APPRENTICESHIP AND WORKPLACE MATHEMATICS 11

Introduction Assignment

Welcome to AWM 11! This assignment will help you review some topics from a previous math course and introduce you to some of the topics that you'll be studying this year.

This assignment consists of two sections organized as follows:

Section 1: Graphing
- Part A – Review Graphing
- Part B – Misleading Graphs
- Part C – Graphing Questions (23 marks)

Section 2: Puzzler
- Part A – Solve the Puzzle
- Part B – Puzzle Strategy Questions (11 marks)

Section 1 contains some self-marked activities. You will find the solutions for these activities at the end of the assignment.

When you have completed the assignment, please submit it in to your teacher for marking.

Student Name _____

Student No. _____ **Date** _____

Address _____ **Postal Code** _____

_____

Complete the following Apprenticeship and Workplace Mathematics 11 Assignment independently and return it to your teacher based on the instructions provided by your school. No external resources are required to complete this assignment.

Title	**Marks**
Section 1, Part C: Graphing Questions	/23
Section 2, Part B: Puzzle Strategy Questions	/11
Total marks	**/34**

Contents:
32 pages

Assignment time:
3 hours

Section 1: Graphing

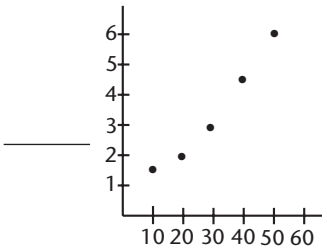
Part A: Review Graphing

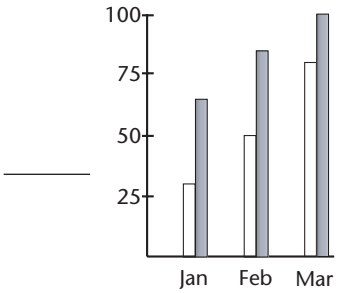
Warm-Up

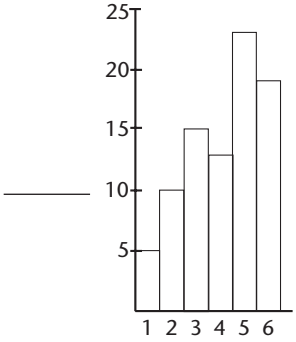
Activity 1

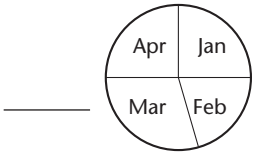
You've likely encountered many graphs in previous math courses and in your day-to-day life. Test your graph-reading skills by completing the following matching exercise.

1. Match each data set with its graph.









a.

(1, 5)
(2, 10)
(3, 15)
(4, 13)
(5, 23)
(6, 19)

b.

Jan	3
Feb	2
Mar	4
Apr	3

c.

Jan	30
Feb	50
Mar	80

Jan	65
Feb	85
Mar	100

d.

(10, 1.5)
(20, 2)
(30, 3)
(40, 4.5)
(50, 6)

Turn to Solutions at the end of the Introduction Assignment to check your answers.

Graphing Data Sets

A graph is a way to display a set of data visually. Different types of data require different types of graphs.

Discrete data is grouped into separate categories, with no information existing between the categories. Discrete data usually occurs in a case where there are only a certain number of values, or when we are counting something (using whole numbers).

> **Example:**
> The number of answers that a student gets correct on a five-question quiz is an example of discrete data. The number of correct answers would have to be one of the following: 0, 1, 2, 3, 4, or 5. There are no values between these scores, so this data set is discrete.

Continuous data consists of data that can be infinitely divided into smaller and smaller fractions. This is a type of data that is usually associated with some sort of physical measurement or something that changes over time.

> **Example:**
> The height of trees at a nursery is an example of continuous data. It's possible for a tree to be 1.9 m tall, or 1.934 m tall, or 1.934582175 m tall. The possibilities depend only upon the accuracy of our measuring device.

One general way to tell if a data set is continuous is to ask yourself if it is possible for the data to take on values that are fractions or decimals. If your answer is yes, this is probably continuous data.

Try It!

Activity 2

Classify each description of data as continuous (C) or discrete (D).

_____ The diameter of a ball determines its circumference.

_____ Students at our school eat different types of foods for breakfast.

_____ The distance from home depends on how long we've been travelling.

_____ A store tracks the sales of different brands of marmalade.

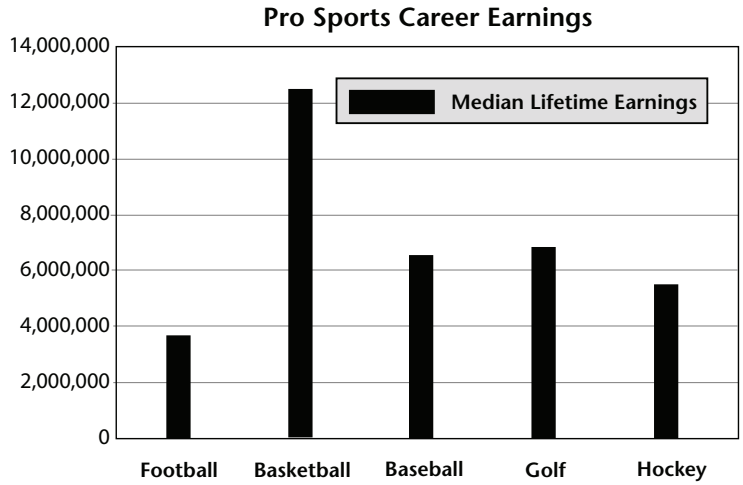
_____ The height of water in a reservoir goes up and down depending on the season.

