Name:_____

Start date:_____

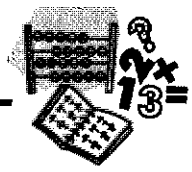
Hand in date:_____

Grade:_____

Math 9 K&E

Statistics and Probability

Reading and Interpreting Graphs

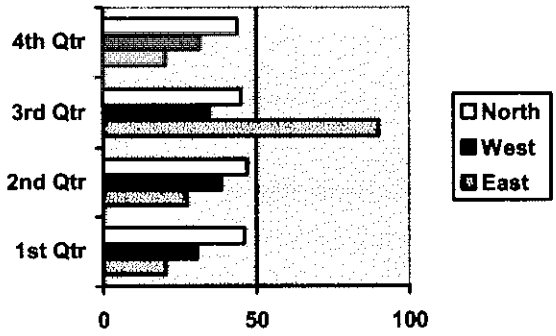


Information can be displayed in many ways, such as in graphs.

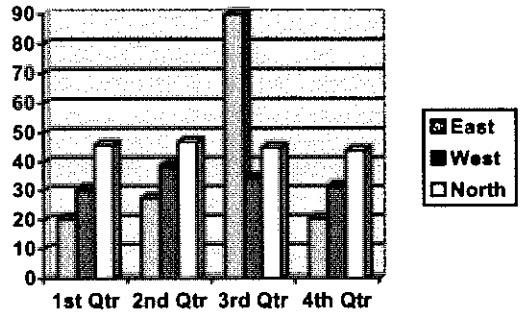
Graphs are visual representations (pictures) of data. Graphs help us to compare data, draw conclusions, make predictions and see trends.

Types of graphs include:

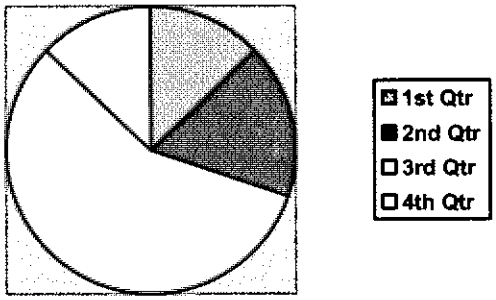
Bar Graphs



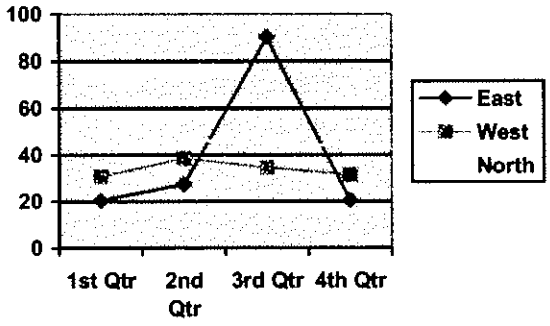
Bar Graphs (Column)



Circle Graphs

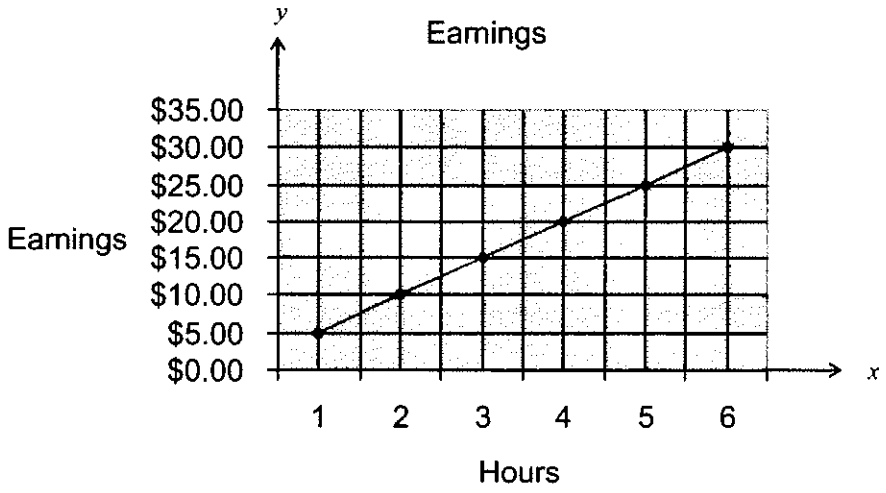


Line Graphs



Examples

A)



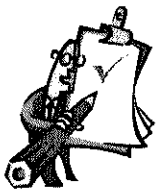
Use the following information to help you understand the graph above.

- The x-axis represents the number of hours worked.
- The y-axis represents earnings.

1. Select an hour on the x-axis; e.g., hour 3.
2. Find the • directly above the hour.
3. Follow the horizontal line to the amount on the y-axis; e.g., $15.00.
4. State the relationship. During hour 3, $15.00 was earned.

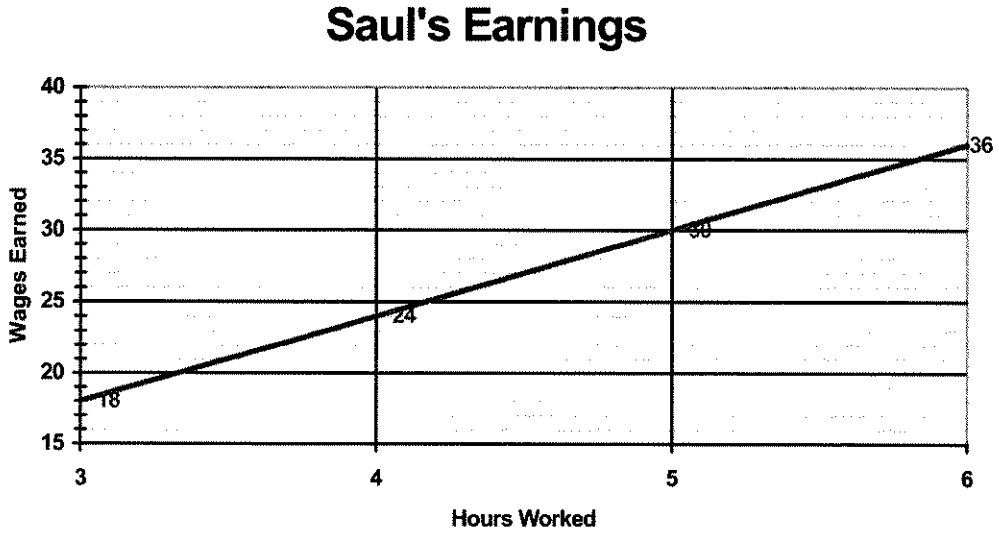
Predictions can be made by examining patterns on graphs and determining the relationship between the data. Equations for relationships can also be identified.

For example, based on the previous graph, it can be predicted that by hour 7, $35.00 will be earned and by hour 8, $40.00 will be earned.



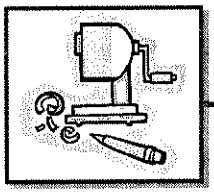
Many people estimate or calculate the amount of money they will make before receiving their paycheques. This is done by examining, calculating, predicting and drawing conclusions about the number of hours worked and the hourly wage earned.

B) This graph shows how much money Saul will make working 3, 4, 5 and 6 hours. How many dollars per hour does Saul earn? The graph shows that Saul makes $18 for 3 hours; $24 for 4 hours; $30 for 5 hours and $36 for 6 hours. The pattern is $6 for every hour.



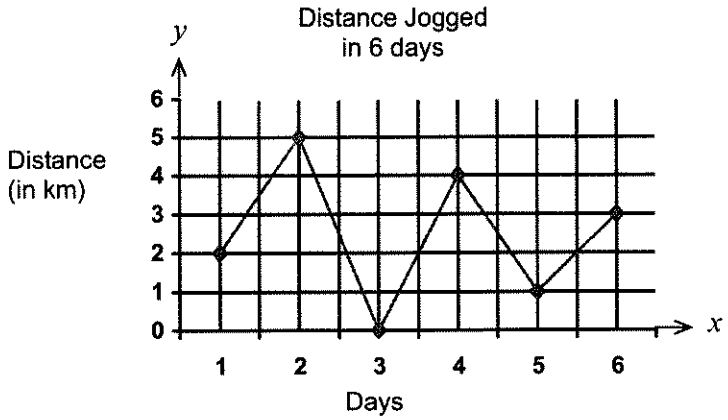
Predict how much money Saul will make if he works 8 hours and if he works 10 hours. To solve the problems above, extend the graph and/or set up an equation.

x	$y = 6x$
3	18
4	24
5	30
6	36
8	= 6 × 8
10	= 6 × 10



Practice: Reading and Interpreting Graphs

1. The following questions can be answered by reading the graph. Answer and discuss them with classmates.



a) What information is the graph showing?

b) What is the label of the x-axis?

c) What is the label of the y-axis?

d) How far did the runner jog on the 1st day? On the 4th day?

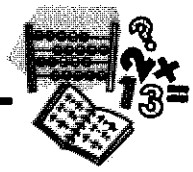
e) Which day did the runner jog the farthest? Not at all?

f) If the jogger rested on Sundays, which day was Sunday?

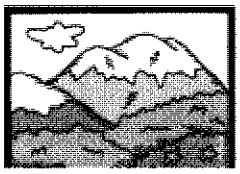
2. Use a variety of sources such as the Internet, atlases and newspapers to locate a variety of different graphs. With your classmates or teacher, examine and interpret the graphs. Answer these questions.

- What types of graphs are they?
- What is the topic of each graph?
- What are the headings of the axes?
- What is the range of data on each?
- Does each show a snapshot or change over time?

Bar Graphs

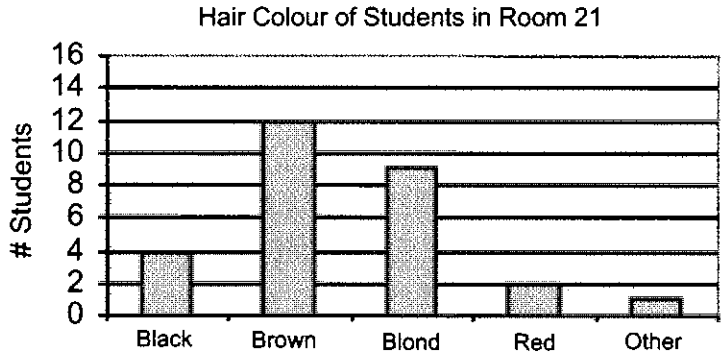


Bar graphs are used to compare information or data that does not change. They give a snapshot of information in one period of time.



