Working with Graphs

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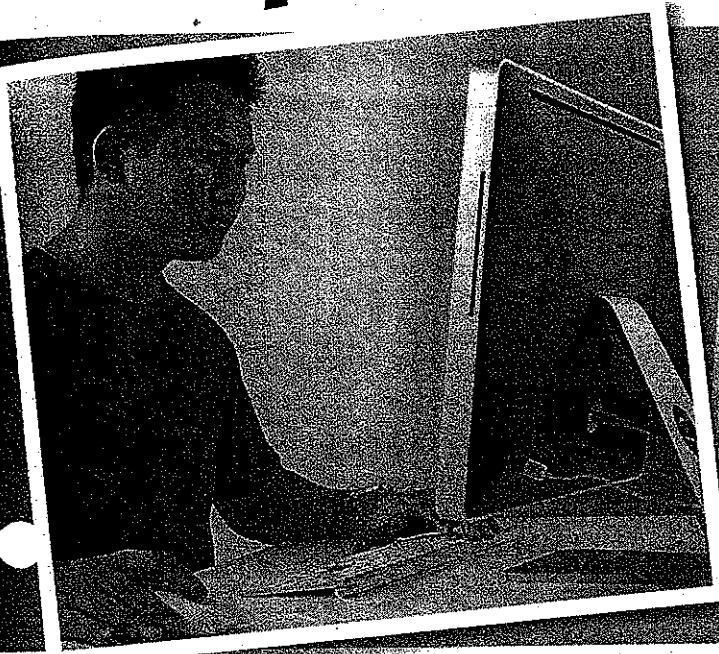
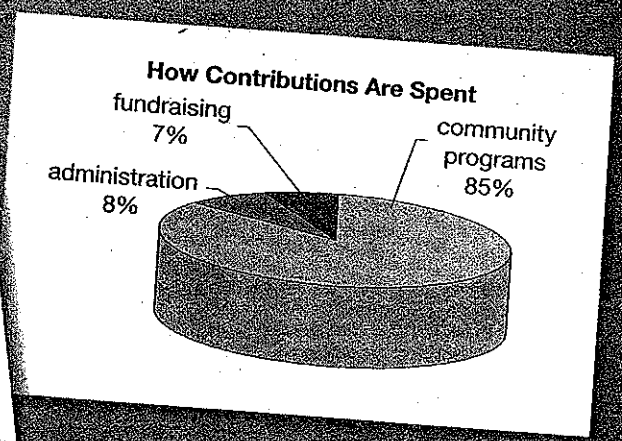




Landan is a graphic designer. He creates brochures and newsletters for clients. One brochure Landan created shows this graph about how the contributions to a charity are spent.

A. Why are graphs used so often in brochures and newsletters?

e.g., You can display information that looks good. The graphs show comparisons. They look professional. Graphs can catch your attention.

B. Choose a type of graph. When might you or a designer use it?

e.g., I might use a circle graph for amounts I spend on different things. A fundraiser might use a line graph to show donations during a year. A community centre might use a bar graph to compare attendance at programs.

2 Getting Started

You will need
- a ruler
- a protractor

bar graph
a graph that shows data with horizontal or vertical bars

1. a) What do you think this **bar graph** might be about?

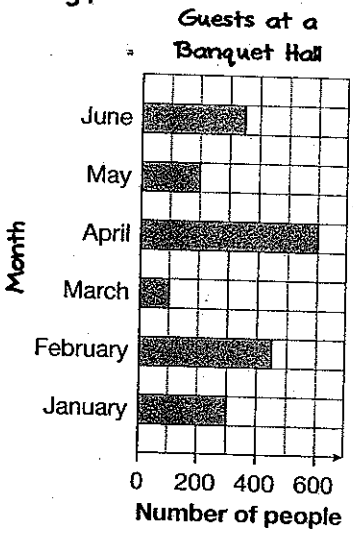
e.g., number of guests at a banquet hall in the first half of the year

b) Label the **vertical axis** and title for the topic you named in Part a).

c) About how many more people were there in April than in

- the 2 mo before? about 50
- the 2 mo after? about 50

e.g.,



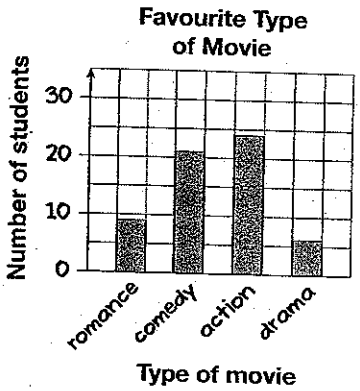
Type of movie	Number of students
romance	9
comedy	21
action	24
drama	6

data
information gathered in a survey, in an experiment, or through observation

2. Rob surveyed Grade 11 students. He asked about their favourite type of movie. He recorded the results in the chart on the left.

a) Create a bar graph for the **data**. You need to put the categories along the **horizontal axis**.

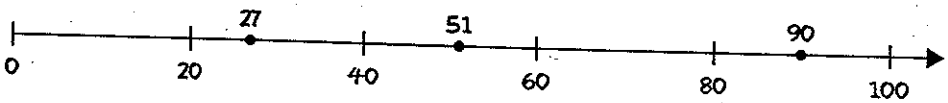
b) Rob decided to rent a movie to watch with some friends from school. What type of movie would you suggest? Justify your decision.



e.g., An action movie with some funny parts should please the students who voted for comedy and the students who voted for action. That's most of the students.

scale
the number represented by each unit in a graph

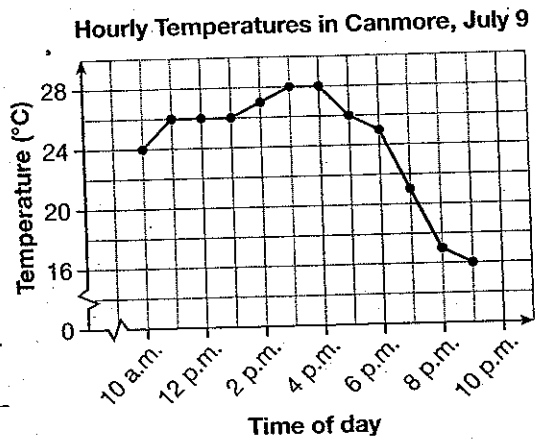
3. Draw a horizontal number line from 0 to 100. Label the **scale** by 20s. Then plot 27, 51, and 90.



4. Calculate each percent of 360°.

a) 15% of 360° = 54° **b)** 5% of 360° = 18°

5. John works at a camp in Canmore. He used this **line graph** to schedule events for tomorrow.



line graph
a graph that shows data with connected plotted points

Hint
A zigzag mark is used on each axis to show a break from 0 to the first label.

a) It was 16 °C at 9:00 p.m. Plot this on the graph.

b) In which hour was the temperature warmest for swimming? from 3 p.m. to 4 p.m.