Turn to Solutions at the end of the Introduction Assignment to check your answers.

Review Graph Types

In this assignment you'll work with four graph types: bar graphs, histograms, line graphs, and circle graphs. Each graph has a specific purpose and can be used as a visual display of a certain type of data. Read through the following information to review these graph types.

Bar Graphs

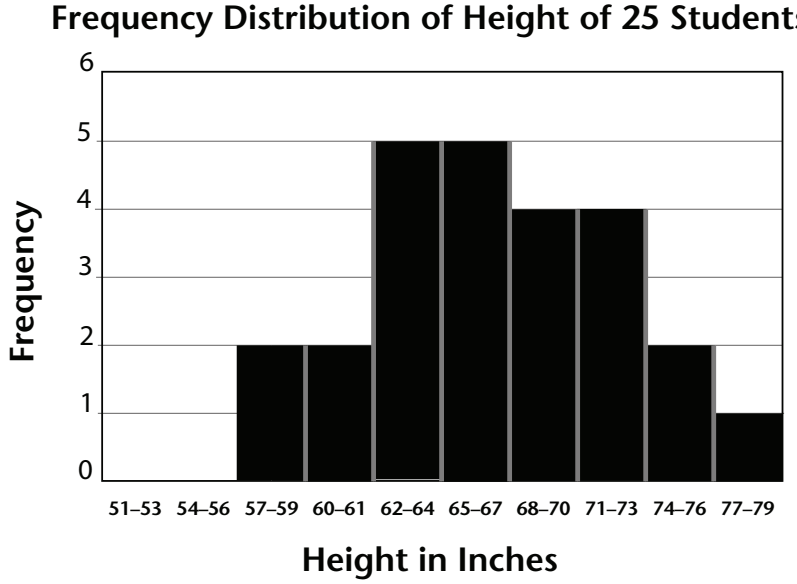


Bar graphs, like the one shown above, display data for various groups or categories. They allow us to easily and quickly compare situations and make generalizations.

Key points:

- Bar graphs should be used for discrete data.
- The category labels should always be at the bases of the bars.
- The bars should all have the same width.
- Bar graphs are a great way to show survey or inventory results.

Histograms

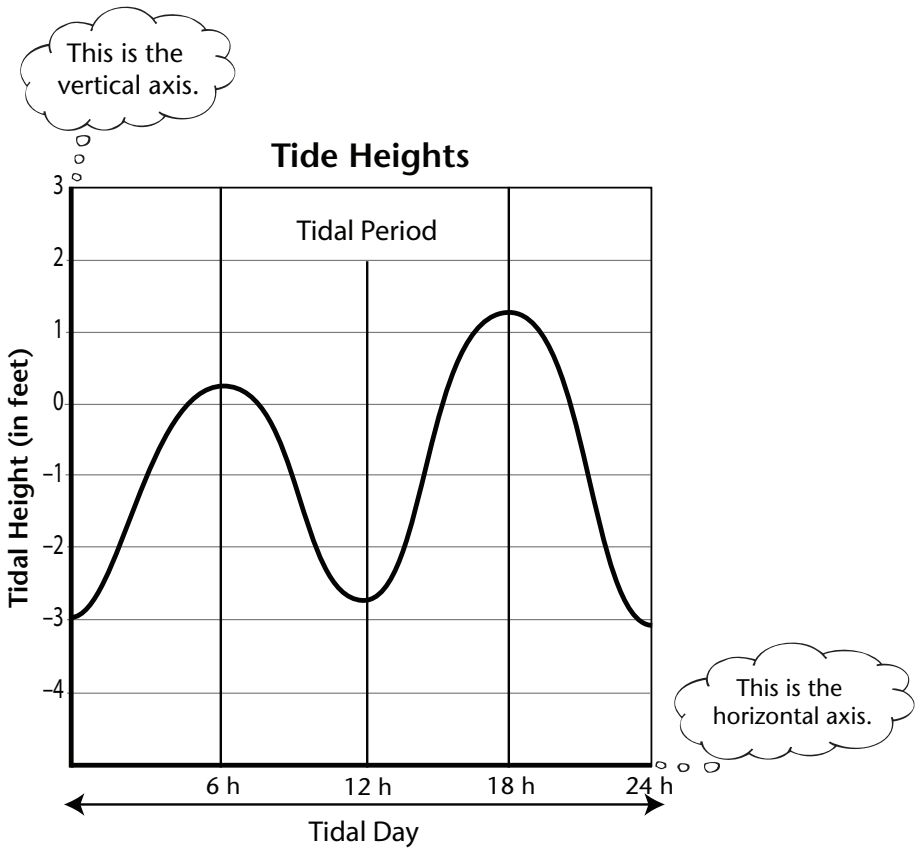


A histogram looks similar to a bar graph. However, in a histogram the categories are organized into consecutive, non-overlapping intervals or ranges.