Examples of information represented in bar graphs include: heights of mountain ranges, lengths of rivers, numbers of different types of trees in a forest and the mass of large mammals.

The graph below is a bar graph. Bar graphs are used to represent quantities or amounts.



Examine the graph carefully to fully understand what it represents. Follow these steps.

Step-By-Step Procedure	Example
1. Look at the title to see what the graph is about.	Hair colour of students in room 21.
2. Look at the x-axis ($\leftrightarrow$) to see what is identified.	The different types of hair colour (black, brown, blond, red and other).
3. Look at the y-axis ($\updownarrow$) to see the numbering system.	The numbers go up by 2's.
4. Read each bar and follow the bar to the top to see what number it represents.	The bar representing black hair goes up to 4. Therefore, 4 students have black hair.
5. Repeat this procedure with each bar.	12 students have brown hair. 9 students have blond hair. 2 students have red hair. 1 student has hair that is not black, brown, blond or red.

The range of data is the least and greatest quantities represented. The range is used to determine the maximum number needed for the y-axis.

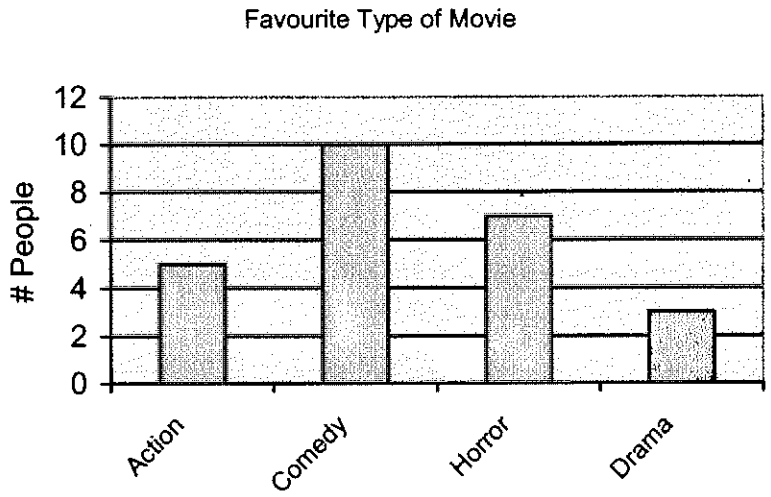
For example, the range of data for hair colour of students is from 1 to 12. One represents the fewest number of students, 12 represents the greatest number of students.

Conclusions can be drawn from graphs. For example, conclusions from the bar graph about hair colour include:

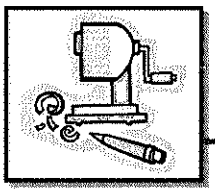
- 4 students have black hair.
- 12 students have brown hair.
- 9 students have blond hair.
- 2 students have red hair.
- 1 student has hair that is not black, brown, blond or red.
- There are 28 students in the class.

Example

Erin surveyed family members and friends about their favourite types of movie. Her findings are represented on the bar graph below.

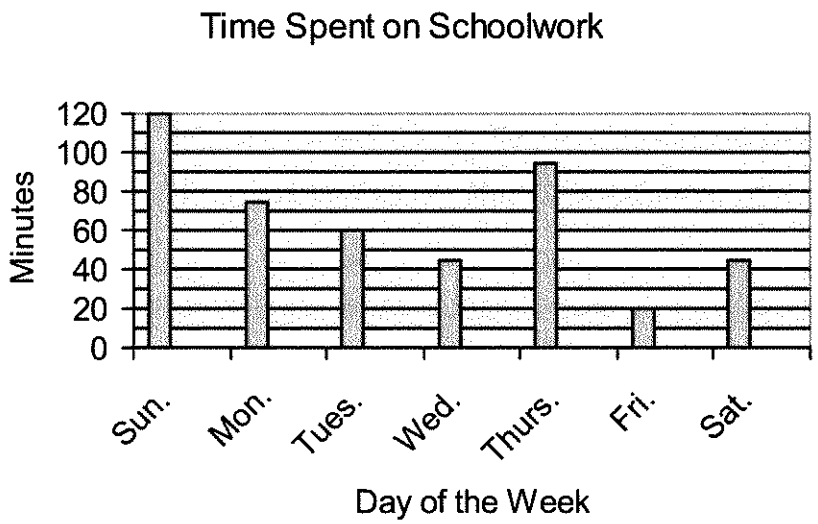


To interpret this graph, ask the following questions.
What is the bar graph about? Favourite movie types
How many people selected action movies? 5
How many people selected comedies? 10
How many people selected horror movies? 7
How many people selected drama movies? 3
How many people were surveyed in total? 25 people
What is the range of data? 3 to 10
Does the graph show a change of favourite movie selections over time? No



Practice: Reading and Interpreting Bar Graphs

Homework! Completing homework usually results in improved marks. The bar graph below represents the number of minutes Gerald spent on schoolwork each night during one week. Look at the bar graph and answer the questions that follow.



1. What is the topic of the graph?

2. What information is on the x-axis?

3. How much time did Gerald spend doing schoolwork on:
   a) Sunday?
   b) Wednesday?
   c) Friday?
   d) Saturday?

4. On which day did Gerald spend:
   a) the most time on schoolwork?
   b) the least amount of time on schoolwork?

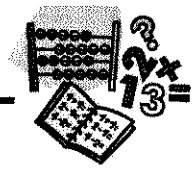
5. Why do you think that Gerald spent more time doing schoolwork on Sunday than on any other day of the week?

6. How many minutes did Gerald spend doing schoolwork in total? Convert this number into hours and minutes.

7. Write a conclusion statement about the graph.

8. Estimate the amount of time that you spent on schoolwork last week. Keep track of the number of minutes that you spend on schoolwork for the next three days. Display your information in a bar graph.

Broken Line Graphs

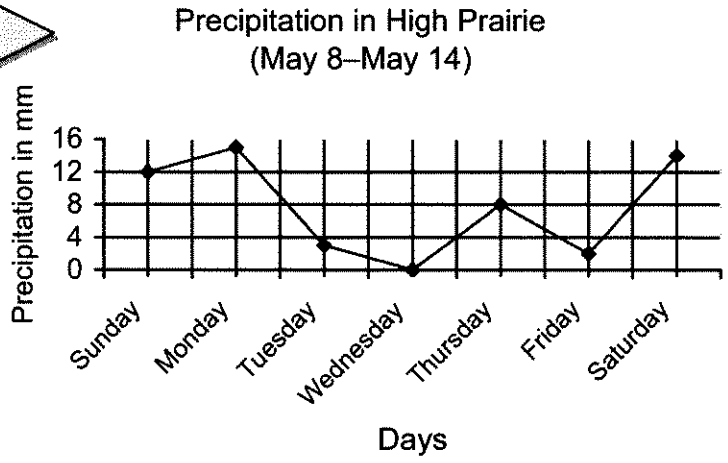


Broken line graphs (also called line graphs) are used to show changes in data over time. They display trends (patterns) and help us make predictions.

Examples of information represented in broken line graphs include: the growth pattern of a person, the Earth's climate changes over time, the temperature change of vinegar when baking soda is added and the pollution of a water system over time.

In a broken line graph, markers are used to represent amounts. These amounts are then joined together by straight lines. Markers can be dots, stars or other representations.

Example



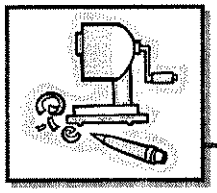
Examine the graph thoroughly to understand the information presented.
Ask the following questions. Discuss your answers with classmates.

- How many days are represented?
- Which days had the most/least amount of precipitation?
- Where was the data recorded?

Conclusions can be drawn from graphs. For example, conclusions from this line graph include:

- The range of data is 0 to 15.
- 15 mm of precipitation fell on Monday.
- 0 mm of precipitation fell on Wednesday.
- More precipitation fell on Sunday and Monday than on Tuesday and Wednesday.
- The most precipitation that fell in a day during this period of time was 15 mm.

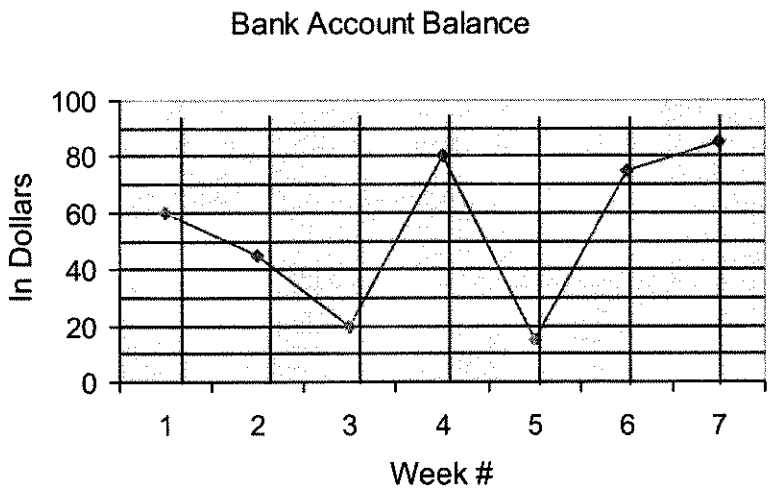
Does the broken line graph show a change in precipitation over time? Yes



Practice: Reading and Interpreting Broken Line Graphs

1. Joe tracked the approximate balance of his bank account over the course of 7 weeks.

Week	Balance (in $)
Week 1	60
Week 2	45
Week 3	20
Week 4	80
Week 5	15
Week 6	75
Week 7	85



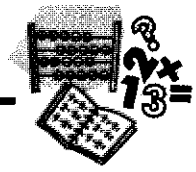
The line graph shows Joe very quickly that during weeks 3 and 5 he spent more money than at any other time.

