Applied Math 9
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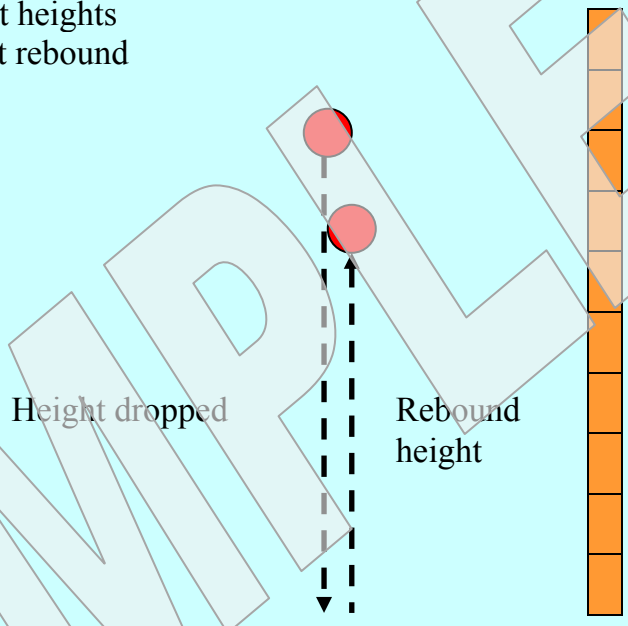
DATA MANAGEMENT AND RELATIONSHIPS

A grade 9 mathematics class is conducting experiments and recording their data.

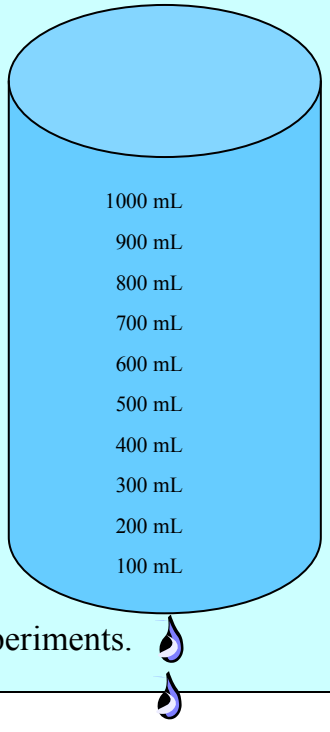
Calum's group will carry out these experiments and record the data:

1. Drop rubber balls from different heights and record the height of the first rebound



2. Record the temperature of a hot cup of coffee at regular intervals as it cools.

3. Record the amount of liquid in a can at regular intervals as the liquid leaks from a small hole in the bottom of the container.



You should carry out one or more of these or similar experiments.

This is the data that Calum's group collected.

Experiment 1: The Bouncing Ball

Height (cm)	Rebound Height (cm)
40	36
80	70
120	100
160	132
200	171
240	201
280	235
320	275

Experiment 2: The Cooling Cup

Time (min.)	Temperature °C
0	80
10	62
20	50
30	41
40	35
50	31
60	28
70	25
80	24

This is primary data for Calum's group; they collected it. If you use it, it becomes secondary data for you.

Experiment 3: The Leaking Cup

Time (sec)	Water In Container (mL)	Time (sec)	Water In Container (mL)	Time (sec)	Water In Container (mL)	Time (sec)	Water In Container (mL)
0	1000	150	660	300	435	450	285
30	890	180	600	330	395	480	260
60	825	210	560	360	370	510	240
90	770	240	505	390	340		
120	710	270	475	420	305		

You may be able to borrow a graduated cylinder from a science classroom to collect the water leaking out.

Scatter Plots And Graphs

12 students belong to a cross-country running club. Their ages and heights are given in the table.

Name	Age (years)	Height (cm)
Faisel	8	116
O'Neil	9	121
Jarvis	9	119
Steven A.	9	123
Bern	10	131
Cherise	10	129
Jenna	11	137
Maureen	11	131
Carole	11	140
Jevon	11	128
Akila	12	141
Steven W.	13	150

Their ages and heights can be written as ordered pairs.

For Bern, the ordered pair is (10,131).

Bern is 10 years old and is 131 cm tall.

This ordered pair is shown in the scatter plot.

Complete the scatter plot using the other 11 points.

Choose any 3 points in the scatter plot. Label them A, B, and C.