Key Points:

- Histograms can be used for discrete or continuous data.
- If the data set is discrete, there should be spaces between the bars. If the data is continuous, the bars should be touching.
- The categories (intervals) must be consecutive and the width of each bar must be proportional to the interval size. This means that, if the intervals are different sizes, so should be the bars.
- It's not necessary for the horizontal axis to begin at zero.

Line Graphs



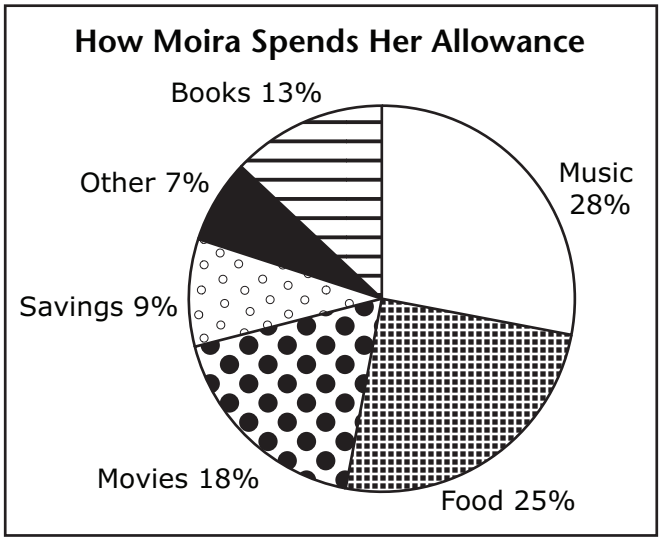
Line graphs show the relationship between two different sets of numbers. The vertical axis shows one set of numbers, and the horizontal axis shows the other set. The line is the place where the number sets match up.

We put points on the graph that represent the data we measured; then we draw a line between the points to represent all the data we couldn't or didn't measure.

Key Points:

- Line graphs should be used for continuous data.
- Line graphs are often used to show things that change as time passes.

Circle Graphs



Circle graphs show the fraction or percent amounts that create one whole thing. Each wedge (or pie slice) represents one data entry, and the wider it is, the larger the fraction it represents. We usually show the percent of the total that the wedge represents.

Key Points:

- Circle graphs compare parts of a whole.
- Each sector is proportional in size to the amount it represents; therefore, it is easy to make generalizations and comparisons.

Try It!

Activity 3

For each item below, read the statement, then decide which kind of graph is most appropriate. Put a **B** (bar), **H** (histogram), **L** (line), or **C** (circle) in the blank in front of each description. Use the space on the right to provide a brief justification for the graph type you chose.

_____ a.	how many people there are between the ages of 0 and 10, 11 and 20, 21 and 30, 31 and 40, 41 and 50 etc	
_____ b.	temperature of water in a kettle as it heats up	
_____ c.	amount of wood in a tree as it grows	
_____ d.	average cost of living compared to location	
_____ e.	average income versus years of education	
_____ f.	types of garbage that goes into the landfill	
g.	number of households that have each type of pet	

Turn to Solutions at the end of the Introduction Assignment to check your answers.

Part B: Misleading Graphs

Misleading Statistics and Statements

In Canada, it's illegal to lie in advertising. Sometimes, though, it seems like it happens anyway. What's going on?

It is legal to advertise in truthful, yet misleading ways, and sometimes this occurs. If we are to be wise consumers and voters, we must be aware of the ways in which people can be misled. Otherwise, how can we make good choices?

People naturally will say the things that support their views, and without lying, or without even knowing, they might warp the numbers (or graphs!) to make them more convincing. And as in the case above, a phrase that is omitted from the argument can be crucial information.

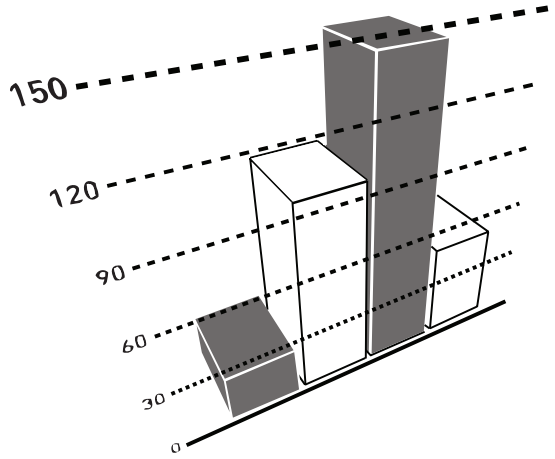
Foiled and Fooled by Formatting

Graphs can be formatted in ways that encourage people to make false assumptions. The graphs don't lie, but they manipulate the reader into inferring something that isn't true.

Formatting includes the eye–catching features of a document or graph: colours, shadings, patterns, sizing of objects, positioning of objects and text, and use of white space or blank areas.