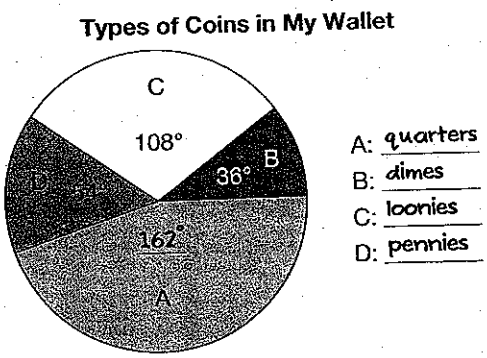
c) When did the temperature

- decrease? from 4 p.m. to 9 p.m.
- increase? from 10 a.m. to 11 a.m. and from 1 p.m. to 3 p.m.
- not change? from 11 a.m. to 1 p.m. and from 3 p.m. to 4 p.m.

6. What is the measure of the angle in the **circle graph**? Complete the **legend** to tell what each **sector** might represent.

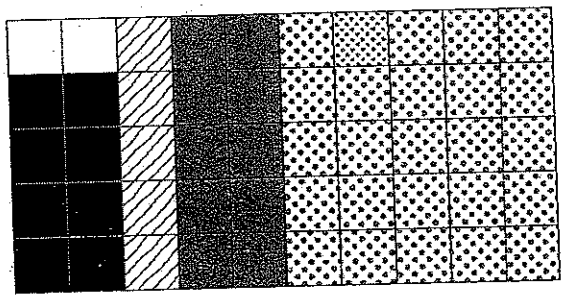
circle graph
a graph that shows how the parts make up the whole

legend
an explanation of the symbols or colours in a graph



A: quarters
B: dimes
C: loonies
D: pennies

7. What percent is each rectangle compared to the large rectangle?



a) white 4%

b) black 16%

c) light grey 20%

d) spotted 50%

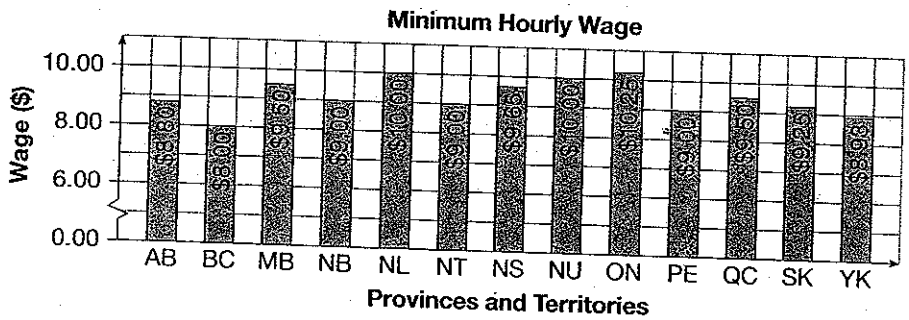
e) striped 10%

f) the whole large rectangle 100%

Practice

1. a) What is the range of minimum hourly wages?

$10.25 − $8.00 = $2.25



b) Where are the three highest minimum wages?

Ontario, Nunavut, Newfoundland and Labrador

c) Suppose you worked an 8 h shift for minimum wage. How much more would you earn in Nunavut than in Manitoba?

e.g., Difference per hour: $10.00 − $9.50 = $0.50

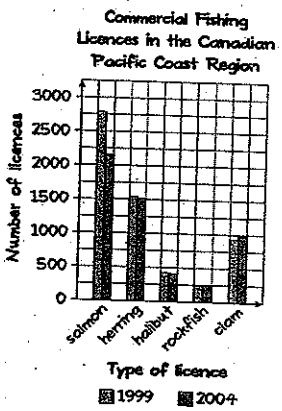
Difference for 8 h: 8 × $0.50 = $4.00

I would earn $4.00 more in Nunavut.

2. Adam is a commercial salmon fisher in British Columbia. He saw this chart about fishing licences in past years.

Commercial Fishing Licences in the Canadian Pacific Coast Region		
Type of licence	Number in 1999	Number in 2004
salmon	2786	2157
herring	1539	1512
halibut	423	410
rockfish	249	246
clam	933	978

2. a) e.g.,



a) Use grid paper. Create a double-bar graph for the data.

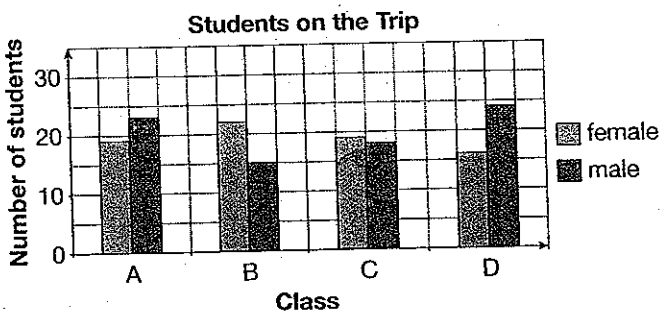
b) What change does the chart show for the salmon licences?

2786 − 2157 = 629 The number decreased by 629.

c) Choose one type of licence. Predict the number of licences in 2014.

e.g., herring: about 1500; The numbers are close for the 2 yr, but decreased a little. OR rockfish: about 248; The numbers stayed about the same.

3. Damien created this graph to show the number of students on a school trip to a planetarium.



a) Marcia said the number of boys was about the same as the number of girls. How does the graph show this?

e.g., For two classes, the bars for girls are a little higher than for boys. For the other two classes, the bars for boys are a little higher than for girls. So the numbers are about the same.

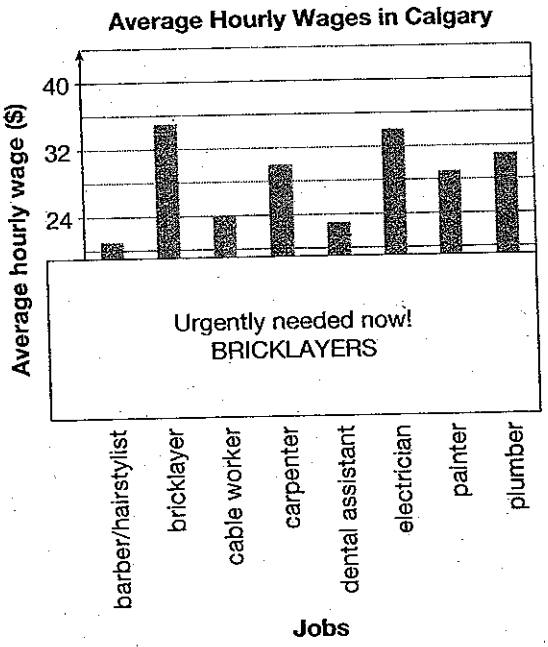
b) The trip cost $40 per student. Was the total cost more or less than $7500? Explain.