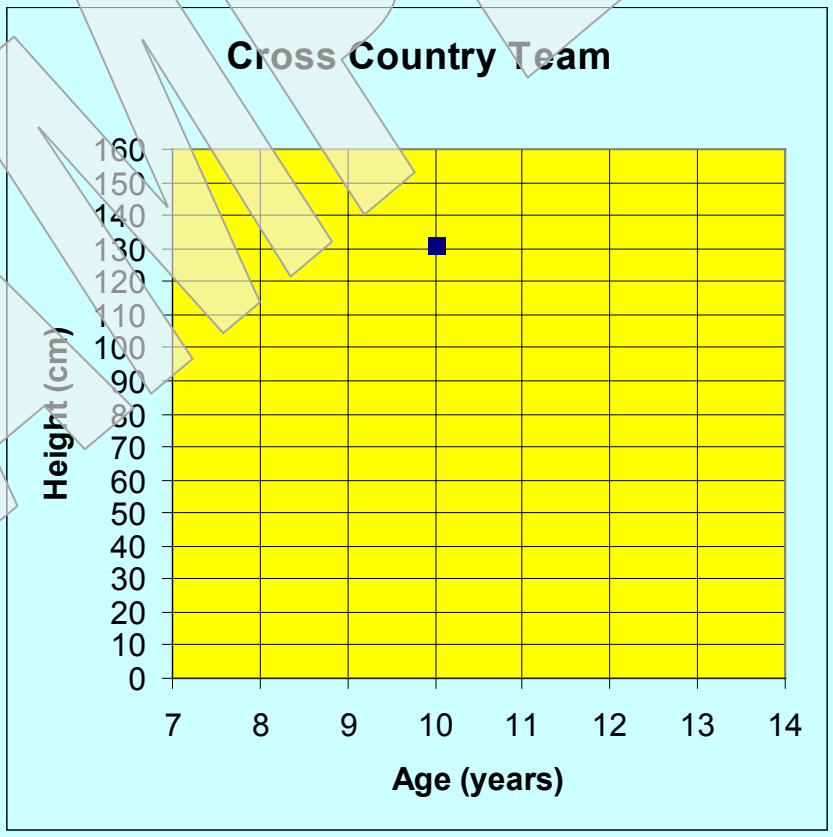
List the ordered pairs below.

Explain what each ordered pair represents.

A(____,____)
A represents a student who is ___ years old and ___ cm tall.

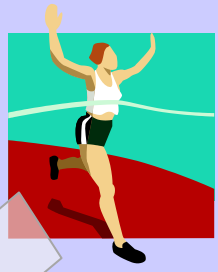
B(____,____)
B represents a student who is ___ years old and ___ cm tall.

C(____,____)
C represents a student who is ___ years old and ___ cm tall.



Use this scatter plot to answer these questions.

Look at the ordered pair representing Bern.
How many students are younger than Bern? _____ How do you know this?
List the students who are younger than Bern.



How many students are older than Bern? _____ How do you know this?
List the students who are older than Bern.

How many students are taller than Bern? _____ How do you know this?
List the students who are taller than Bern.

How many students are shorter than Bern? _____ How do you know this?
List the students who are shorter than Bern.

How many students are the same height as Bern? _____ How do you know this?

How many students are younger than Bern, but taller? _____ How do you know this?
List the students who are younger than Bern but taller.

How many students are older than Bern, but shorter? _____ How do you know this?
List the students who are older than Bern, but shorter.

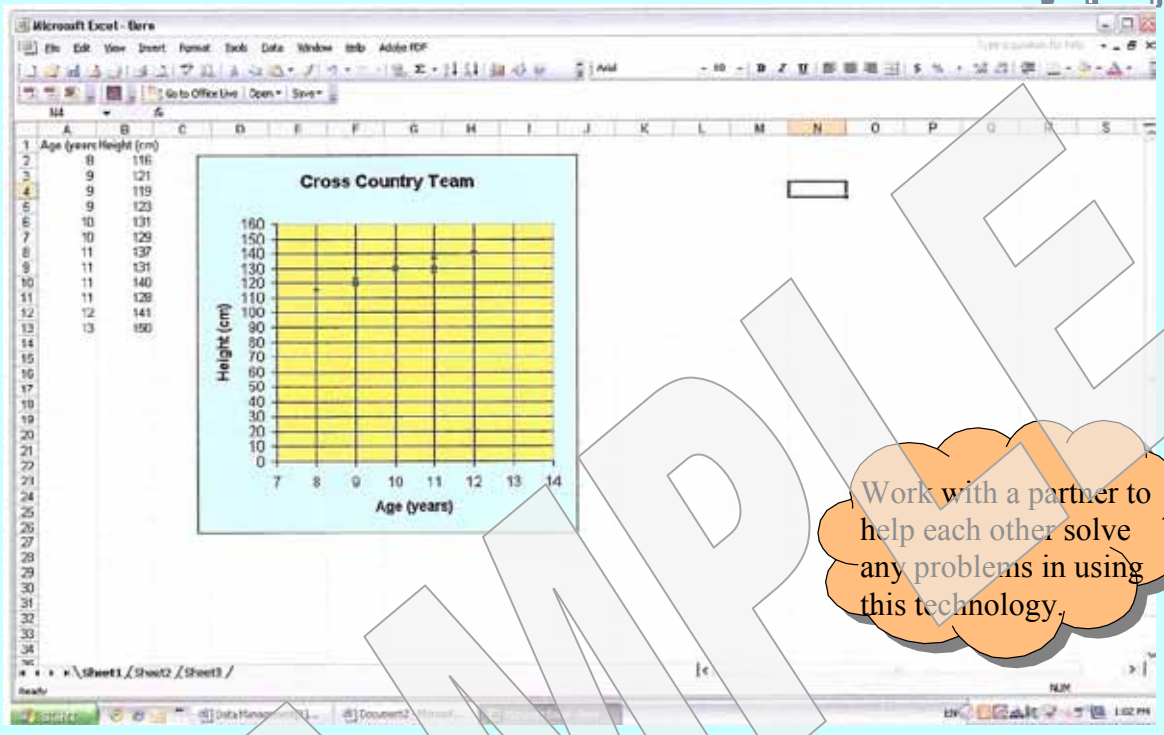
How did you use the scatter plot to help you answer questions like these? Explain.