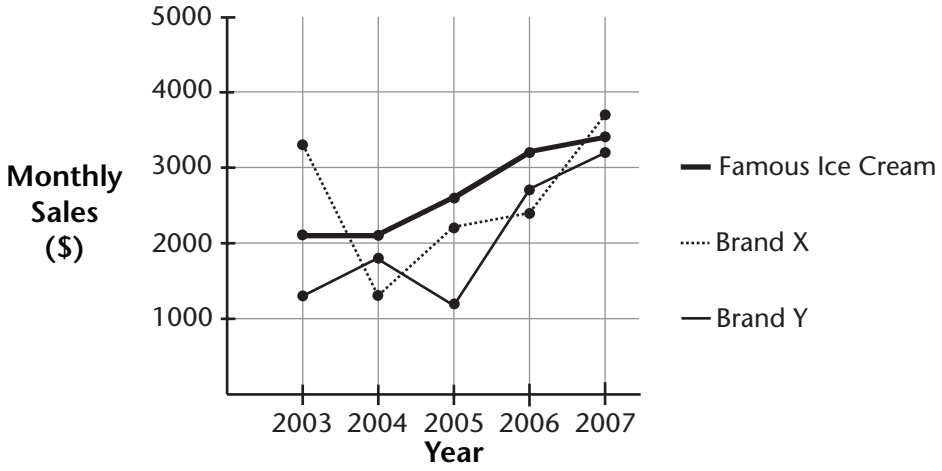
Formatting to Fool

On bar graphs, making a bar wider, darker, or separated from the other bars will make it appear more important. Using colour, or a brighter colour, on a bar can do the same thing.



3–D graphs are sometimes used to make the view more interesting. However, these can be misleading, because the nearest bars look larger than the ones at the back of the graph.

With line graphs, a line that changes thickness or colour can draw the reader's eye towards a particular area of the graph. Again, creating a 3–D effect can cause misperceptions of the data.



Try It!

Activity 4

Sketch two bar graphs that show the highest bar as being less important than the second–highest bar.

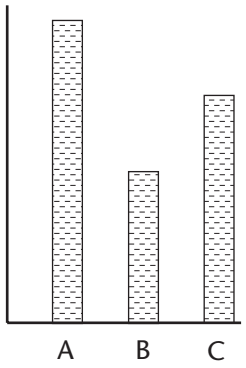
a. use colours, shadings, or patterns

b. use sizes of objects and text

Turn to Solutions at the end of the Introduction Assignment to check your answers.

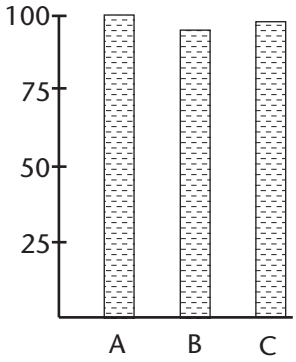
Struggling With Scale

A very common attempt to mislead a reader is the "scale scam." It works like this: draw a graph—bar or line—and leave the numbers off the vertical axis.



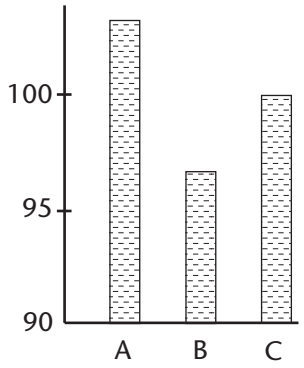
Now, many readers look at this and **assume** that Bar A appears twice as big a number as Bar B. After all, the bar is twice as tall. But with no numbers along the left, the graph does not actually say anything at all. It's not, technically, lying to the reader.

Here's a version of the previous graph that has been changed to enable a more accurate reading.

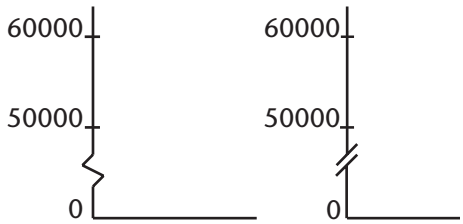


So the first graph is a "zoomed–in" version of the real graph. It only shows the very top of the accurate graph, and that's how it **emphasizes the differences** between the bars. When we look at the accurate graph and compare the numbers, we see the differences aren't all that significant.

This effect also occurs when the scale does not start at zero, or when a "break" is inserted into the vertical axis.



Here are two different ways that the break in a graph can be shown.



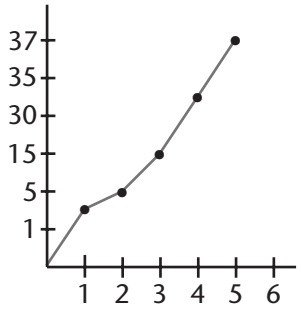
A similar misrepresentation is to have numbers along the scale that do not go up in even intervals. Each grid line, and each interval on the axes, must represent the same amount of data in order for our graph to be honest. Sometimes people forget this when making a graph, and only show the numbers they want to use from their data.

Try It!