Less, e.g., The graph shows an average of a little less than 20 boys and 20 girls, or about 38 students per class.

$4 \times 38 = 152$; $152 \times \$40 = \$6080$

Hint
You can estimate the number of students on the trip by looking at the graph.

4. Nicole heard that bricklayers make a lot more money than dental assistants. She saw this graph at a job fair in Calgary.



a) Order the wages from greatest to least.

bricklayer, electrician, plumber, carpenter, painter, cable worker, dental assistant, barber/hairstylist

b) Nicole thought that bricklayers make 4 times as much as dental assistants. Why might she think this?

e.g., From the top of the banner, the bar for bricklayers is about 4 times the height of the bar for dental assistants.

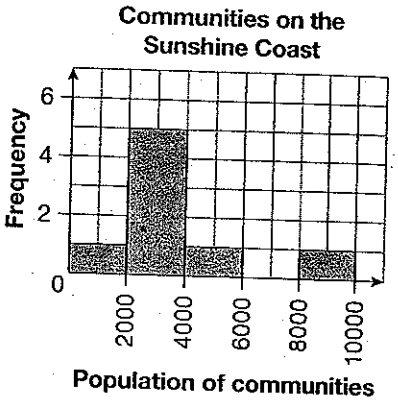
c) Do you agree with Nicole? Explain.

No, e.g., because part of the graph is covered by a banner. You need to see the whole graph. A bricklayer earns about $12 more per hour than a dental assistant. That is less than twice as much.

REFLECTING
Choose a graph. What other questions could you answer using the data in the graph?

Practice

1. Zenaida created this histogram for a tourist brochure about British Columbia's Sunshine Coast.



   a) How many communities are there? 8

   b) Which population interval has the most communities? 2000 to 4000.

   c) What fraction of the communities have a population in each interval?

   Interval from 0 to 2000: $\frac{1}{8}$

   Interval from 2000 to 4000: $\frac{5}{8}$

   d) Zenaida says that the total population is a little less than 38 000. Do you agree? Why or why not?

   e.g., Yes. I used the maximum of each interval:

   Total: $5 \times 4000 + 2000 + 6000 + 10\,000 = 38\,000$

   OR No. I used the middle of each interval:

   $5 \times 3000 + 1000 + 5000 + 9000 = 30\,000$

2. Joseph raises cattle on his farm near Melfort, Saskatchewan. He looked at this frequency table.

Number of Calves Born, Semi-Annually (in Thousands), in Saskatchewan						
Time period	Jul.–Dec. 08	Jan.–Jun. 09	Jul.–Dec. 09	Jan.–Jun. 10	Jul.–Dec. 10	Jan.–Jun. 11
Number of calves born (in thousands)	163.1	1248.4	187.1	1226.0	186.3	1170.7

   a) Use grid paper. Create a histogram for the data.

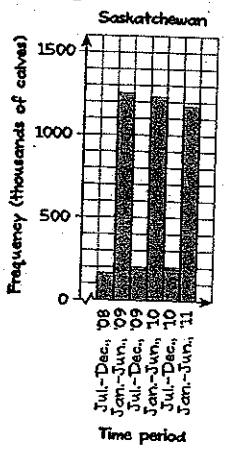
   b) What trend does the histogram show?

   e.g., More calves are born from January to June than from July to December.

   c) Predict the number of calves born in Saskatchewan from July to December of 2011.

   e.g., There would be about 180 000 calves.

2. a) e.g.,



3. Jill is a tour guide in Yellowknife. She takes tour groups to nearby Cameron Falls in July. She needs to let the tourists know what temperatures to expect.

a) Use the data below to create a frequency table.

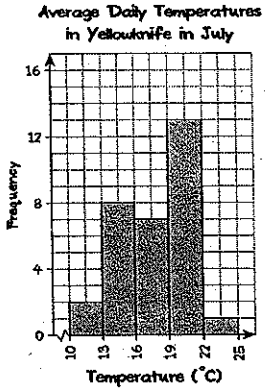
Hint
Each temperature interval must be the same size.

Temperatures from Previous Year (°C)			
13.8	13.5	15.7	16.7
13.9	16.0	13.4	18.4
15.2	18.3	16.2	19.4
13.4	20.9	17.3	19.4
12.6	23.2	19.4	21.6
12.6	21.3	21.3	20.4
16.9	20.4	21.2	20.4
19.1	17.8	20.9	

Average Daily Temperatures in Yellowknife in July	
Temperature (°C) (over–including)	Frequency (number of days)
10–13	2
13-16	8
16-19	7
19-22	13
22-25	1

b) Create a histogram on grid paper.

3. b) e.g.,



c) How many days have average temperatures above 19 °C? 14 d What might Jill report about these days?

e.g., The average temperature is fairly warm.

d) What does the histogram show about the number of days with average temperatures from 13 °C to 16 °C and from 16 °C to 19 °C?

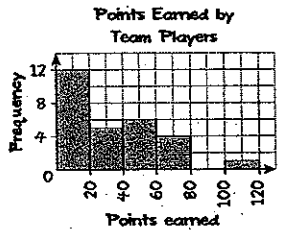
e.g., The number of days in each interval is about the same.

4. a) Grayson is a coach for a junior hockey team. He kept statistics for the season. Create a frequency table.

Points Earned by Each Player			
107	1	2	44
15	2	78	7
8	40	29	73
35	27	76	65
3	6	18	9
3	14	25	58
43	53	55	42

Points for team members (over–including)	Frequency (number of players)
0–20	12
20-40	5
40-60	6
60-80	4
80-100	0
100-120	1

4. b) e.g.,



b) Create a histogram on grid paper.

c) How many players scored from 0 to 20 points? 12

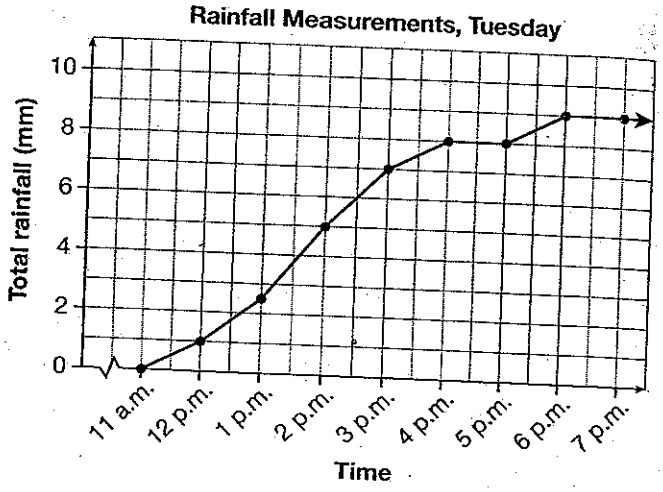
d) Can this data be displayed better on a bar graph? Explain.