Compare with a partner.

Using Technology To Create Scatter Plots And Graphs

Microsoft Excel can be used to create scatter plots and graphs.

The table in a spreadsheet is shown. By selecting Insert/chart from the menu, you can then create a spreadsheet.
This is what your spreadsheet and scatter plot should look like.



Work with a partner to help each other solve any problems in using this technology.

If you use a graphing calculator such as TI84, you can select Stat/Edit and enter the data into L1 and L2.

L1	L2
8	116
9	121
9	119
9	123
10	131
10	129
11	137
11	131
11	140
11	128
12	141
13	150

You can then set the window as shown. Then select STAT PLOT.

X min = 7
X max = 14
X scl =1
Y min = -10
Y max = 160
Y scl = 10
X res =1

STAT PLOTS:
1:Plot 1…On
|___ L1 L2
2:Plot 2…Off
|___ L1 L2

Turn STAT PLOT 1 On. Use the Graph key to obtain the scatter plot.

Temperatures In ^{o}C and ^{o}F

We use ^{o}C (Celsius) to measure and describe temperatures.
Some people still use ^{o}F (Fahrenheit) when measuring temperatures.

Temperature (^{o}C)	Temperature (^{o}F)
– 40	– 40
– 30	– 22
– 20	– 4
– 10	14
0	
10	
20	
30	
40	

Complete the conversion table.
Compare with a partner.

Temperatures can be converted from Celsius to Fahrenheit using the formula

$$F = \frac{9}{5}C + 32$$

The first one is done here.

$$F = \frac{9}{5}(-40) + 32$$
$$= \frac{-360}{5} + 32$$
$$= -72 + 32$$
$$= -40$$

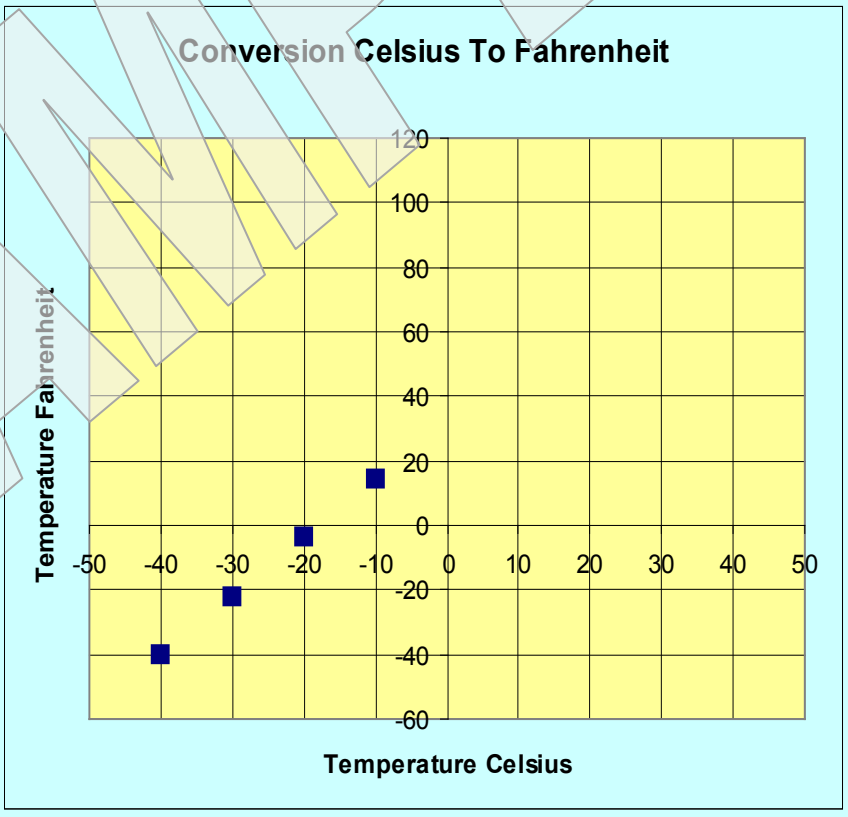
Which countries still use the Fahrenheit scale? Use the Internet to find 3 countries.

