and red is my favourite colour.

Practice

1. Explain how each decision is based on theoretical probability, experimental probability, or subjective judgment.

- a) Josh is given a bag that contains 5 red marbles and 5 blue marbles. He is to pick one marble from the bag without looking. He decides that his chance of picking a red marble is 1 out of 2, or 50%.

Circle the statement that best describes how Josh made his prediction.

Josh made his decision based on the results of a survey or experiment.

Josh made his decision based on theoretical probability.

Josh made his decision based on his personal thoughts or feelings.

Explain your thinking.

- b) A quality control officer for a light bulb manufacturer tested 10 light bulbs. Nine of the bulbs burned for more than 1000 h. So, the manufacturer decides that 90% of the light bulbs will burn for more than 1000 h.

Circle the statement that best describes how the manufacturer made the decision.

The manufacturer made the decision based on the results of an experiment.

The manufacturer made the decision based on theoretical probability.

The manufacturer made the decision based on personal thoughts or feelings.

Explain your thinking.

- c) A pair of concert tickets is hidden in an envelope. There are 3 envelopes to choose from: red, green, and blue. Desi chooses the green envelope because green is his favourite colour.

Circle the statement that best describes how Desi made his decision.

Desi made his decision based on the results of an experiment.

Desi made his decision based on theoretical probability.

Desi made his decision based on personal thoughts or feelings.

Explain your thinking.

2. What assumptions are being made in each situation?

- a)** Lin passed 6 of her last 7 math tests. So, Lin is sure she will pass tomorrow's test.

Assumptions: – _____
– _____

- b)** The first tunnel on a road through the mountains has height 4.5 m. A truck driver decides that her truck of height 4.3 m will pass safely through all tunnels on the road.

Assumption: – _____

- c)** The Tigers have won all of their home games to date. So, they will win tomorrow's home game.

Assumptions: – _____
– _____

3. For each situation:

- i)** What assumptions are being made?
ii) How might the outcome change if the assumptions change?

- a)** One hundred bottles of water were sold in the school cafeteria yesterday. So, the school orders 500 bottles of water for next week.

i) Assumptions: – _____
– _____
– _____
– _____

- ii)** Fewer bottles of water might be sold if:

– _____
– _____

More bottles of water might be sold if:

– _____
– _____

- b)** Marcel's dad leaves for work 5 min later when there is a school holiday because traffic is always lighter.

i) Assumptions: – _____
– _____
– _____
– _____

ii) _____

9.2 Potential Problems with Collecting Data

A biased question could lead to a problem with data collection. There are many other factors that should also be considered.

Potential Problem	Example
Timing – when data are collected could affect the results	The results of a survey on ski jackets may differ if the survey is conducted in the summer instead of the winter.
Privacy – people may not want to share personal information	Students may not want to share their school grades.
Cultural Sensitivity – the survey must not offend other cultures	A question about Christmas shopping may offend those who do not celebrate Christmas.
Cost – the cost of collecting data should be considered	The cost of mailing a survey to a large number of people may be too expensive.
Time – the amount of time needed to collect the data should be considered	A 30-min survey conducted over the lunch period may not interest students. Most would not want to give up 30 min of their lunch time.
Use of Language – the way a question is worded could lead people to answer in a certain way	This question may lead students to answer “Yes”: Don’t you think the price of a concert ticket is too high?

Practice

1. For each survey, identify a potential problem.

- a) An on-line pet magazine surveys its readers by asking this question:

Don't you think people who don't walk their dogs at least once a day are being cruel to their dogs? Yes or No

Is there a problem with the survey question? ____

Is there a problem with cost or time? ____

Is there a problem with privacy or cultural sensitivity? ____

Explain your thinking.



- b) The school cafeteria surveys all students to find out what meat dishes they would like to see served. They asked this question:

Which meat dish would you like to see served in the cafeteria:

Meatloaf ____ Roast Beef ____ Sausage ____ Chicken ____ Other ____?

Is there a problem with language? ____

Is there a problem with cost or time? ____

Is there a problem with privacy or cultural sensitivity? ____

Explain your thinking.

- c) A French tutor asks all students in the school for their French marks so she can find out which students might need her help.

Is there a problem with cost or time? ____

Is there a problem with privacy or cultural sensitivity? ____

Explain your thinking.

2. For each scenario in question 1, describe how the problem could be avoided.

- a) _____

- b) _____

- c) _____

3. Explain why each survey might be problematic.

a) A cell-phone company wants to find out how satisfied customers are with the company and its product. They plan to conduct a 25-min telephone survey with 10 000 of its customers.

Is there a problem with time or cost? _____

Is there a problem with privacy? _____

Is there a problem with cultural sensitivity? _____

Explain. _____

b) To find out which sport students in the school prefer, you plan to poll the students the day after the volleyball team wins the championship.

Is there a problem with timing or cost? _____

Is there a problem with privacy? _____

Is there a problem with cultural sensitivity? _____

Explain. _____

4. For each scenario in question 3, describe how the problem could be avoided.

- a) _____

- b) _____

► 9.3 Using Samples and Populations to Collect Data

When a **census** is conducted, data are collected from *all* people or items in the **population**. For example, to find the favourite movie of all Grade 9 students in a school, all Grade 9 students in the school are surveyed. Since all students in the population were surveyed, a census was conducted.