No. e.g., You could show a bar for each player, but there would be 28 bars. That is a lot.

REFLECTING
What other interpretations can you make using the frequency table and histogram in Question 4?

Practice

1. This line graph shows the total rainfall one day at Moose Mountain Provincial Park.



   a) What was the total rainfall?
   9 mm

   b) How much rain fell between 11 a.m. and 2 p.m.? about 5 mm

   c) When was there no rain?

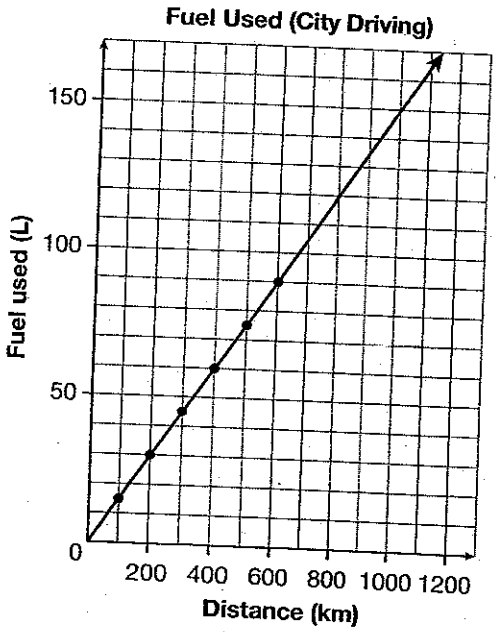
   e.g., between 4 p.m. and 5 p.m., and after 6 p.m.

REFLECTING
Did you interpolate or extrapolate for Question 1? Explain.

2. Jackson operates a catering truck in Victoria. He travels about 1100 km within the city per month.

   a) Complete the chart. Then, create a line graph for the data.

Distance (km)	Fuel used (L)
100	15
200	30
300	45
400	60
500	75
600	90



Hint
Look at the trend in the data. Estimate using interpolation or extrapolation.

   b) About how much fuel does Jackson use in a month?

   e.g., Jackson uses about 165 L of fuel.

   c) About how far can Jackson drive with 50 L of fuel?

   e.g., Jackson can drive about 330 km with 50 L of fuel.

   d) What trend does the graph show?

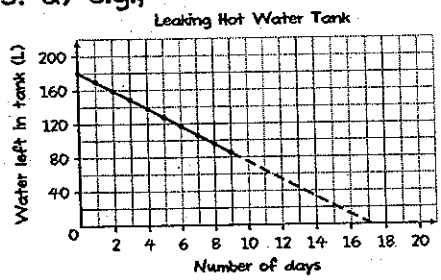
   e.g., As the distance travelled increases, the amount of fuel used increases.

3. A hot water tank holds 180.0 L. It is dripping at a constant rate. When will the tank be empty if it is not fixed?

Days	0	1	2	3	4	5	6	7	8	9
Water in tank (L)	180.0	169.5	159.0	148.5	138.0	127.5	117.0	106.5	96.0	85.5

a) Create a line graph on grid paper.

3. a) e.g.,



b) Describe the trend.

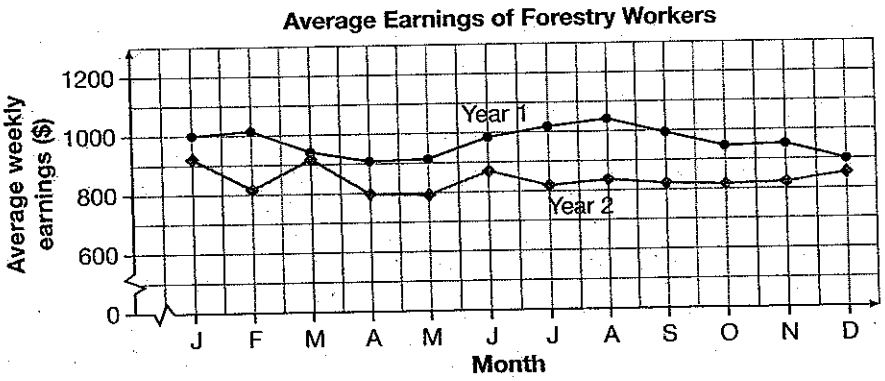
e.g., As the number of days increases, the volume of water in the tank decreases.

c) How many days will it take for the tank to empty? about 18 d

d) Suppose you graph the total amount of water lost by the leaking hot water tank over 5 d. What trend would you see?

e.g., As time increases, the volume of water would increase. The graph would go up to the right.

4. Coral works in payroll for the forestry industry in British Columbia. She made this double-line graph for a company newsletter.



a) How do the average earnings in Year 1 compare with the average earnings in Year 2?

e.g., The average earnings were much higher in Year 1 than in Year 2.

b) How do the trends compare for the years in the graph?

e.g., In both years, the average earnings were lower in April and May. In Year 1, there was a big increase from June to September. This increase did not happen in Year 2.

5. What other questions could you answer using a chart or graph in this lesson?

e.g., For the graph in Question 2: How much fuel would Jackson need to drive 900 km? For the chart in Question 3: About how many days did it take for the tank to lose half of its water?

Mid-Chapter Review

1. a) Marcel created this graph for a community newsletter. What does it compare?

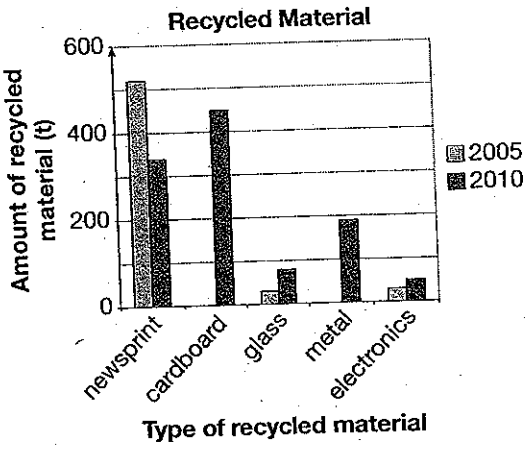
   e.g., amounts of five kinds of recycled materials in two different years

   b) Write *more* or *less* to compare amounts in 2010 with 2005.

   In 2010, there was __more__ glass recycled. There was __less__ newsprint recycled.

   c) What does the graph show about recycling metal?

   e.g., Metal was not recycled in 2005. It was recycled in 2010.

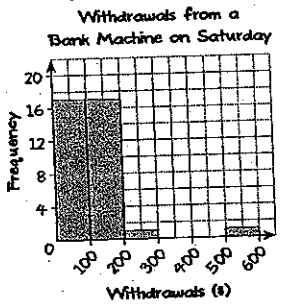


2. Megan works at a bank, where she collected this data. Graph the data on grid paper. Justify the type of graph.

   e.g., histogram; I could show the data in 6 intervals.