Activity 5

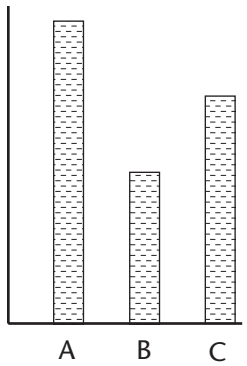
Identify the misleading feature of each graph:

1.



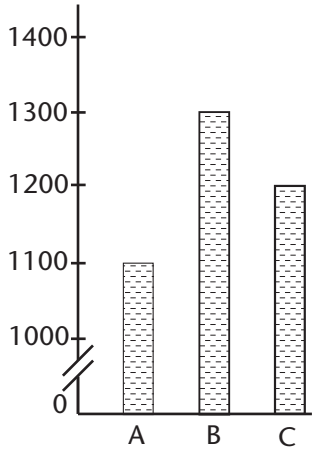
_____

2.



_____

3.



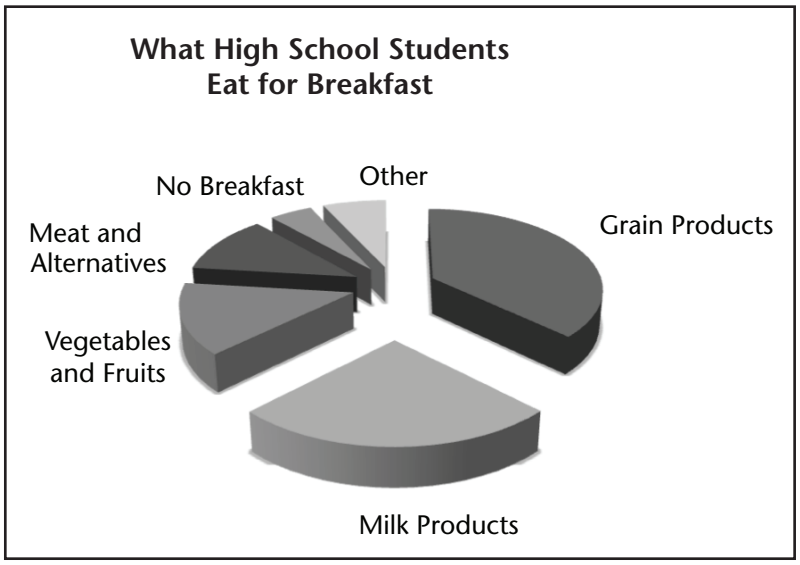
_____

Turn to Solutions at the end of the Introduction Assignment to check your answers.

Problems With Your Pies?

Circle graphs have their own set of number and formatting problems. Circle or pie graphs are so easy to understand, many people don't bother to read the numbers or percents. Without the numbers, they can be easily mislead by the pie slices.

Sometimes a 3–D pie graph is used, perhaps with an "exploded" slice or slices:



These kinds of pie charts are particularly easy to misunderstand, since the viewer's perspective makes the nearest pie slice the most important or biggest, regardless of the angle or percentage of the circle. Notice how the slice at the bottom seems closer to the viewer than the others.

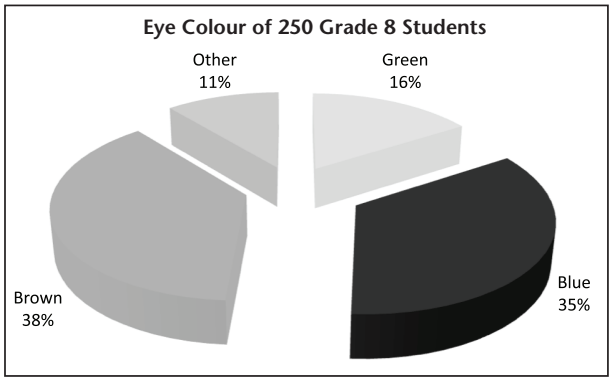
How else can the slices be presented to mislead? We could make a circle graph wedge or slice look bigger than it should be (on purpose or by accident). If we label the graph with the correct percentages, then technically we haven't lied—we just let the viewer get a false impression!

Try It!

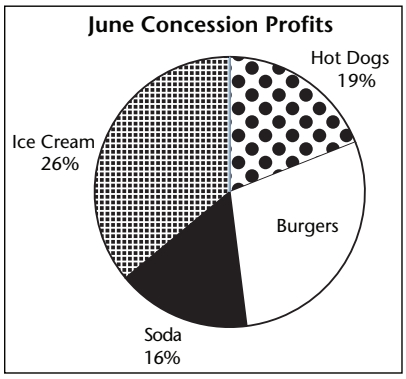
Activity 6

Identify the misleading features (if any) in the graphs.

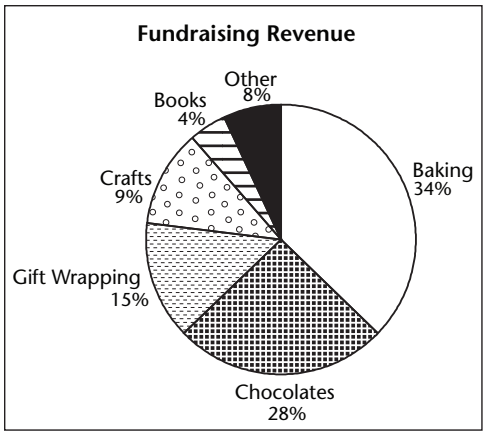
1.