When the population is large, it is often too costly or time consuming to survey the entire population. So, we often collect data from a representative portion of the population, or a **sample**. For example, surveying 50 of the 300 Grade 9 students is a sample.

Practice

1. Identify the population of each survey.

- a) The manager of an apartment building wants to find out which apartments in the building need new carpet.

- b) The manager of a video game store in Grande Prairie wants to find out how many video games are owned by the average teenager in town.

- c) A company that manufactures programmable thermostats wants to test its thermostats for defects.

2. In each case, describe why a sample was used instead of a census.

- a) A car company in Canada wants to find out whether people plan to buy or lease their next vehicle.

- b) A clothing manufacturer wants to make sure the guarantee that its clothing will not shrink when washed is upheld.

3. In each case, describe why a census was used instead of a sample.

- a) The Canadian government wants to determine the population of the different towns and cities in Canada.

- b) A school principal wants to find out how many students plan to take the Grade 10 Computer and Information Science course next year.

4. In each case, should a sample or a census be used to collect the data?

- a) The school basketball teams are getting a new logo. There are 2 logos to choose from and 24 basketball team members in the school.

Would it take a long time to survey each team member? ____

Would it cost a lot of money to survey each team member? ____

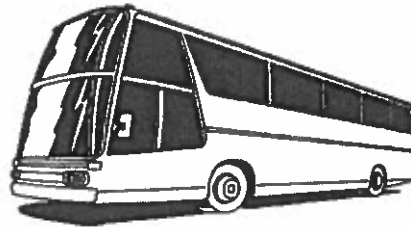
Should a sample or census be used? _____

- b) The City of Regina wants to find out what percent of its residents use public transportation on a daily basis.

Would it take a long time to survey each resident of Regina? ____

Would it cost a lot of money to survey each resident? ____

Should a sample or a census be used? _____



5. In each case, a sample was used to collect data. Do you think the conclusions would be valid? Explain.

- a) To find out if more daycare centres are needed in the city, all residents over the age of 50 were surveyed.

Do you think most residents over the age of 50 would have children in daycare? ____

Do you think the conclusions would be valid? ____

- b) To find out what percent of the vehicles in a mall parking lot have a bumper sticker, Neil looks on the bumper of every fourth vehicle.

9.4 Selecting a Sample

There are many different ways to select an appropriate sample.

Sampling Method	Example
Simple Random Sampling – each member of the population has an equal chance of being chosen	The name of each student in your class is put in a hat and 5 names are drawn.
Systematic Sampling – every m th member of the population is chosen	Every 10th name in the telephone directory is chosen.
Cluster Sampling – the population is divided into groups and every member of <i>one</i> group is chosen	A school has five Grade 9 classes. All students in one class are chosen.
Self-Selected Sampling – members of the population volunteer to be chosen	Forty students volunteer to take a survey about homework habits.
Convenience Sampling – members of the population who are convenient are chosen	The principal chooses the first 3 boys she sees to help her choose the word of the week.
Stratified Random Sampling – some members of each group of the population are randomly chosen	The school's population is divided into grades and 20 students from each grade are chosen.

Practice

1. Identify the sampling method used for each survey.

- a) The population is divided into age groups and those people in the 18–24 age group are surveyed.

- b) The members of the population are given ID numbers. The numbers are entered into a computer. The computer randomly selects 50 numbers. The people whose numbers are selected complete the survey.

- c) A market researcher stands beside the information booth of a mall and asks people who walk by to participate in a survey.

2. Identify a potential problem with each sampling method.

- a) To find out which new books students would like to see in the library, the school librarian surveys all English teachers in the school.

- b) To find out the favourite vacation destination of Canadians, listeners of a Regina radio station were asked to complete an on-line survey on the radio station's website.

3. Which sampling method do you think is better? Why?

- a) Marco wants to find out whether students who purchase lunch at the cafeteria would like to have the lunch special served with salad or coleslaw.

Method A: Survey every 5th person who enters the cafeteria.

Method B: Survey every 5th person in the cafeteria line-up.

Method A: Does everyone who eats in the cafeteria buy their lunch? _____

Does the opinion of those who don't buy their lunch matter to the cafeteria staff? _____

Method B: Does each student who buys from the cafeteria have an equal chance of being surveyed? _____
Is the sample representative of the students who purchase from the cafeteria? _____

Better method: _____

- b)** A local street has an apartment building on the north side and houses on the south side. Maya wants to find out whether residents would like to see a 24-h bus service on the street.

Method A: Survey the occupants of every apartment on the third floor.

Method B: Survey every 5th house on the street and every 5th name on the apartment building's directory.

Method A: Who do you think would make more use of public transit: the residents of the apartment building or the residents of the houses?

Is the sample representative of all the residents of the street? _____

Method B: Is the sample representative of all the residents of the street? _____

Better method: _____

- 4.** In each case, which sampling method was used? Is the sampling method appropriate? Explain.

- a)** To find out about the study habits of students in the school, all students on the honour roll were asked to complete the survey.

Sampling method: _____

Is the method appropriate? _____

Why? _____

- b)** To find out the favourite toast topping of people in the restaurant, every 4th person who orders toast is surveyed.

Sampling method: _____

Is the method appropriate? _____

Why? _____