Write two statements about the graph.

Write a conclusion statement about the information displayed on line graphs.

2. Use a variety of sources of information such as a library, atlas, newspaper or the Internet, to locate line graphs. Discuss with classmates the type of data/information displayed on these graphs.

Circle Graphs



Circle graphs show and compare percentage information.
Data is gathered and changed to percents.

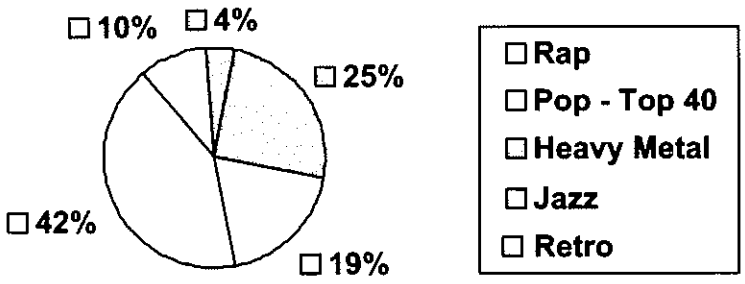
Circle graphs are like bar graphs. They show and compare a snapshot of information, rather than changes over time. Circle graphs are often used to display information from surveys, such as opinions and consumer information.

Examples of information displayed in circle graphs include: components of air, land masses of the continents, and population of the continents.

Examples

A) Amir gathered information from patrons to decide on the type of music he should play at his radio station.

Music Preferences



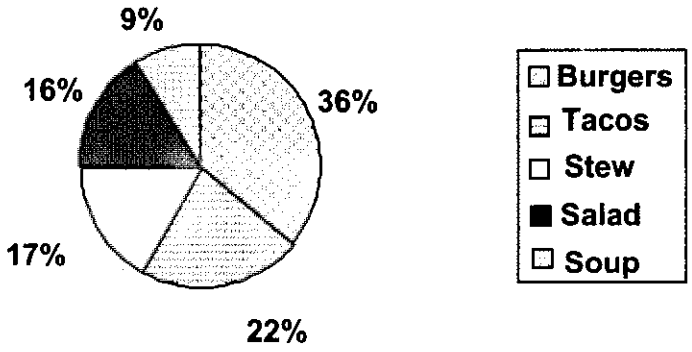
Conclusions can be drawn from graphs. For example, the circle graph shows that:

- 42% of the people surveyed prefer rap music.
- 4% of the people surveyed prefer heavy metal music.
- More people surveyed prefer retro to heavy metal music.

Circle graphs do not display the total number of people surveyed. Amir may have gathered information from 20 or 200 people.

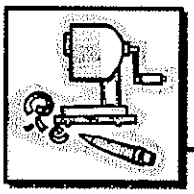
B) Shannon surveyed 200 students to gather information about cafeteria food. Her results are displayed on the circle graph below.

Favourite Cafeteria Food



Conclusions can be drawn from the circle graph, such as:

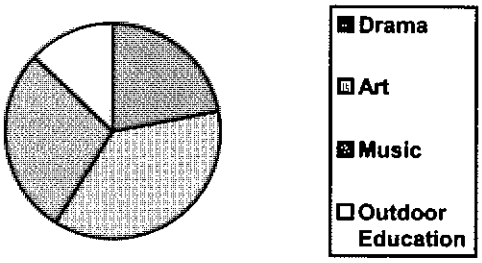
- The range of data is 9% to 36%.
- 36% of people surveyed prefer burgers.
- 9% of people surveyed prefer soup.
- More people surveyed prefer tacos than stew.



Practice: Reading and Interpreting Circle Graphs

1. Four option courses are offered to Grade 8 students. Examine the circle graph and answer the following questions.

Percentage of Requests for Course Options

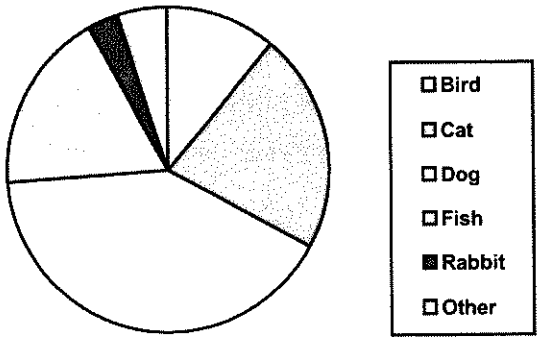


a. Which course is most popular?

b. Which course is least popular?

c. If Outdoor Education were not offered, predict the course that the majority of students would take.

2. The students in Mrs. Walker's class were surveyed on the kinds of pets they have. Their results were compiled in a circle graph.



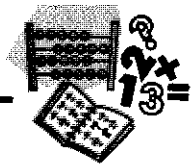
a. Which pet do most students have?

b. What conclusions can you make from the graph?

c. What is information is missing when reading a circle graph?

d. How is a circle graph different from a bar graph?

Pictographs



An easy and colourful way to display information from survey questions is in **pictographs**.

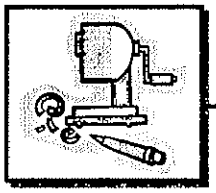
Example Eye colour of the students in Bobbie's class.

Each (👁) represents 2 people.

Eye Colour	Number of People
Brown eyes	👁👁👁👁👁👁
Hazel eyes	👁👁👁👁👁👁👁
Green eyes	👁👁
Blue eyes	👁👁👁

Conclusions that can be drawn from the pictograph:

- The range of data is from 4–14.
- 12 people have brown eyes.
- 4 people have green eyes.
- More people in Bobbie's class have blue eyes than green eyes.



Practice: Reading and Interpreting Pictographs

1. Which type of movie do you like to watch? A random survey was taken in your class and the results were displayed in a pictograph.

   Each symbol represents 2 votes.

Type of Movie	Number of Votes
Adventure	
Animation	
Comedy	
Drama	
Science Fiction	
Horror	

   a. How many votes in all?

   b. What conclusions can you make from the graph?

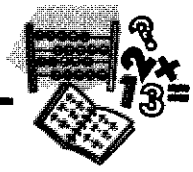
   c. How is a pictograph different from a bar graph? a circle graph?

Think About ...

Graphs are often used in the workplace, for example:

- to show sales over a month
- to show attendance over a week
- to show what types of customers buy your products

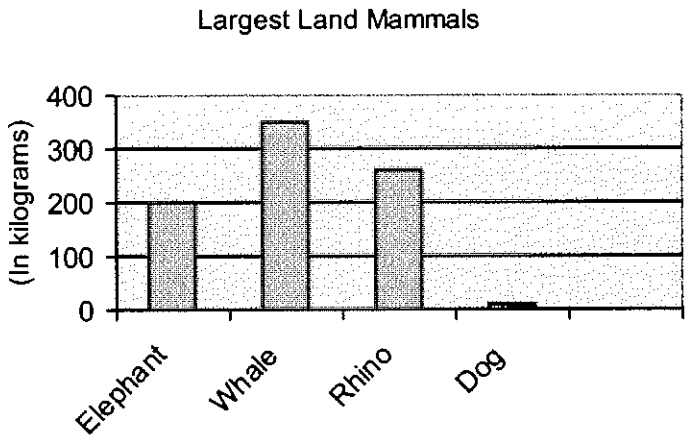
Graphs are sometimes the best way to paint a picture from data you have collected —and a picture is worth a thousand words!



Reasonableness of Data and Results

Data presented in graphs, charts, tables, lists and databases may be misleading and must be examined carefully.

Examples A)

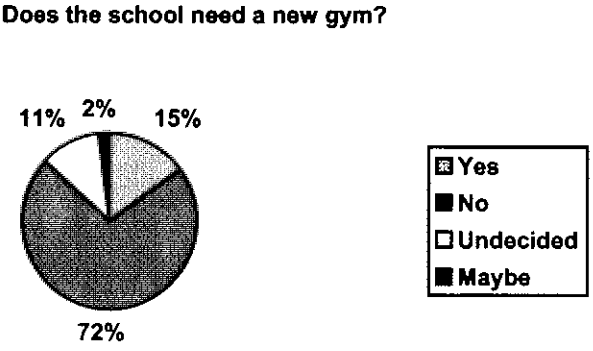


Read and interpret the graph above. These questions may guide you.

- Are the animals all large, as the title states?
- Are the mammals all land mammals?

We may conclude that the graph is incorrect, and is not a reasonable representation of the data. When reading graphs, charts, tables, lists and databases, the reasonableness of the data should be questioned. Critically analyze and question the accuracy of all sources of information, including information on the Internet.

B) The following circle graph demonstrates critical analysis of data. It indicates the results of a survey asking the question, "Does the school need a new gym?".

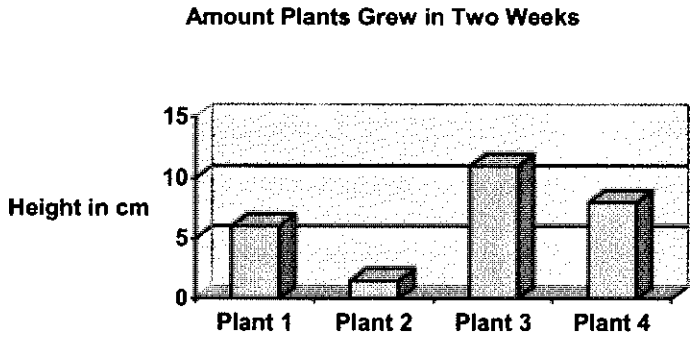


Analysis: 72% of the responses indicate no, the school does not need a new gym.
Only 15% said yes.

The survey was actually conducted at a senior citizens' home. If students at the school were surveyed, do you feel the results would be the same as those above?

To help make the information on a graph accurate and reasonable, the title should state **who** was surveyed.

C)

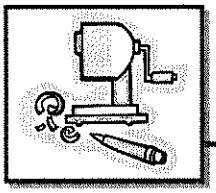


Discuss what may be wrong with the graph or the data on the graph.

There is a big difference in the amounts the plants grew.