2.



3.



Turn to Solutions at the end of the Introduction Assignment to check your answers.

MARKS

Part C: Graphing Questions

Answer the following questions based on the information and activities in Section 1: Graphing. (23 marks in total)

1. Classify each description as either continuous (**C**) or discrete (**D**). (4 marks)

   _____ distance travelled over the course of a road trip

   _____ number of votes for each candidate in a school election

   _____ number of students participating in each of eight track and field events

   _____ the temperature in your backyard over the course of a day

2. For each item below, read the statement, then decide which kind of graph is most appropriate. Put a **B** (bar), **H** (histogram), **L** (line), or **C** (circle) the blank in front of each description. Use the space on the right to provide a brief justification for the graph type you chose. (8 marks)

_____ a. Compare the concession sales of pizza to burgers and sandwiches and show approximate values for each.	
_____ b. See if there is any connection between the resting heart rate and the height of all players on the basketball team. Try to figure out what the heart rate might be for a 7-foot tall player.	
_____ c. Show that well over half the student population participated in the Spring Fair, and that only about 3% of the students didn't participate because they were away on the date of the fair.	
_____ d. Show results from a survey of 124 million people asking: "Which range describes your travel time to work? 1–15 min, 16–30 min, 31–45 min, 46–60 min, 61–75 min, 76–90 min."	

MARKS

3. Choose one graph type, and list two advantages it has over other graph types. (2 marks)

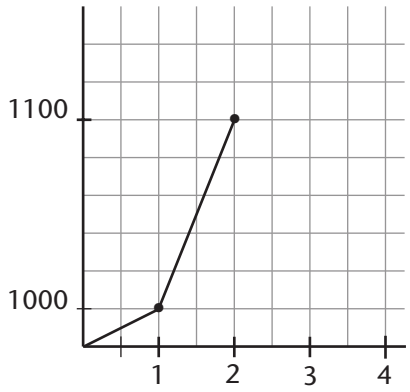
_____

_____

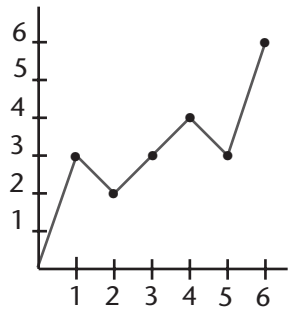
_____

4. Observe the three graphs. Label anything about the graphs that makes them misleading. If a graph has no misleading features, put a check mark beside it. (4 marks)

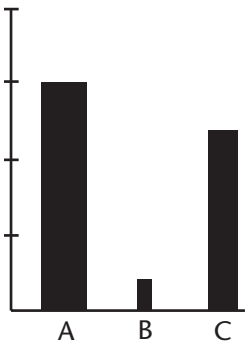
a.



b.



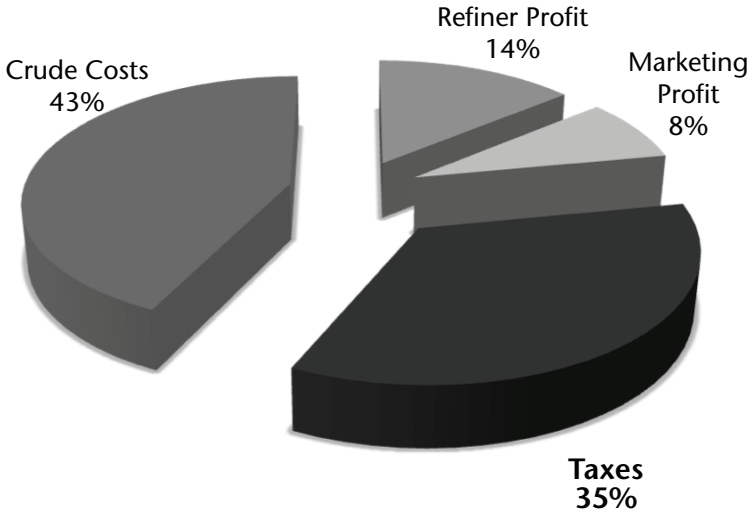
c.



MARKS

5. At some gas stations the pumps display a circle graph that shows how the money we pay for gas is divided up. Station owners want to tell drivers why gas prices are so high, so they put the circle graph right there at the pump. The graph is easy to understand, and keeps the customers from pestering the staff with questions.