Withdrawals from a Bank Machine on Saturday					
$120	$220	$ 80	$ 80	$ 60	$ 80
$ 60	$ 80	$200	$140	$160	$ 60
$100	$140	$160	$200	$140	$120
$120	$160	$ 80	$120	$120	$140
$ 80	$ 40	$ 60	$100	$180	$ 80
$ 40	$600	$120	$ 40	$140	$100

2. e.g.,



3. a) Hikers made these records. Graph the data on grid paper. Justify the type of graph.

   e.g., line graph; There are no intervals in the data.

   b) How long did they hike? __1__ h

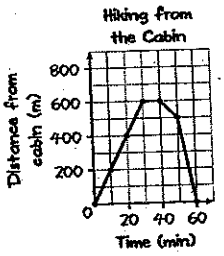
   c) What distance did they hike? __1200__ m

   d) Describe the trend.

   e.g., The hikers' distance increased until they stopped. Then their distance decreased as they came back.

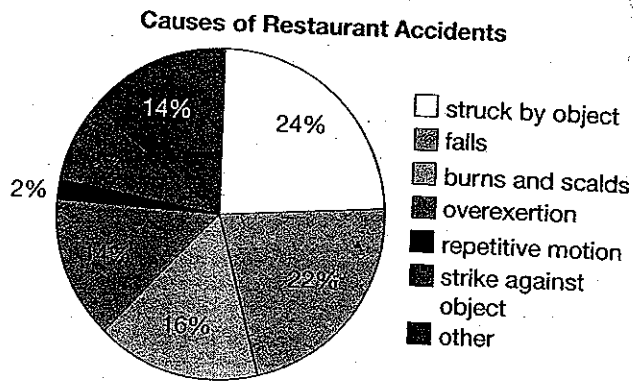
Distance Travelled from the Cabin on a Hike	
Total time (min)	Distance from cabin (m)
0	0
10	200
20	400
30	600
40	600
50	500
60	0

3. a) e.g.,



Practice

1. Morris is training for a restaurant job in Kelowna. He read information about job safety.



   a) Which combinations, or groups, make up about half of all the restaurant accidents? Give two possible answers.

   e.g., struck by objects and falls; falls, burns and scalds, overexertion

   b) Being struck by an object happens ___3___ times more often than strikes against objects.

   c) Why do you think Morris was asked to read this information?

   e.g., He is a new employee. He might be more careful if he is aware of the types of accidents that happen in restaurants.

   d) Suppose there were 150 restaurant accidents in Kelowna in a year. Predict the number of accidents of each type.

   struck by object 36, falls 33, burns and scalds 24, overexertion 21, repetitive motion 3, strike against object 12, other 21

2. Liza is a fitness coach. She read the main ingredients in a new 85.0 g protein bar.

   a) Complete the chart.

"Chocolate Brownie" Protein Bar			
Ingredient	Mass (g)	Percent of total mass	Angle measure
protein	34.0	34.0 ÷ 85 × 100 = 40	0.4 × 360° = 144°
total carbohydrates	33.0	33.0 ÷ 85 × 100 = 38.823...	0.388... × 360° ≐ 140°
total fat	6.0	6.0 ÷ 85 × 100 = 7.058...	0.070... × 360° ≐ 25°
sodium and potassium	0.5	0.5 ÷ 85 × 100 = 0.588...	0.005... × 360° ≐ 2°
other	11.5	11.5 ÷ 85 × 100 = 13.529...	0.135... × 360° ≐ 49°
total	85.0	100	360°

b) Create a circle graph.

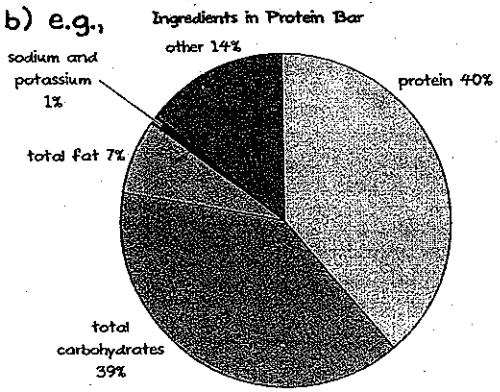
c) The mass of protein is higher than that of carbohydrates.

Protein has almost 6 times more mass than total fat.

d) What other type of graph could you use for this data?

e.g, a bar graph with 5 bars

2. b) e.g.,



3. David lives on a farm near Red Deer. He read about energy use on two kinds of farms in Alberta.

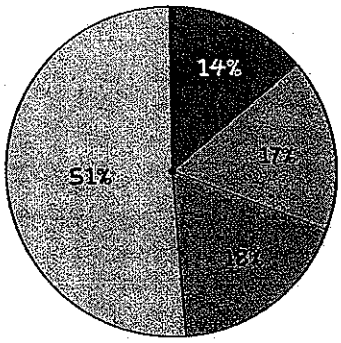
a) Complete the chart. Then create two circle graphs.

Hint
Use the same legend for both graphs.

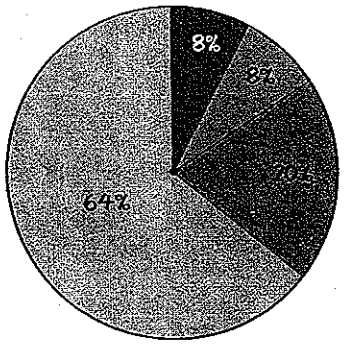
Type of energy	Dairy Farm %	Dairy Farm Angle measure	Grain Farm %	Grain Farm Angle measure
diesel	51	$0.51 \times 360° \doteq 184°$	64	$0.64 \times 360° \doteq 230°$
gasoline	18	$0.18 \times 360° \doteq 65°$	20	$0.2 \times 360° = 72°$
electricity	17	$0.17 \times 360° \doteq 61°$	8	$0.08 \times 360° \doteq 29°$
natural gas	14	$0.14 \times 360° \doteq 50°$	8	$0.08 \times 360° \doteq 29°$

3. a) e.g.,

Energy Use on Dairy Farm



Energy Use on Grain Farm



diesel, electricity, gasoline, natural gas

b) Estimate a fraction to describe the part of the total energy used.

diesel on dairy farms: $\frac{1}{2}$

diesel on grain farms: $\frac{2}{3}$

non-diesel on dairy farms: $\frac{1}{2}$

non-diesel on grain farms: $\frac{1}{3}$

c) What other type of graph could you use to display the data? Explain.

e.g., a double-bar graph; You would have 4 categories for types of energy and 2 bars for each category—one for a dairy farm and one for a grain farm.

4. Describe a situation where you might use a circle graph to display data.

e.g., I would use a circle graph to show the percent of total time I spend each week doing homework for each of the subjects I am taking this semester.