Why might this be?

- Perhaps four different plants were used.
- Perhaps some plants were given more water and sunlight.



Practice: Analyzing Reasonableness of Data and Results

1. Telephone surveyors often contact people in their homes to ask them questions. Contact a company that conducts these types of surveys. Ask what they do to ensure the information they gather is accurate. What do they do to ensure the data is accurate when they compile it?

2. Sunita was researching the effects of acid rain on vegetation in rural Canadian communities. She found a Web site that contained a graph on the effects of acid rain. The graph did not support Sunita's hypothesis that acid rain has negative effects on plant life. Upon looking more closely at the graph, Sunita discovered that the graph was not applicable to her research. Why?

   Discuss with a classmate or your teacher why the graph may not be appropriate for Sunita's study.

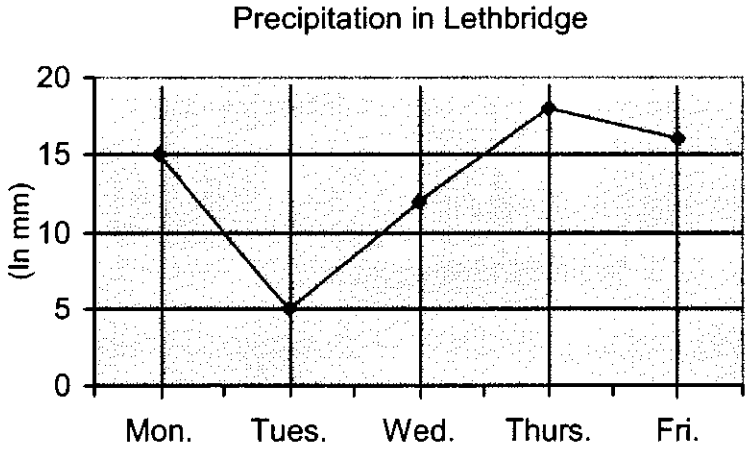
Predictions and Inferences

A **prediction** is an informed guess as to what may happen in the future. Predictions can be made through observation. For example, a glance at the sky may provide information for an informed prediction about the day's weather.

Examining and interpreting graphs also provides information for informal predictions.

Example

The broken line graph may help predict the weather for Saturday. What is your prediction for precipitation on Saturday and Sunday?



An **inference** is an informed guess about why events occurred. That is, the cause that resulted in the effect that is displayed on the graph. An inference statement about the Precipitation in Lethbridge graph is: Rain clouds from the west resulted in rain in Lethbridge.

Inferences assist in making predictions. For example,

- It is **probable** that it will rain on Saturday.
- It is **improbable** that it will be sunny on Saturday.

Probable means that an event will likely occur.
Improbable means that it is unlikely that an event will occur.

Statements about probable and improbable events are based on informed inferences and predictions.

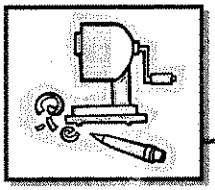
Probability statements may also be expressed using "more likely" and "less likely." It can also be predicted that:

- It is **more likely** to rain than be sunny on Saturday.
- It is **less likely** to be sunny than rainy on Saturday.

More likely means there is a better chance of an event occurring.
Less likely means there is less of a chance of an event occurring.
Equally likely means there is the same chance of an event occurring or not occurring.

Probability statements help form conclusions. For example, according to the previous graph, if someone had wanted to play baseball:

- The **best** day to have been outside would have been Tuesday.
- The **worst** day to have been outside would have been Thursday.



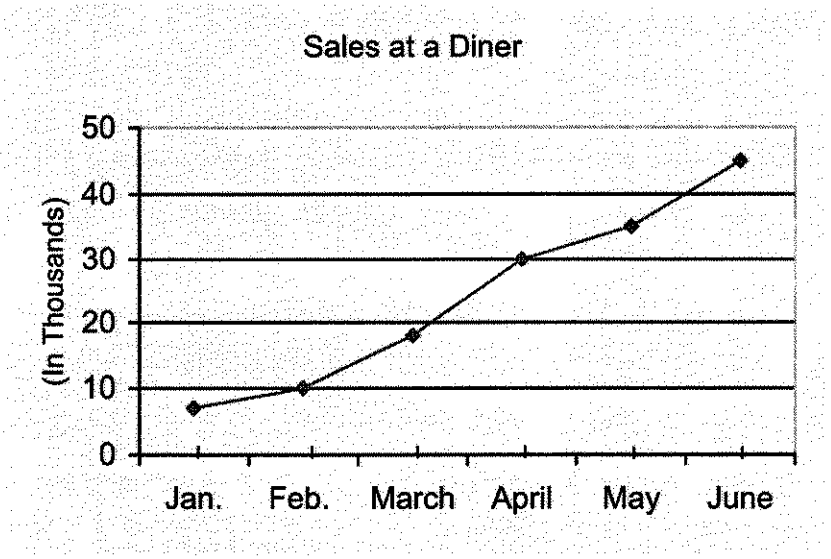
Practice: Predictions and Inferences

1. Examine the graph and discuss your observations with a classmate or your teacher. Prediction statements can be made by looking at the sales graph of a diner. For example,
   - It is **probable** that sales will increase in July.
   - It is **improbable** that sales will decrease in July.

   OR
   - Sales are **more likely** to increase in July.
   - Sales are **less likely** to decrease in July.

   Conclusion statements:
   - The **best** month for sales was June.
   - The **worst** month for sales was January.

An inference statement based on the graph is:
Sales increased from January through June because warmer weather causes people to eat out more.



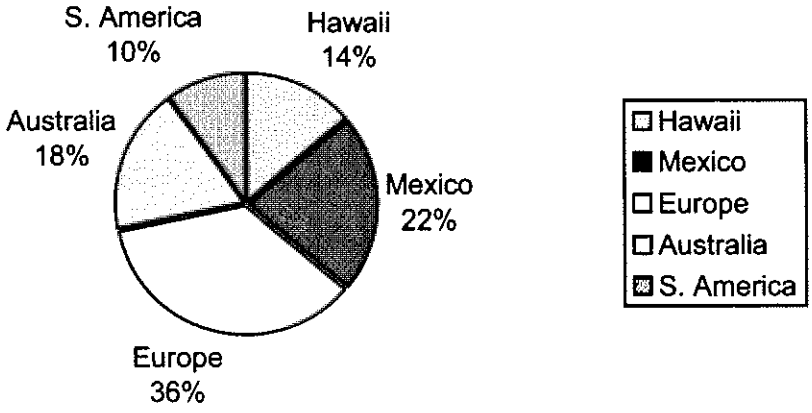
Write your own inference statement.

2. Examine a pay cheque and make predictions and inferences. For example, a **prediction** statement is: If an employee works the same number of hours, the pay cheque will be for the same amount.

   An **inference** statement is: The pay cheque is a certain amount because of the hours the employee worked.

3. Use appropriate vocabulary about predictions, inferences and conclusions to complete the following statements based on the circle graph.

Popular Family Vacation Destinations



a) The most popular choice for a family vacation is _____.

b) The least popular choice for a family vacation is _____.

c) Families are _____ to travel to Europe than South America for a family vacation (more likely, less likely, equally likely).

d) It is _____ that a family of four would travel to Europe for a vacation (improbable, probable).

e) Families are less likely to travel to _____ than to Mexico for a vacation.

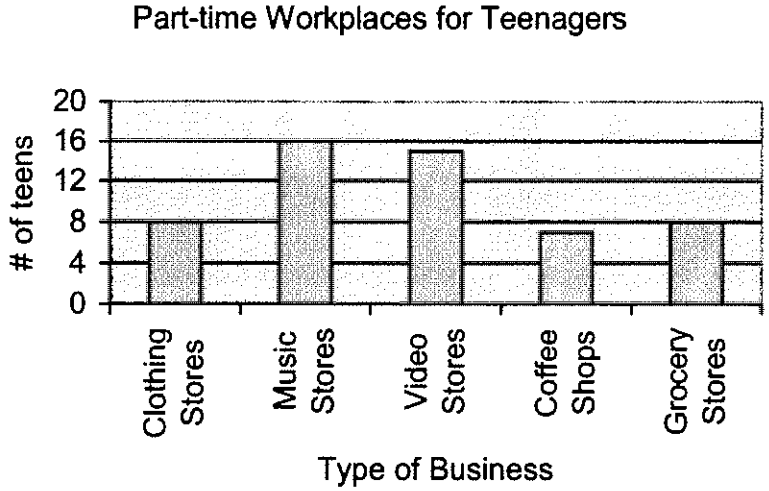
f) It is fairly equally likely that families would travel to _____ or Hawaii for a vacation.

g) Use the graph above and write a statement using the phrase **improbable**.

h) Write an inference statement based on the graph.

4. Use appropriate vocabulary about predictions, inferences and conclusions to complete the following statements based on the bar graph.

   Where are popular places for teenagers to get part-time jobs? Look below to find out.



a) According to the graph, the place where most teenagers work is at a _____.

b) The place where the least number of teenagers work is at a _____.

c) It is _____ that a teenager would work at a clothing store or a grocery store (more likely, less likely, equally likely).

d) It is _____ that a teenager would work at a music store (improbable, probable).