   Here's an example of the type of graph found at the pumps:



   As well as informing, this graph can also be used to try to change attitudes. Answer the questions below.

   a. What features of the graph might be misleading? (2 marks)

   _____

   _____

   _____

   b. Why might the gas station want to mislead you? (1 mark)

   _____

   _____

   _____

MARKS

c. How would you change this graph so it is more "honest"? (1 mark)

d. Imagine that you wanted to change the graph to persuade people that the profit margins on gas prices were very high. How would you change the graph so that the "profit" sector seems more prominent? (1 mark)

Section 2: Puzzler

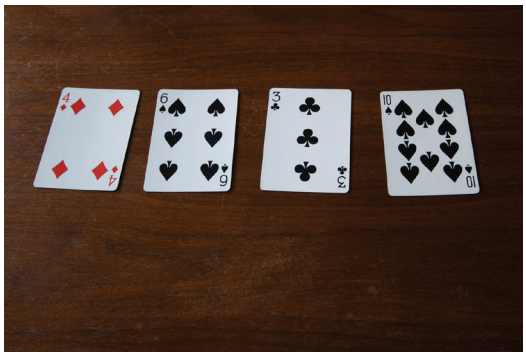
Part A: Solve the Puzzle

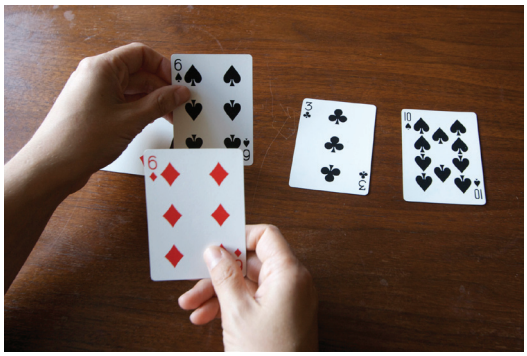
Strategy

Strategy is about the choices you make while you play a game or solve a puzzle.

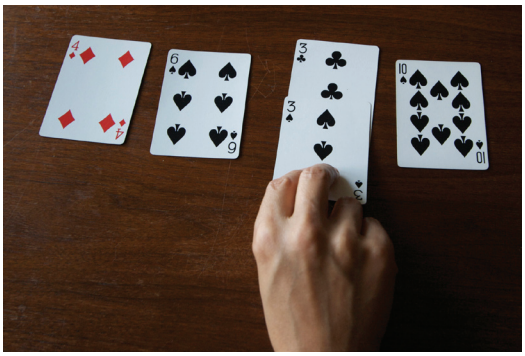
Think about some simple games you have played. What steps do you take, or choices do you make, in the effort to win? For example, you might start with the corners when solving a jigsaw puzzle. In the card game *Crazy Eights*, eights are wild—you can play them as any suit. So the key game strategy is to hold onto any eights until you are required to play a card or suit that you don't have in your hand. Then you can use the eight as a wild card, so you don't have to pick up another card.

In some games and puzzles, you need you to use your knowledge about math facts. The card game called *Casino* is one example. In *Casino*, you play cards out of your hand to match and take other cards down on the table. You can make a straight match, taking a single card with a single card from your hand.





Or, you can place a card from your hand on to a card on the table to "build" up to another number in your hand. The picture below shows "building sixes."



In the following turn, you can then take any cards that match your card, or any builds that match your card. In this example, you used addition math facts to work out a way to capture four cards altogether, doubling the number you would have captured if you just used your plain ol' match.

In this section, you will work out a strategy to solving a simple puzzle, using addition math facts.

Warm-up

Activity 7

Use the "Magic Square" below to answer the questions.

4	14	15	1
9	7	6	12
5	11	10	8
16	2	3	13

1. Make some general observations about the square. What do you notice about the numbers?

2. Find the sum of the numbers in each row.

   Row 1: _____

   Row 2: _____

   Row 3: _____

   Row 4: _____

3. Find the sum of the numbers in each column.

   Column 1: _____

   Column 2: _____

   Column 3: _____

   Column 4: _____

4. Find the sum of the numbers in the square's diagonal.

   Diagonal: _____

Turn to Solutions at the end of the Introduction Assignment to check your answers.

Introduction to Magic Squares

Had you seen a magic square before the Warm-up activity? These are grids of *at least* 3 × 3, with a number in each gridspace. Each number occurs exactly once. The sum of the numbers in each row, column, and diagonal is the same.

In the Warm-up activity you looked at a 4 × 4 magic square. It contains the whole numbers from 1 to 16. The sum of the numbers in each row, column, and diagonal was 34.

In ancient China, the 3 × 3 square called the "Lo Shu Square" featured in a legend in which a turtle emerged from floodwaters with this pattern on its shell. According to the story, the pattern was used to interpret the offerings required to appease the river god to stop the river Lo from flooding.

The 3 × 3 square contains the whole numbers from one to 9. The sum of the numbers in each row, column, and diagonal is… well, you have to solve the puzzle to find out!

Create a Magic Square

You will need the following supplies:

- the grid on the next page:
- pencil
- eraser

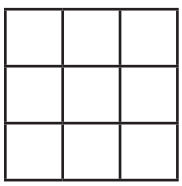
Instructions:

Fill in the 3 × 3 grid with the numbers 1 to 9.

While you work on solving this puzzle, think about the steps you take to find your solution. Make notes about what you are doing.

Remember, each number from 1 to 9 must appear only once.

Every row, column, and diagonal must add up to the same number. This is called the "magic number."



Enter the numbers 1 to 9 so that each row, column, and diagonal adds up to the same number. Copy or print out additional sheets if you need more practice space to work out the magic square puzzle.