Practice

Number of People Working in Industries in Winnipeg	
agriculture	47 595
construction	32 310
manufacturing	62 580
wholesale	23 040
retail	65 475
finance/real estate	31 505
health/social services	75 915
education services	47 365
business services	95 353
other	121 030

1. Lionel researched these data for a recent year.

   a) Use a spreadsheet. What was the total number of people working in Winnipeg? 602168

   b) Create a graph to display the data.

   c) Explain why you chose your graph type.

   e.g., circle graph; I can show the percent of people who work in each job type and compare. OR bar graph; I can use the lengths of bars to compare the number of people in each category.

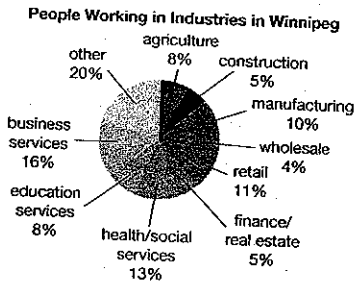
   d) Use your graph to estimate. What fraction of these people work in agriculture, construction, manufacturing, and wholesale? about $\frac{1}{4}$ How does your graph show this?

   e.g., These types of work take up about $\frac{1}{4}$ of my circle graph. OR Altogether, the bars for these types of work in my bar graph are about $\frac{1}{4}$ the length of all the bars put together.

   e) Suppose the population working in industries in Winnipeg increases by 8%, and the percent in each industry stays the same. Would your graph change? Explain.

   e.g., My circle graph would stay the same. It shows the part of the whole for each industry. If I had chosen a bar graph, each bar would become higher.

1. b) e.g.,



Exchange Rate	
Canadian $	Euro €
100.00	74.37
50.00	37.18
122.00	90.73
1.00	0.74

2. a) Lily used an online converter to research the cost of four items in Canadian dollars and in euros. She recorded the amounts in the chart on the left. Graph Lily's data. What type of graph did you choose? Why?

   e.g., line graph; I can use the line to interpolate and extrapolate.

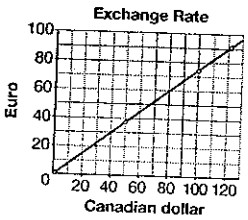
   b) Use the graph to estimate each conversion.

   C$40 ≐ EUR e.g., 30

   C$90 ≐ EUR e.g., 65

   C$ e.g., 115 ≐ EUR85

2. a) e.g.,



3. Miriam is the manager at a food-packaging plant. She records the amounts of apple juice, raspberry-grape juice, and cranberry-blueberry juice packaged during the year.

Amounts of Juice Packaged (L)			
Month	Product 1 (apple)	Product 2 (rasp-gr)	Product 3 (cran-blu)
Jan.	6754	268	3150
Feb.	6681	257	2788
Mar.	5926	900	2841
Apr.	6075	1391	595
May	5003	3544	607
Jun.	2294	4906	110

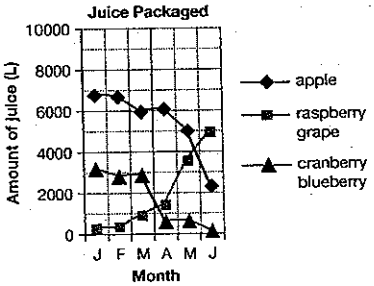
a) Use a spreadsheet to calculate each total of juice produced.

apple: 32733 L; rasp-gr: 11266 L; cran-blu: 10091 L

b) Create a graph. What type of graph did you choose? Why?

e.g., line graph; There are three groups of data so I used three different-coloured lines. Each line has a different symbol for points.

3. b) e.g.,



c) Describe the trend for each product.

apple juice:

e.g., A lot more apple juice is produced than the other types of juice. Production decreases from April to June.

raspberry-grape juice:

e.g., Production is very low in January and increases from March to June.

cranberry-blueberry juice:

e.g., Production from January to March is much higher than from April to June.

d) Devon says the apple juice is the most popular. Carla says raspberry-grape juice is the most popular. How does the graph show these two opinions?

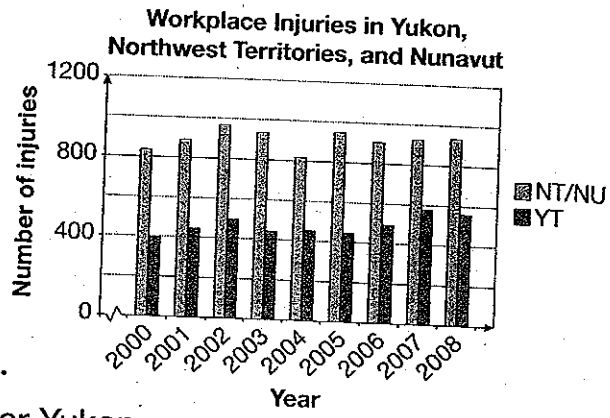
e.g., For some months, the line for apple juice is higher. For other months, the line for raspberry-grape juice is higher.

e) Do you agree with Devon or Carla? Why?

e.g., I agree with Devon, because the line for apple juice is higher for more months, and it shows a greater total. OR I agree with Carla, because the trend for apple juice decreased. So I think it will continue to decrease. The trend for raspberry-grape juice is increasing. I think this trend will continue.

Practice

1. Di saw this graph.



a) Describe the trend for the Northwest Territories and Nunavut.

e.g., In the Northwest Territories and Nunavut, workplace injuries increased, then decreased, then increased again, and then decreased a bit.

b) Describe the trend for Yukon.

e.g., The number of injuries increased, then decreased, and then increased.

REFLECTING

What are two conclusions you could make from the graph in Question 1?

c) Can the following graphs be used to display the data in Part a)? Explain.

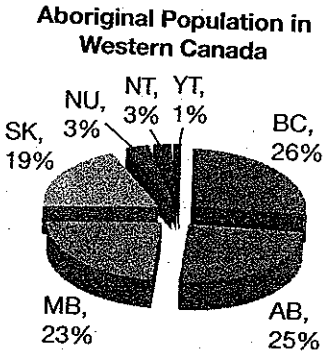
Histogram: Yes. e.g., I would organize the data into intervals. The first interval would be 2000–2001.