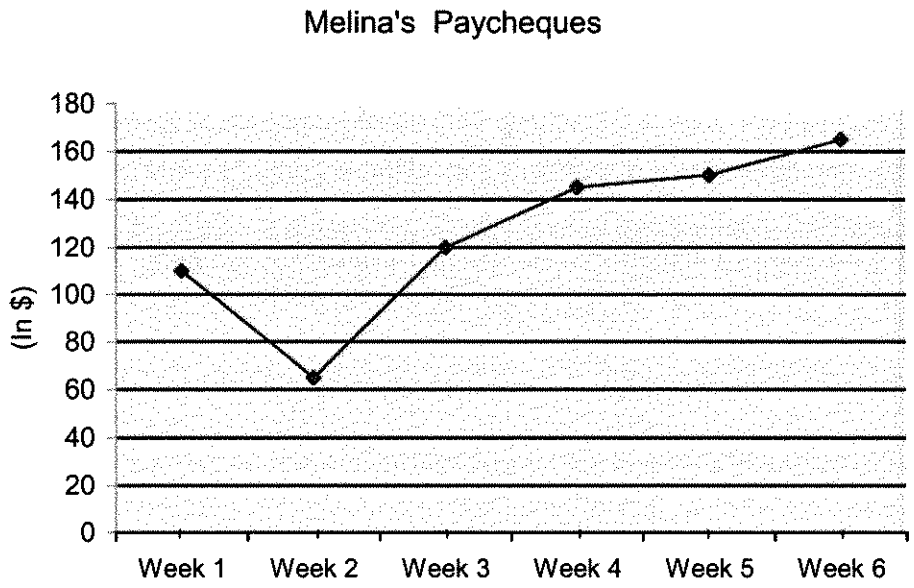
e) Teenagers are less likely to work at a _____ than at a video store.

f) It is improbable that a teenager would work at a _____.

g) Use the graph above and write a statement using the phrase **less likely**.

h) Write an inference statement based on the information displayed in the graph.

5. Use appropriate vocabulary about predictions, inferences and conclusions to complete the following statements based on the line graph.



a) According to the graph, Melina received the largest paycheque during week _____.

b) Melina received her lowest paycheque during week _____.

c) It is _____ that Melina's paycheque will increase rather than decrease in week 7 (more likely, less likely, equally likely).

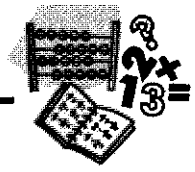
d) It is probable that Melina's paycheque will _____ in week 7 (increase, decrease).

e) Melina is _____ to find that her paycheque decreases rather than increases in week 7 (more likely, less likely, equally likely).

f) Use the graph above and write a statement using the phrase **improbable**.

g) Write an inference statement about the information on the graph.

h) Compare responses to those of classmates.



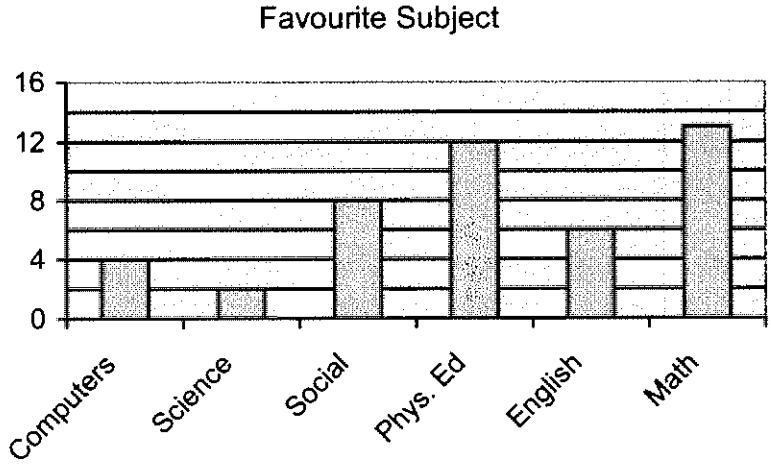
Selecting Graphs

The chart lists five movies and the number of students who selected each as their favourite. The information in the chart is a snapshot and can be displayed on a bar or a circle graph (for the circle graph, percentages would need to be figured out).

Favourite Movie	
Movie	**Number of Students**
Star Trek	24
Titanic	16
Lord of the Rings	6
Men In Black	20
Harry Potter	14

Circle and bar graphs are used to compare items. For example:

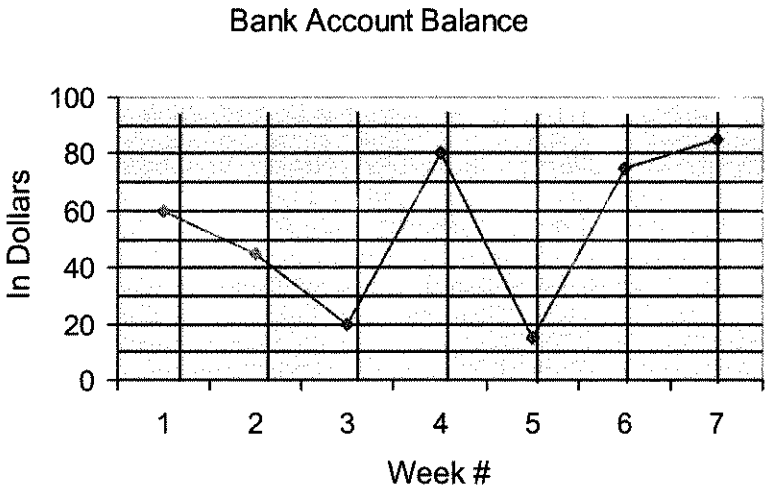
Favourite Subject	Number of Students
Computers	4
Science	2
Social Studies	8
Phys. Ed.	12
English	6
Math	13

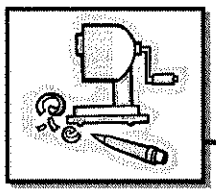


The graph shows us quickly that math and phys. ed. are the favourite subjects of this group of students.

Broken line graphs show trends or changes in one item over time.

Week	Balance (in $)
Week 1	60
Week 2	45
Week 3	20
Week 4	80
Week 5	15
Week 6	75
Week 7	85





Practice: Selecting Graphs

1. Use a variety of sources of information, such as a library, atlas, newspaper or the Internet, to locate circle and bar graphs. Discuss with classmates the type of data/information displayed on these graphs.

   Write a conclusion statement about the information displayed on circle and bar graphs.

2. Look at the following survey topics. For each, state which type of graph would be best (circle, bar, broken line).

   a) The percentage of people living in each province in Canada.

   b) People's favourite day of the week.

   c) The cost of renting an apartment from 1990–2000.

   d) The amount of money that a business makes monthly for one year.

   e) The favourite restaurants of people.

   f) The brands of laundry detergent used.

   g) The percentages of each ingredient in a bottle of pop.

   h) The percentages of Albertans in different age ranges.

   i) The amount of sunshine per day over one year.

   j) People's favourite authors.

3. Select a partner. Brainstorm survey topics where the results could be displayed in:
   - circle graphs
   - bar graphs
   - line graphs.

Making Bar Graphs

Bar graphs can be made using the data from charts and tables.

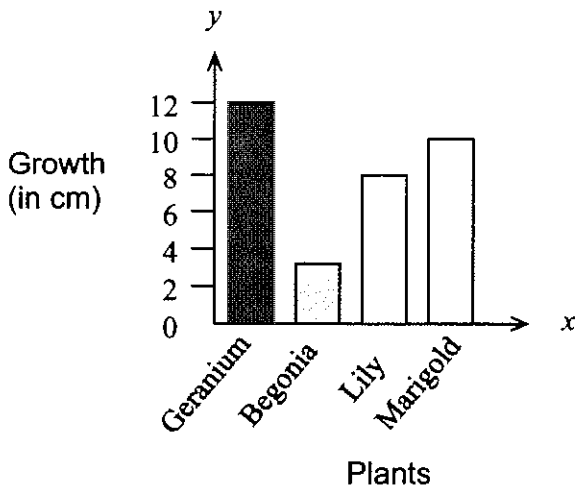
Step 1: With a ruler, draw an x-axis (horizontal line) and a y-axis (vertical line) on a piece of graph paper.
Step 2: Label each axis with the type of information it contains.
Step 3: Decide what scale to use (how much each line represents), based on the range of data you want to show; e.g., if you had data with a range from 0–80 cm, you might choose an increase of 10 cm for each line.
Step 4: Draw marks to show the intervals (spaces between each measurement) in a way that is easy to read.
Step 5: Plot your information on the graph.
Step 6: Draw a bar for each category.
Step 7: Give the graph a title that explains what the data represents.

Example

Growth of Plants in 3 Weeks

Plants (x-axis)	Growth (y-axis)
Geranium	12 cm
Begonia	3 cm
Lily	8 cm
Marigold	10 cm

Growth of Plants in 3 Weeks



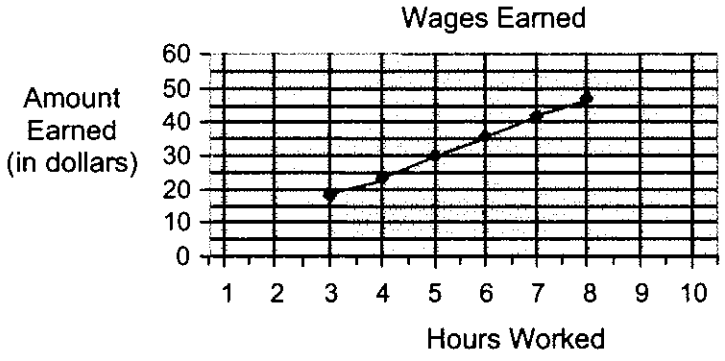
Making Line Graphs

Line graphs can also be made using information from tables or equations.

Step 1: With a ruler, draw an x-axis (horizontal line) and a y-axis (vertical line) on a piece of graph paper.
Step 2: Label each axis with the type of information it contains.
Step 3: Decide what scale to use (how much each line represents), based on the range of data you want to show; e.g., if you had data with a range from 0-80 cm, you might choose an increase of 10 cm for each line.
Step 4: Draw marks to show the intervals (spaces between each measurement) in a way that is easy to read.
Step 5: Plot each point by finding the appropriate spot where the x-axis and y-axis intersect. For example, for the first point, find 3 on the x-axis, then move up until you hit 18 on the y-axis. Draw your first point there.
Step 6: Connect the dots with a line, using a ruler.
Step 7: Give the graph a title that explains what the data represents.