MARKS

Part B: Puzzle Strategy Questions

Answer the following questions based on the information and activities in **Section 2: Puzzler**. (11 marks in total)

1. Did you use one strategy to solve the entire puzzle, or a combination of strategies? (1 mark)

2. Using complete sentences, explain the strategy you used to solve the puzzle. Hint: can you describe a part of your strategy as one of the following? Which one(s) did you use? (3 marks)

   - Guessing and checking
   - Looking for a pattern
   - Making a systematic list
   - Drawing or modelling
   - Eliminating possibilities
   - Working backward
   - Developing alternative approaches

MARKS

3. Describe what you did while you worked out the solution, and why your strategy was successful. (2 marks)

4. Chandra says she has a good strategy for solving the 3×3 magic square. She says she always puts the same number in the middle. She says if you don't, you can't solve the puzzle. What number did Chandra use? Is she right? Why or why not? (3 marks)

5. Is there only one solution to this puzzle? Why or why not? (2 marks)

Solutions

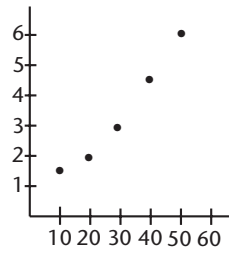
Warm-Up

Activity 1

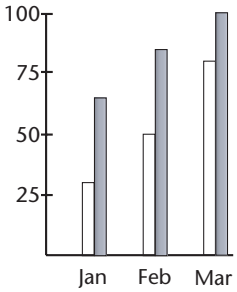
You've likely encountered many graphs in previous math courses and in your day-to-day life. Test your graph-reading skills by completing the following matching exercise.

1. Match each data set with its graph.

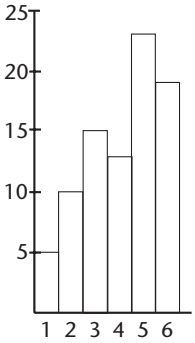
d



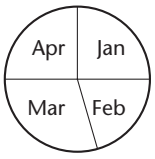
c



a



b



a.

(1, 5)
(2, 10)
(3, 15)
(4, 13)
(5, 23)
(6, 19)

b.

Jan	3
Feb	2
Mar	4
Apr	3

c.

Jan	30
Feb	50
Mar	80

Jan	65
Feb	85
Mar	100

d.

(10, 1.5)
(20, 2)
(30, 3)
(40, 4.5)
(50, 6)

Try It!

Activity 2

C The diameter of a ball determines its circumference.

D Students at our school eat different types of foods for breakfast.

C The distance from home depends on how long we've been travelling.

D A store tracks the sales of different brands of marmalade.

C The height of water in a reservoir goes up and down depending on the season.

Try It!

Activity 3

H	a.	how many people there are between the ages of 0 and 10, 11 and 20, 21 and 30, 31 and 40, 41 and 50 etc	• discrete data • categories (ages) grouped as consecutive intervals
L	b.	temperature of water in a kettle as it heats up	• continuous data • shows a change (temperature) over time
L	c.	amount of wood in a tree as it grows	• continuous data • shows a change (amount of wood) over time
B	d.	average cost of living compared to location	• discrete data • comparing categories (locations)
B	e.	average income versus years of education	• discrete data • comparing categories (years of education)

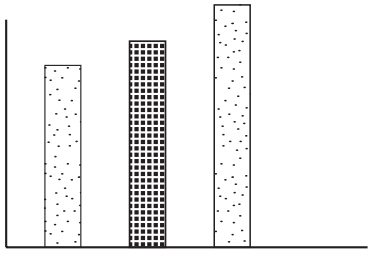
C	f.	types of garbage that goes into the landfill	• discrete data • showing parts (types of garbage) of a whole (total garbage in landfill)
B	g.	number of households that have each type of pet	• discrete data • comparing categories (pet types)

Try It!

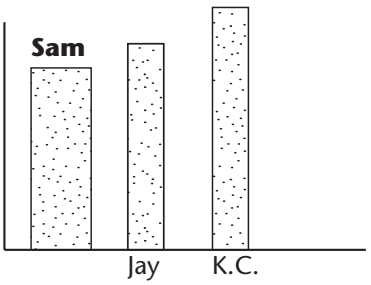
Activity 4

Here is one possibility:

a.



b.



Try It!

Activity 5

1. uneven scale numbers
2. no numbers on scale
3. break inserted on scale

Try It!

Activity 6

1. Exploded slice and darker colour makes the slice seem bigger.
2. The ice cream wedge is larger than its percentage seems to indicate; 26% is approximately one quarter. That wedge is much bigger than one quarter of the circle. The burger wedge has no numbers on it.
3. No misleading features.

Warm-up

Activity 7

1. Answers will vary. You may have made some of the following observations:
   - The square contains the whole numbers 1-16.
   - None of the numbers are repeated.
   - The numbers in each row, column and diagonal add to 34
2. Row 1: 34

   Row 2: 34

   Row 3: 34

   Row 4: 34
3. Column 1: 34

   Column 2: 34

   Column 3: 34

   Column 4: 34
4. Diagonal: 34