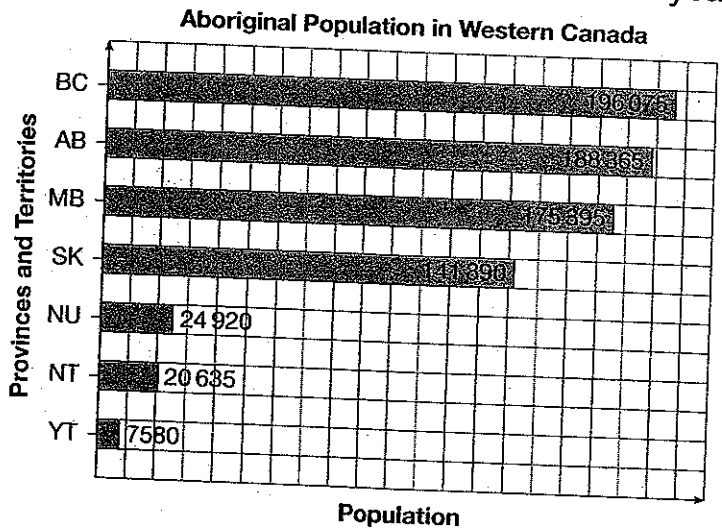
Line graph: Yes. e.g., You can plot and join points. You would use 2 different-coloured lines.

Circle graph: Yes. e.g., However, you would need 2 circles. Each year is a category, so each circle would have 9 sections, but they would not show the trend.

2. Yvonne researched this graph for a recent year.

2. e.g.,





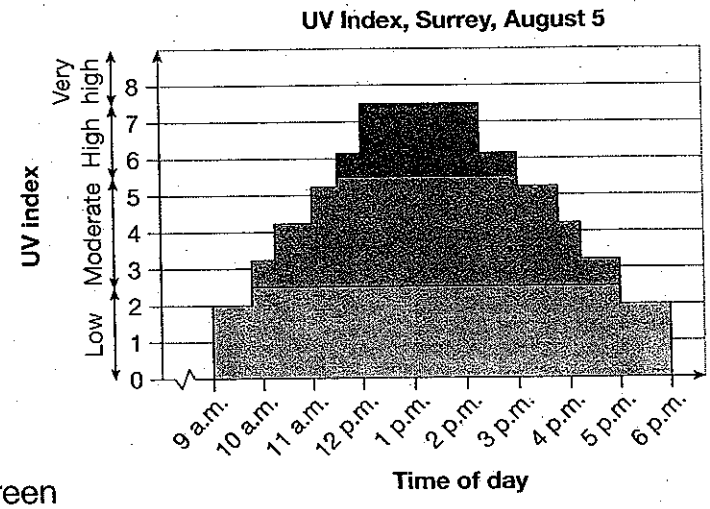
Hint
Think of a creative way to represent the data.

Use technology to represent the data. Explain your choice.

e.g., I chose a circle graph, but I separated the parts. This helps show the data clearly.

3. Jerod works as a landscaper in Surrey. He is using this graph to make a decision about sun protection.

He knows that when the ultra-violet rays are stronger, the UV index is higher.



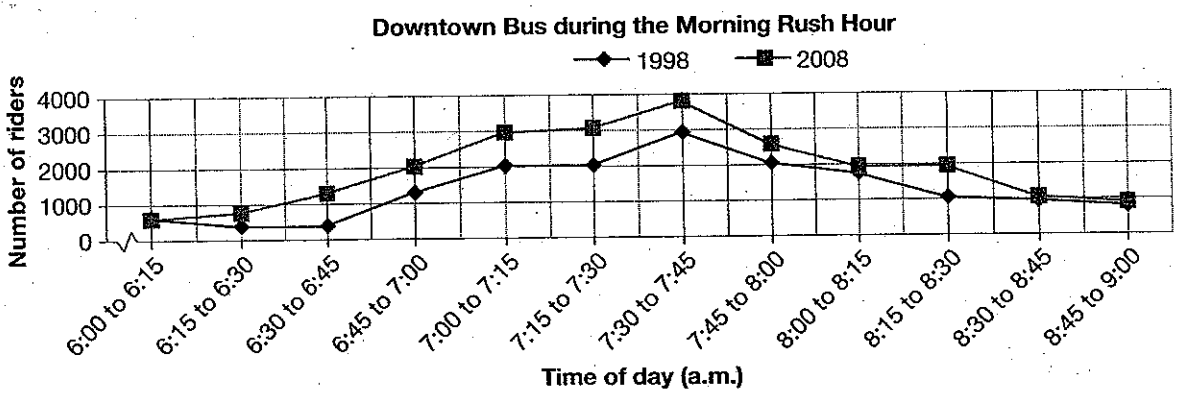
a) At what time of the day are the UV rays at a dangerous level?

e.g., 11:30 a.m. to 3 p.m.

b) Should Jerod reapply his sunscreen after 5 p.m.? Explain.

No. e.g., The UV index is low, so sunscreen is not essential.

4. Farhan is preparing for a city planning meeting. He created this graph to show use of bus transportation in the past. He will use the data to predict transportation trends.



a) What trends does the graph show?

e.g., More people took the bus in 2008 than in 1998. In both years, the number of riders steadily increased until about 7:30 a.m., and then gradually decreased.

b) Farhan said, "The bus system made more money in 2008 than it did 10 years earlier." Complete.

- This would be true if e.g., rider fares and expenses stayed the same.
- This would be false if e.g., expenses, such as the cost for more buses, increased more than revenue.

5. How does the appearance of a graph affect your point of view?

e.g., Starting the values at a different number along the vertical axis can affect the point of view.

Chapter Review

People Working at Site	
Type of work	Number
plumbers	4
electricians	3
carpenters	8
drywallers	5
painters	6
cleaners	3
tile setters	2
technicians	4

1. Joanne created this chart about people working at a housing construction site.

   a) Use paper or graphing software. Graph the data in two different ways. Justify your choices.

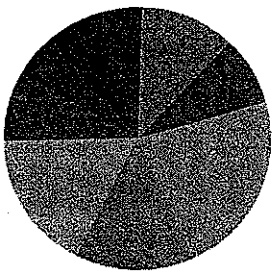
   e.g., circle graph, because the data is part of a whole; bar graph, because I can compare the heights of the bars.

   b) Use your graphs to answer these questions.

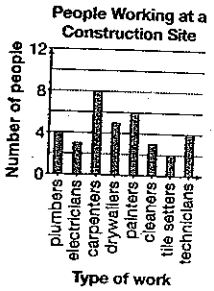
   - How many workers are in the largest three groups? 19
   - Which two groups make up about half the people? carpenters and painters
   - About what percent of the people are either drywallers or painters? about e.g., 30 %