Example

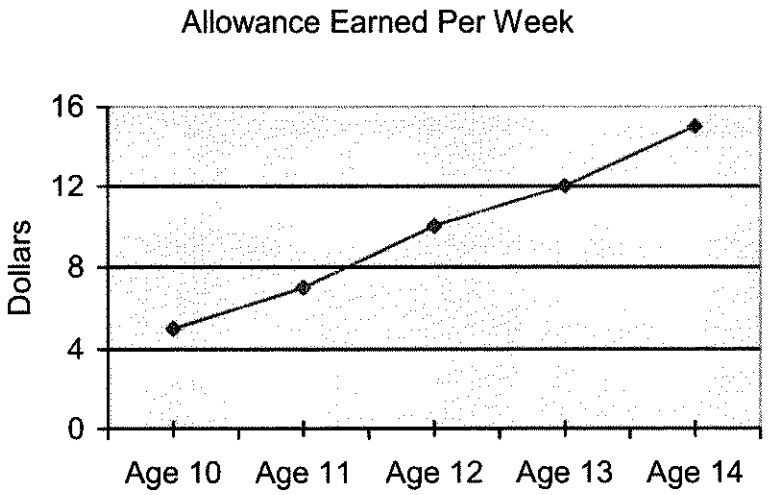
Hours Worked (x)	Amount Earned ($y = 6x$)
3	18
4	24
5	30
6	36
7	42
8	48



Now the pattern can be extended by continuing the line on the graph. For example, if Saul works for 10 hours, he will make $60.00.

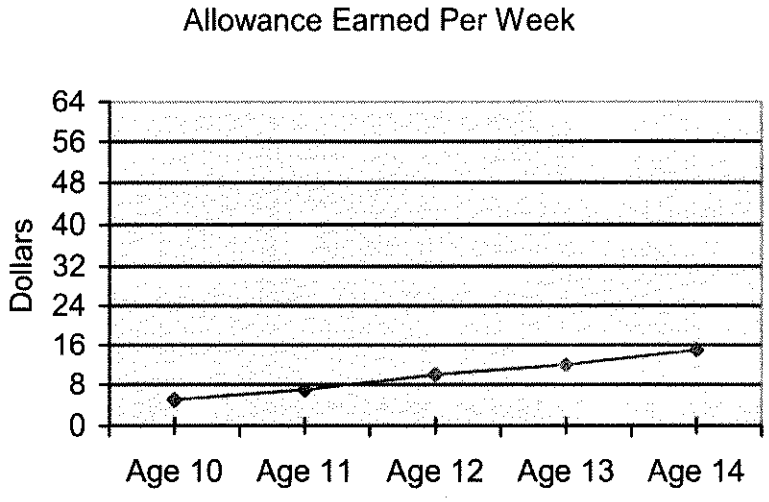
Graphs can be manipulated to change the appearance of the results of the data.

The graph below shows how one student's allowance increased over time.



The graph shows what appears to be a significant increase in allowance over 4 years.

Manipulating or changing the y-axis can make the graph look different.



Changing the y-axis makes it appear that the increase in allowance was not as great.

Making a Circle Graph

Step 1: With a compass or tracer, draw a circle.
Step 2: Calculate the size of each category using the following percentage formula:

$$\frac{\textbf{Percentage of Total}}{\textbf{100\%}} = \textbf{360}$$

This gives you the angle you will need to draw to create a section for that category.
Step 3: Draw a straight line from the centre to the edge of the circle.
Step 4: Use a protractor to measure and mark a section for each category.
Step 5: Label and/or colour each section.
Step 6: Give the graph a title that explains what the data represents.

Example

Shannon surveyed 200 students to gather information about cafeteria food. Her results are displayed on the chart and the circle graph. The chart shows raw data—exact numbers that have not been converted into percentages.

Favourite Cafeteria Food	Number of Students
Burgers	72
Tacos	44
Stew	34
Salad	32
Soup	18
Total number of students surveyed:	200

Shannon converted the raw data to percents to represent the data more clearly. Check out Calculating Percents for more information.

Burgers

$$\frac{72}{200} \div \frac{2}{2} = \frac{\textbf{36}}{100} = 36\%$$

Salad

$$\frac{32}{200} \div \frac{2}{2} = \frac{\textbf{16}}{100} = 16\%$$

Tacos

$$\frac{44}{200} \div \frac{2}{2} = \frac{\textbf{22}}{100} = 22\%$$

Soup

$$\frac{18}{200} \div \frac{2}{2} = \frac{\textbf{9}}{100} = 9\%$$

Stew

$$\frac{34}{200} \div \frac{2}{2} = \frac{\textbf{17}}{100} = 17\%$$

Shannon must then figure out how many degrees should represent each percentage. We know that a circle has 360 degrees, so:

$$\frac{36}{100} = \frac{?}{360}$$

36% × 360 degrees ÷ 100 = 129.6 round to 130 degrees

22% × 360 degrees ÷ 100 = 79.2 round to 80 degrees

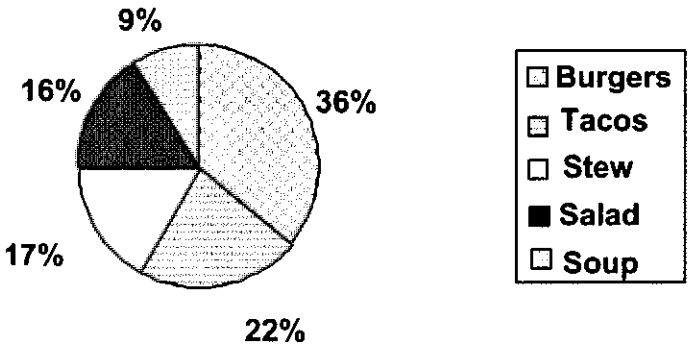
17% × 360 degrees ÷ 100 = 61.2 round to 61 degrees

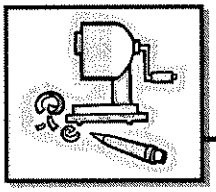
16% × 360 degrees ÷ 100 = 57.6 round to 58 degrees

9% × 360 degrees ÷ 100 = 32.4 round to 32 degrees

Shannon must then measure and draw in the degrees on her circle graph.

Favourite Cafeteria Food





Practice: Making Graphs

1. Use the data in the chart to make a broken **line graph** using a computer spreadsheet or a piece of graph paper.

Number of Students Absent From School	
Day	**Total Absent**
Monday	15
Tuesday	12
Wednesday	8
Thursday	9
Friday	16

2. The table shows the amount of snowfall in Banff during one week.

Precipitation in Banff	
Day of the Week	**Snowfall (in cm)**
Sunday	27
Monday	24
Tuesday	16
Wednesday	18
Thursday	5
Friday	22
Saturday	6

Select an appropriate graph type and make a graph using technology or a pencil and graph paper.

3. The table shows the amount of tips earned by a server.

Tips Earned in One Week	
Day of the Week	**Tips Earned**
Sunday	$52.00
Monday	$18.00
Tuesday	$16.00
Wednesday	$25.00
Thursday	$48.00
Friday	$64.00
Saturday	$76.00

Use technology or pencil and paper to create a bar or broken line graph to display the information in the above chart.

4. People were surveyed to identify their favourite type of potato. Survey results are displayed in the chart.

Favourite Type of Potato	
Type of Potato	**# People**
Stuffed	27
Mashed	32
Baked	16
French Fries	40
Roasted	12

Use technology or graph paper and pencil to create a graph using the information in the chart.

5. Use the table below to complete the following questions.

x = days	attendance
1	28
2	24
3	30
4	36

a) Plot the information from the table on a graph.
b) Mark the x values along the horizontal line ($\leftrightarrow$) of the graph.
c) Mark the y axis with numbers from 20 to 36 (even numbers only). This is called your scale.
d) Plot the attendance values on the graph with a point ($\bullet$).
e) Use a straightedge and join the points.
f) Create another graph with a different scale on the y axis: 5, 10, 15, 20, 25, 30, 35, 40
g) Compare the two graphs.

6. With a partner, survey friends, family and/or classmates on a topic of interest. Create a graph using technology to display the data. Present your graph to your class or teacher and be prepared to explain your findings.

Organizing Data Using Charts, Tallies and Lists

Charts, tallies and lists are often used to collect and/or organize data before placing the information on a graph.

Charts

Charts can be used to organize survey responses. Charts are a good way to organize information when the amount of information is limited.

Example A survey is conducted with 10 people. They are asked which season is their favourite.

Person	Spring	Summer	Winter	Fall
1	✓			
2		✓		
3		✓		
4			✓	
5				✓
6				✓
7		✓		
8		✓		
9		✓		
10	✓			
Totals:	2	5	1	2

Tallies

A tally chart is useful when numbers, rather than individual people, are important. The information above could be placed on a tally chart.

	Spring	Summer	Winter	Fall
Numbers:	||	𝍸 |	|	||
Totals:	2	5	1	2

Conclusions can be drawn from the charts. Of the 10 people surveyed:

- 5 people prefer summer.
- 1 person prefers winter.
- The same number of people prefer spring and fall.

Lists

Lists can be used to organize and display information, such as answers to questions.

Example For a survey, 10 people were asked to name their favourite sport. The information is recorded in a list.

Name of Person	Favourite Sport
Alex	Hockey
Jessica	Badminton
Amandeep	Figure Skating
François	Basketball
Miguel	Lacrosse
Kumar	Hockey
Lynette	Volleyball
Sophia	Cross-country Skiing
Ben	Lacrosse
Cherise	Soccer

Frequency Tables

Example For a survey, 25 people were asked about their favourite winter Olympic sport. A frequency table with rank ordering is used to display the data.

Frequency means the number of times something happened. In the table below, the frequency of how many times someone said a sport is shown.

Rank order lists the responses in order—the most responses to the least.

Favourite Winter Olympic Sport in Rank Order		
Winter Olympic Sport	**Tally**	**Frequency**
Downhill Skiing	𝍸 𝍸 |||	13
Figure Skating	𝍸 𝍸 ||	12
Aerial Skiing	𝍸 |||	8
Cross-country Skiing	𝍸 |	6
Speed Skating	||||	4
Luge	||	2

Look at the tally column of the frequency table.

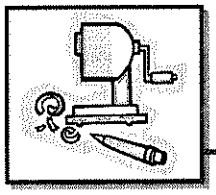
Each | represents 1.

When you see 𝍸, this means that there are 5.

Here is another frequency table displaying information about the favourite activities of teenagers.

Favourite Activities of Teenagers		
Activity	**Tally**	**Frequency**
Watching television	𝍸 𝍸 ||	12
Talking on the telephone	𝍸 |||	8
Surfing the Internet	𝍸 𝍸	10
Doing arts and crafts	|||	3
Participating in sports	𝍸	5
Reading for pleasure	𝍸 ||	7

Rank order:
Watching television, surfing the Internet, talking on the telephone, reading for pleasure, participating in sports and doing arts and crafts.



Practice: Organizing Information with Charts, Tallies and Lists

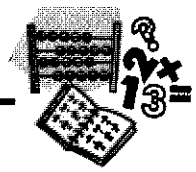
1. With a classmate, list a variety of questions to help interpret the survey data. Answer the questions and compare your answers.

2. Visit a number of different stores in a shopping area. Ask an individual in each store to tell you which is the busiest time of day for their store: mornings, afternoons or evenings. Organize your information in a chart and compare with other students.

   What does this information tell you? Can you conclude who spends the most time in the mall? During which part of the day are the stores the busiest? Would this information be better represented on a graph? Explain why or why not.

3. Select a partner and brainstorm survey questions that you could ask other people. Design an instrument to collect the data, such as a list or tally chart. Display the data on a bar, line or circle graph. Topics may include:
   - favourite musical artist/group
   - favourite cars and other vehicles
   - job search information
   - hobbies.

Central Tendency: Mode, Median and Mean



When surveys are conducted or information is gathered, the responses may be in the form of numbers. **Stem and leaf plots** can be used to display numerical data.

A student conducted a survey among some of her classmates to determine the amount of money they earned per week. She recorded the following in dollars:

24	37	20	62	63
57	42	58	53	
41	29	35	42	

To make a stem and leaf plot, the numbers are placed on the chart from smallest to largest.

Digits in the tens place are placed on the chart from smallest to largest.

Digits in the tens place represent the **stems**; digits in the ones place represent the **leaves**.

Example 20, 24 and 29 are placed first, in order from least to greatest.

Amount of Money Earned/Week	
Stem	**Leaf**
2	0, 4, 9
3	5, 7
4	1, 2, 2
5	3, 7, 8
6	2, 3

Stem and leaf plots are useful when identifying mode, median and mean.

Mode is the number that occurs most frequently on a list. → 42

Median is the middle number in an ordered list. Find the median by counting down, beginning with the smallest number. There are 13 numbers in this list, so count down to the 7th number. → 42

Mean (average) is the sum of the numbers divided by the amount of numbers.
→ 563 ÷ 13 = 43.

Identifying mode, median and/or mean may help businesses and other services decide on such things as products to sell or music to play.

Example

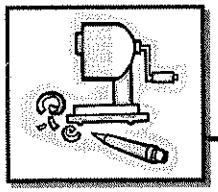
The high school basketball coach is taking a look at team statistics. She has made a list of the points scored in each game for the past two seasons. The points are as follows:

25	37	69	97	14
64	72	91	46	70
68	94	34	26	56
54	38	64	18	55

The points were then placed in a stem and leaf plot.

Stem	Leaf
1	4, 8
2	5, 6
3	4, 7, 8
4	6
5	4, 5, 6
6	4, 4, 8, 9
7	0, 2
9	1, 4, 7

Mode: 64
Median: 55 and 56 are in the middle. 55.5 is between both. Using rounding rules, 55.5 will round up to 56. Median is 56.
Mean: (average) 54.6 or 55.



Practice: Identifying Mean, Median and Mode

1. Obtain a list of your math marks. Organize your scores on a stem and leaf plot. Use the data from the stem and leaf plot to identify the mean, mode and median. This information will give you an idea of your overall progress in math so far this year.

2. Record how many minutes or hours you spend on school or at work each weeknight. Organize the data on a stem and leaf plot. Identify the mean, mode and median.

3. Investigate the number of students in each class in your school by visiting classrooms, asking the teacher or talking with a school administrator. Organize the information on a stem and leaf plot. Identify the mean, mode and median.

4. Select a trade, such as welding or plumbing. Locate a business in your community that employs people in the occupation. Ask how many years of experience each employee has. Record these years of experience on a stem and leaf plot. Identify the mean, mode and median.

5. Compare your data with classmates. Examine the information and be prepared to respond to the following questions and statements.
   - Are the mode, median and/or mean low or high compared to other occupations?
   - Give reasons why the mode, median and/or mean may be lower or higher.

Mean

Example Larry's assignments and marks in percent are represented on the table.

Assignment	Mark in percent
Acute angles	82
Obtuse angles	56
Right angles	74
Straight angles	65
Reflex angles	73

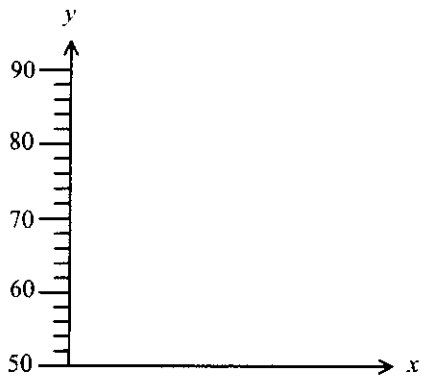
Larry's lowest mark is 56% and his highest mark is 82%. The range is 56 to 82.

Range of Data

The range helps identify the scale to use on the ***y*-axis** of a graph.

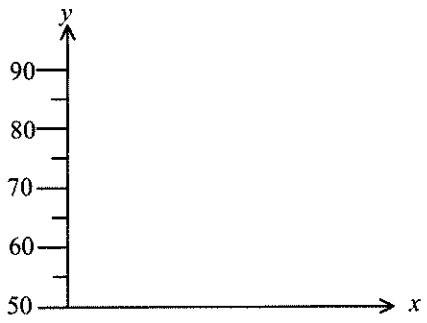
An appropriate scale for this information could increase by multiples of 2 or 5 on the y-axis. The lowest mark is 56, so the graph could begin at 50, rather than zero.

Example: Set up the graph using multiples of 2.



Each marker on the y-axis represents an increase of 2%.

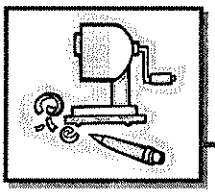
Or, set up the graph using multiples of 5.



Each marker on the y-axis represents an increase of 5%.

Calculate the **mean** (average) of Larry's marks.

$(82 + 56 + 74 + 65 + 73) \div 5 = 70\%$



Practice: Calculating Mean

1. Sue-Ling wants to buy a new sweater and has seen it in a number of different stores. The prices are indicated in the chart below.

Price of same sweater in four different stores			
Store #1	Store #2	Store #3	Store #4
$14.99	$17.98	$23.46	$18.97

Respond to the following.

a) What is the range for the price of the sweater?

b) Calculate the mean (average cost) for the price of the sweater. (Remember to answer in the form of dollars and cents. Round to the nearest hundredth.)

2. Natasha conducted a poll of students to determine how many wanted a Valentine's Day dance. She polled 9 classes. The following number of students from each class said they wanted a dance:

7(1) – 18	7(2) – 12	7(3) – 25
8(1) – 23	8(2) – 9	9(1) – 17
9(2) – 15	9(3) – 24	9(4) – 9

What is the mean and range of Natasha's data?

3. The table shows the cost of the lunch specials in a school cafeteria.

Monday	Tuesday	Wednesday	Thursday	Friday
$6.28	$7.45	$5.16	$4.76	$9.85

Respond to the following.

a) What is the range for the cost of the lunches?

b) Calculate the mean (average cost) for the price of the lunches. (Remember to answer in the form of dollars and cents. Round to the nearest hundredth.)

Mode

Mode is the number that occurs most often in a set of numbers.

Example Thuan and his friends compared their results on a math quiz. The scores (out of 10) are as follows:

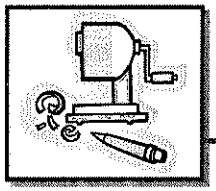
8 8 7 10 6 7 8 6 8

The number that occurs most often in the scores above is 8.
8 is the mode.

There can be more than one mode.

Bowling Scores			
	Game 1	Game 2	Game 3
Week 1	164	178	157
Week 2	212	164	212
Week 3	164	185	129
Week 4	157	143	212

There are two modes in the chart, **164** and **212**.
These are the numbers that appear most often.



Practice: Calculating Mode and Mean

1. Lots of students go to the library during their spare class to study or do homework. The chart below shows the number of students during a 4-week period.

Students in the Library					
	Mon.	Tues.	Wed.	Thurs.	Fri.
Week 1	7	3	5	4	2
Week 2	3	5	4	2	8
Week 3	10	6	4	1	6
Week 4	5	7	6	4	3

Identify the mode for the four weeks.

Identify the range.

Calculate the mean.

2. Use appropriate communication skills to ask a staff member to provide data on the number of students who were absent each day for the past month. Calculate the range, mode and mean of the absences.

3. Use appropriate strategies to find out how many students are in each class. Identify/calculate the range, mode and mean of the numbers.

4. Use appropriate strategies to locate information about how businesses use mean, range and mode.

Median

Median is the middle number in a set of numbers. To find the median, numbers must be placed in order from smallest to greatest.

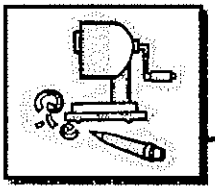
Example The following is a list of the number of people attending a new movie release in seven theatres:

81, 88, 89, 98, 87, 86, 84

To find the median of the numbers above:

1. Put the numbers in order (from smallest to greatest):
   81, 84, 86, 87, 88, 89, 98
2. Identify the middle number:
   81, 84, 86, **87**, 88, 89, 98.

If there are two middle numbers, add the two middle numbers and divide by 2.



Practice: Calculating Median

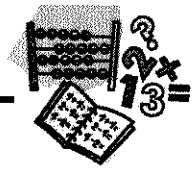
1. Identify the median of each of the sets of numbers below.

   a) 2, 8, 6, 9, 12, 4, 9

   b) 12, 9, 18, 6, 14, 8

   c) 18, 20, 15, 10, 12, 16

Spreadsheets and Databases



Spreadsheets and databases are used to store and organize information.