1. a) e.g.,

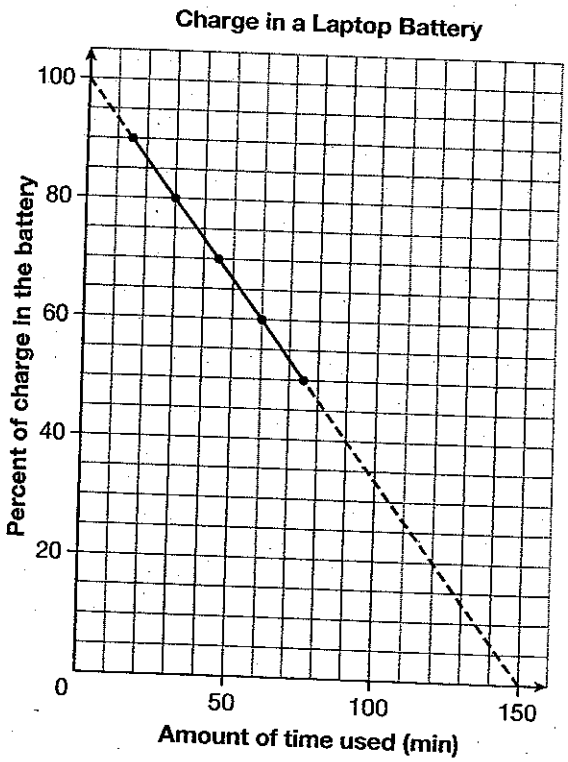
People Working at a Construction Site



- plumbers
- electricians
- carpenters
- drywallers
- painters
- cleaners
- tile setters
- technicians



2. Chad created this graph for customers at his computer store.



   a) What percent of the charge does this battery have left after each length of time?

   25 min e.g., about 83%

   5 min e.g., about 95%

   90 min e.g., about 40%

   100 min e.g., about 35%

   b) How long does it take for the battery to lose all its charge?

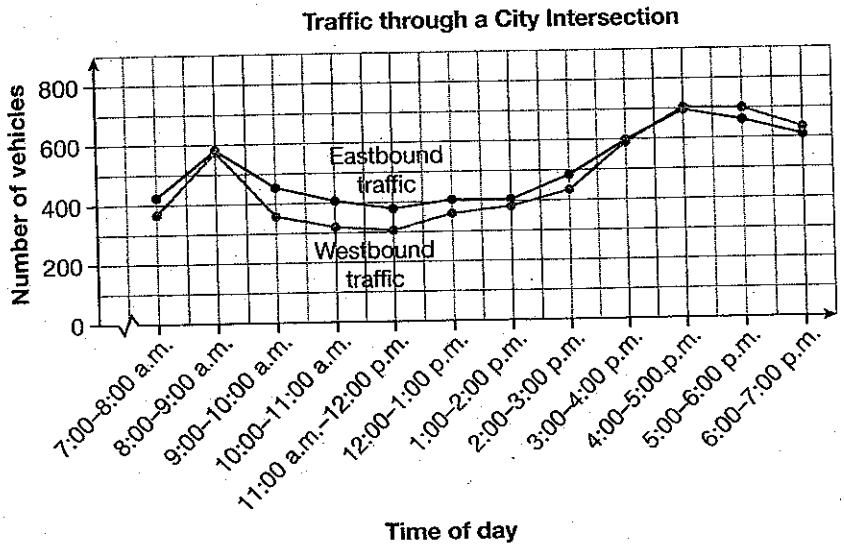
   e.g., after about 150 min

   c) What trend does the graph show?

   e.g., The battery's charge decreases as the amount of time it is used increases.

3. Jon and some friends counted the traffic at an intersection one day.

a) When is traffic heaviest? e.g., from 4 p.m. to 6 p.m.



b) When is the number of vehicles travelling in both directions about the same?

e.g., between 8 a.m. and 9 a.m. and between 3 p.m. and 5 p.m.

c) Did you interpolate or extrapolate for Part b)?

I interpolated, e.g., I estimated data between points on the graph.

d) How does the graph show each point of view?

- From 7:00 a.m. to 4:00 p.m. eastbound traffic is heavier than westbound traffic. So the traffic lights should be set to stay green longer.

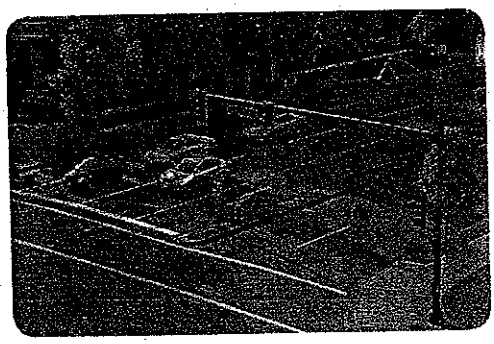
  e.g., The line drawn for eastbound traffic is above the line drawn for westbound traffic during those 9 h.

- The best time to schedule road repairs is from 9 a.m. to 2 p.m.

  e.g., The least traffic in either direction occurs during those 5 h.

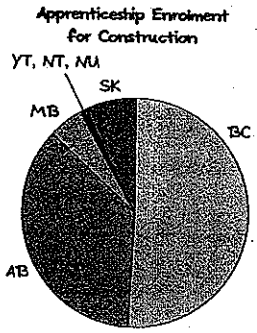
e) Describe the trend. Why do you think this happens?

e.g., The traffic increases during morning rush hour until 8:00 to 9:00 a.m., when people are driving to work. It decreases until early afternoon. Then it increases until about 5:00 p.m. or 6:00 p.m., when people are driving home from work.



Chapter Test

1. a) e.g.,



1. Kelly researched the number of people in building construction apprenticeship programs in a recent year.

Province or Territory	Enrolment
BC	13 885
AB	9655
MN	1440
YT, NT, NU	355
SK	1800
Total	27 135

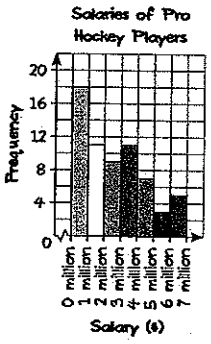
a) Create a circle graph for the data.

b) British Columbia has about half of the total registrations.

c) Louise says that the program was not very popular in the territories. Nic disagrees. Why might he disagree?

e.g., If most of the eligible people in the territories registered, it was popular. The number of eligible people there is less than in the provinces, so the number of registrations should be lower.

2. a) e.g.,



2. a) Graph this data about salaries of pro hockey players. Justify your choice of graph. e.g., histogram, because the bars show the changes

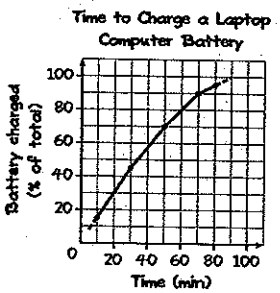
Salaries (million $) (over, including)	Frequency
1 or less	18
1–2	11
2–3	9
3–4	11
4–5	7
5–6	3
6–7	5

b) What trend do you see?

e.g., As the salary increases, the number of players decreases.

c) What fraction of the players make more than $5 million? about $\frac{1}{8}$

3. a) e.g.,



3. a) Create a line graph for the data for the length of time to charge a computer battery.

Time (min)	Battery charged (% of total)
10	15
30	45
50	70
70	90
80	95

b) What percent is the charge after 75 min? about 93%

after 5 min? about 8%

c) How long is it until the battery is half charged? about 35 min

fully charged? about 90 min