Spreadsheets

Spreadsheets are used to list information and related numbers. For example,

- accountants organize and track income and expenses of business
- farmers record data on crops, cattle and other commodities
- teachers use spreadsheets to record students, assignments, tests and marks.

One advantage of spreadsheets is that the related parts will automatically adjust when new information is added.

Each cell, row or column of a spreadsheet is set up and changed according to the needs of the user.

For example, the spreadsheet below shows assignments and marks of a student.

Assignments	**Marks in Percent**
Central tendency	72
Interpreting graphs	60
Inferences	80
Making graphs	56
Average	67

The next spreadsheet shows the marks of the same student, with two new assignments and marks added. When the new marks are added, the average will automatically change on the spreadsheet.

Assignments	**Marks in Percent**
Central tendency	72
Interpreting graphs	60
Inferences	80
Making graphs	56
Changing graphs	76
Using databases	80
Average	70.6

The average has changed from 67 to 70.6 with the addition of the two new assignments.

Databases

Databases contain and connect a variety of information. The Internet is a HUGE database that actually links many databases to each other.

A computer stores information in folders, like a filing cabinet. It stores information much like a **database** does. Internet Web sites are also like databases.

Schools have databases of student information. Many libraries have books entered on databases so people can find information easily and quickly. Businesses have databases that help staff track inventory and invoices.

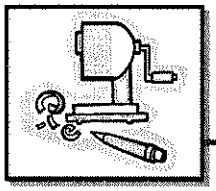
A database like the one below would be found in most schools. It would be kept in the office and used for a variety of purposes, such as attendance, marks and addresses.

Last name	First name	Grade	Room #
Benoit	Charles	7	21
Holliday	Jenny	7	19
Joti	Keith	8	17
Parmar	Harjinder	7	21
Sukhi	Sundeep	8	16

The database below is a record of one student's marks. It could belong to either the student or the teacher.

Assignment	Score	Percent
Adding integers	$\frac{20}{25}$	80%
Subtracting integers	$\frac{13}{20}$	65%
Multiplying integers	$\frac{75}{100}$	75%
Dividing integers	$\frac{14}{20}$	70%
Integer review	$\frac{36}{50}$	72%
Integer quiz	$\frac{56}{80}$	70%

The database contains the name of each assignment, the score and the mark in percent.



Practice: Spreadsheets and Databases

1. Examine the data from the database below.

Potted flowers	Price per single pot	Price per tray
Daisies	$0.79	$8.99
Lilies	$2.99	$34.99
Marigolds	$1.79	$18.99
Pansies	$0.99	$10.99
Petunias	$1.99	$21.99
Roses	$9.99	$97.00

Discuss these questions with a classmate or teacher.

1. Who would maintain a database with the above information?
2. What information is contained within the database?
3. Which is the least expensive single potted flower?
4. Which is the most expensive single potted flower?
5. Which flower tray costs $34.99?
6. Which single potted flower costs $1.79?

2. Using the ALIS Web site (www.alis.gov.ab.ca) or other career information source, develop a list of 10 careers in which databases would be used.

   Explain how a database would be used in each career.

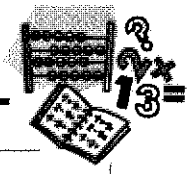
   Select three of the careers from your list and contact people who work in those careers to discuss the use of databases in the workplace.

3. Select a partner and brainstorm ways that databases are used in everyday lives.

4. With the assistance of your teacher:
   - Explore spreadsheets and their use.
   - Set up a spreadsheet for each subject you take; add assignments, tests and your marks; and update on a regular basis.
   - Set up a spreadsheet with your income and expenses for each month.

5. A Web site is a database. With the assistance of your teacher and other students, create a Web site about:
   - math units, facts and information
   - math in the workplace and community
   - your school or community
   - your workplace.

Probability



Probability is the chance of something happening or the expectation, based on past experience, that a prediction will come true.

Predicting is part of the decision-making process. For example, if the sky is blue and the sun is shining, a prediction would be that the weather will be nice for the day.

If a coin is tossed 100 times, what is the probability of tossing heads? Tails?

When 100 or more tosses occur, the probability of heads or tails is likely 50% of the time.

More likely, **equally likely** and **less likely** are terms used when discussing probability.

Example

Francesca is at the Grande Prairie fair. Her favourite game is the bottle ring toss because of the prizes. Winners at this game can win large stuffed dragons, medium stuffed panda bears, small stuffed zebras, CDs or ride coupons. Assuming she wins every time she plays, what is the probability that Francesca will win a stuffed animal?

Solution: If Francesca wins every game, she has a choice of 5 prizes. Three of these prizes are stuffed animals. Therefore, for each game, she has a 3/5 chance of winning a stuffed animal.

Probability over a period of time or for many occurrences can be estimated.

$$\text{Probability} = \frac{\text{The number of times an event could occur}}{\text{Total number of occurrences}}$$

Examples

A) Consider the marbles below.

The total number of outcomes is 5.
The chance of selecting a red each time is 1. The probability of selecting a red each time is 1/5.
The chance of selecting a yellow each time is 2. The probability of selecting a yellow each time is 2/5.

B) The table below illustrates probability including a desired or favourable outcome.

Activity	Possible outcomes	No. of possible outcomes	Desired or favourable outcome	No. of times desired or favourable outcome occurs	Probability
Toss a coin	Heads Tails	2	Heads	1	1/2
Pick a letter from the word "mathematics"	M A T H E M A T I C S	11	M	2	2/11

C) Five rings are placed in a bag. Two of the rings are red.

It can be predicted that a red ring will be drawn more often than any other colour. For every try, there is a 2/5 chance of pulling a red ring.

Test the prediction.

1. Pull a ring from the bag.
2. Record the colour of the ring on a recording chart.
3. Return the ring to the bag.
4. Repeat the experiment 30–50 times.
5. Check the accuracy of the prediction.

Tally Chart

Red	Yellow	Green	Blue
𝍸 𝍸 I	𝍸	𝍸 I	𝍸 III
11	5	6	8

In the trial represented by the tally chart, red rings were pulled from the bag 11/30 times, which is close to 2/5.

Would the accuracy of the prediction increase or decrease with 50, 70 or 100 pulls from the bag? Explain your response.

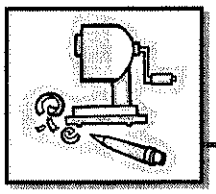
Probability in Real Life

Knowledge of probability can be used to make predictions about things that happen in our daily lives.

Example Hard work often pays off. Pedro finds this to be true with the part-time job he has. When he works extra hard and is pleasant to all the customers, one of the following happens.

Pedro's boss praises him.	**Pedro is given a small bonus on his paycheque.**
Pedro gets the best shifts when his boss does the scheduling.	Pedro gets a small raise on his next paycheque.
Nothing	Nothing

The probability of Pedro receiving praise is: **1/6**.
The probability of Pedro receiving a bonus is: **1/6**.
The probability of Pedro receiving better shifts is: **1/6**.
The probability of Pedro receiving a raise is: **1/6**.
The probability of nothing happening is: **2/6 = 1/3**.
The probability of Pedro receiving a reward is: **4/6 = 2/3**.



Practice: Probability

1. Obtain a 4-coloured spinner from your teacher.
   Predict your results for spinning 1 of the 4 colours for 25–50 or more spins. Spin the spinner 25–50 times. Record the results on a tally chart. Examine the results and compare them to your prediction.
   Because there are 4 colours, each colour will likely appear approximately $\frac{1}{4}$ (25%) of the time.

2. Predict the following.
   If you have a bag of 9 marbles and select one marble each time,
   which colour marble are you **most likely** to pull from the bag?
   Which colour marble are you **least likely** to pull from the bag?

   (P) (Y) (B) (G) (P) (B) (P) (P) (G)

3. Respond to the following and discuss your responses with your teacher or classmates.

   1. Name two things in life that you can be **certain** will happen.
   2. Name two things in life that you are **uncertain** about.
   3. Name two things that will **always** happen if you have your homework done for class.
   4. Name two things that will **never** happen if you have your homework done for class.
   5. Name two things that you believe are **possible** for you to accomplish sometime in your life.
   6. Name two things that would be **impossible** for you to do.

4. Use a career information source such as the library or ALIS Web site and make a list of 10 careers you are interested in. Complete the statements using your career list.

   1. I am **more likely** to become a _____ than a _____.
   2. It is **equally likely** that I will become a _____ or a _____.
   3. I am **less likely** to become a _____ than a _____.

5. When Margaret baby-sits, she has the children choose 1 of a selection of 6 activities: 4 outdoor and 2 indoor. What are the chances of Margaret and the children taking part in an outdoor activity?

6. With a partner, create and conduct a variety of probability activities using manipulatives and/or other strategies.

7. The following marbles are in a bag.

   a. What is the probability that a green marble will be pulled from the bag?
   Possible Outcomes:
   _____

   Probability: _____

   b. What is the probability that a yellow marble will be pulled from the bag?
   Possible Outcomes:
   _____

   Probability: _____

   c. What is the probability that a blue marble will be pulled from the bag?
   Possible Outcomes: _____
   _____

   Probability: _____

   d. What is the probability that a purple marble will be pulled from the bag?
   Possible Outcomes: _____
   _____

   Probability: _____

   e. Write an inference about your predictions.

   f. Examine and discuss factors that would change your predictions.

8. Complete the probability chart.

Activity	Possible outcomes each try	No. of possible outcomes	Desired/ favourable outcome	No. of times desired/ favourable outcome occurs	Probability
Spin a spinner	Yellow Blue Yellow Yellow		Yellow	3	
Pick a number between 1 and 10	1 6 2 7 3 8 4 9 5 10		7		
Pick a certain coloured marble	Blue Purple Red Green Purple		Red		
Pick a letter from the word "probability"			B		
Guess the correct answer on a multiple choice test	A B C D		C		
Select the winner of the 100 metre dash	Esmail Victor Sven Jacob Mohammad Pierre		Sven		