The first 4 ordered pairs of this data set have been plotted.

Complete the scatter plot.

Draw a line through the set of points.

Is this relationship linear? Explain why.



Use the graph to estimate (or the equation to calculate) each equivalent temperature.

15 ^{o}C = _____ ^{o}F	32 ^{o}C = _____ ^{o}F	_____ ^{o}C = 18 ^{o}F
– 50 ^{o}C = _____ ^{o}F	_____ ^{o}C = – 18 ^{o}F	_____ ^{o}C = – 30 ^{o}F

Testing Your Hypothesis

In a recent survey, the favourite pizza toppings were pepperoni, mushrooms and sausage.

What do you think the most popular pizza topping is in your class?

Form your hypothesis. Use these selections; or in a class discussion, replace any that are not fitting for your class.

I think that the most popular pizza topping in my class is _____.

How can you find out whether your hypothesis is correct?

Test your hypothesis by giving each student a small piece of paper to record their choice.
Give them the choices:

A: pepperoni B: mushrooms

C: sausage D: other

My choice is
A B
C D
Circle one

How will you deal with someone who does not like pizza? Are there any other problems that can arise with the survey? How can you solve them?

Collect the papers and record the selections in a Tally Chart.

Pizza Topping	**Tally**	**Frequency (Number Of Students)**
Pepperoni		
Mushrooms		
Sausage		
Other		

Was your hypothesis correct? Explain.

1. Each student was asked to mark their choice on a piece of paper and submit it anonymously.

   Why do you think this is important? Explain.

What are the favourite pizza toppings in 3 other countries? Use the Internet to find out.

2. Do you think that the data for your class would represent:

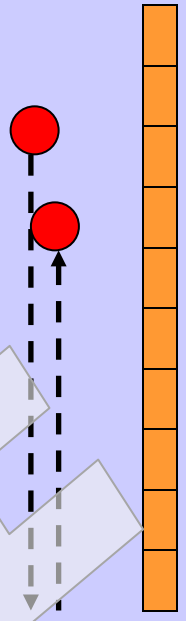
all grade in your school?	all grades in your city?

Explain. Compare with a partner.

Does the height of the first rebound of a rubber ball depend on the height from which it was dropped? If so, how?

What do you think? Work with a partner.
Our hypothesis is:_____

_____



Choose a ball.
Select 8 different heights from which to drop the ball.
Drop the ball four times from each of these heights.
Record the height of the first rebound.
Then calculate the average height of the first rebound.

Record your data below.

Height Of Ball When Dropped (cm)	Trial				Average First Rebound Height (cm)
	1	2	3	4	

Create a scatter plot to display your data.

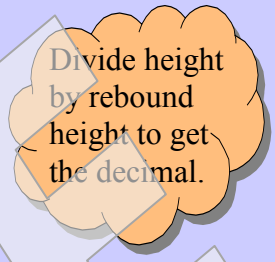
Does your data support your hypothesis?
Explain.

Math Talk
Work with a partner.
Repeat this experiment with a different type of rubber ball.

Look at your table of heights and heights of the first rebound.

Copy your heights and rebound heights into this table. Then complete the 3rd column.

Height (cm)	Average Rebound Height (cm)	$\frac{\text{Height}}{\text{Rebound Height}}$	
		Decimal	**Percent**



Estimate the percent the rebound height is of the height dropped. _____

Write an equation to describe this relationship.

R = _____%×h where R is the first rebound height (cm)

or R = 0._____ h and h is the height the ball was dropped (cm).

Choose 3 different heights that you did not use in the experiment.
Then use the equation to predict the height of the first rebound.
Test your predictions by repeating the experiment.

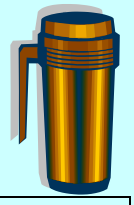
Height (cm)	My prediction: R = 0.___h	Average First Rebound Height (cm)

Were your predictions correct? Discuss with your partner. Compare with other groups.

Are there other factors or conditions that might affect the results of your experiment? Discuss. Compare with other groups. Record your findings in your journal.

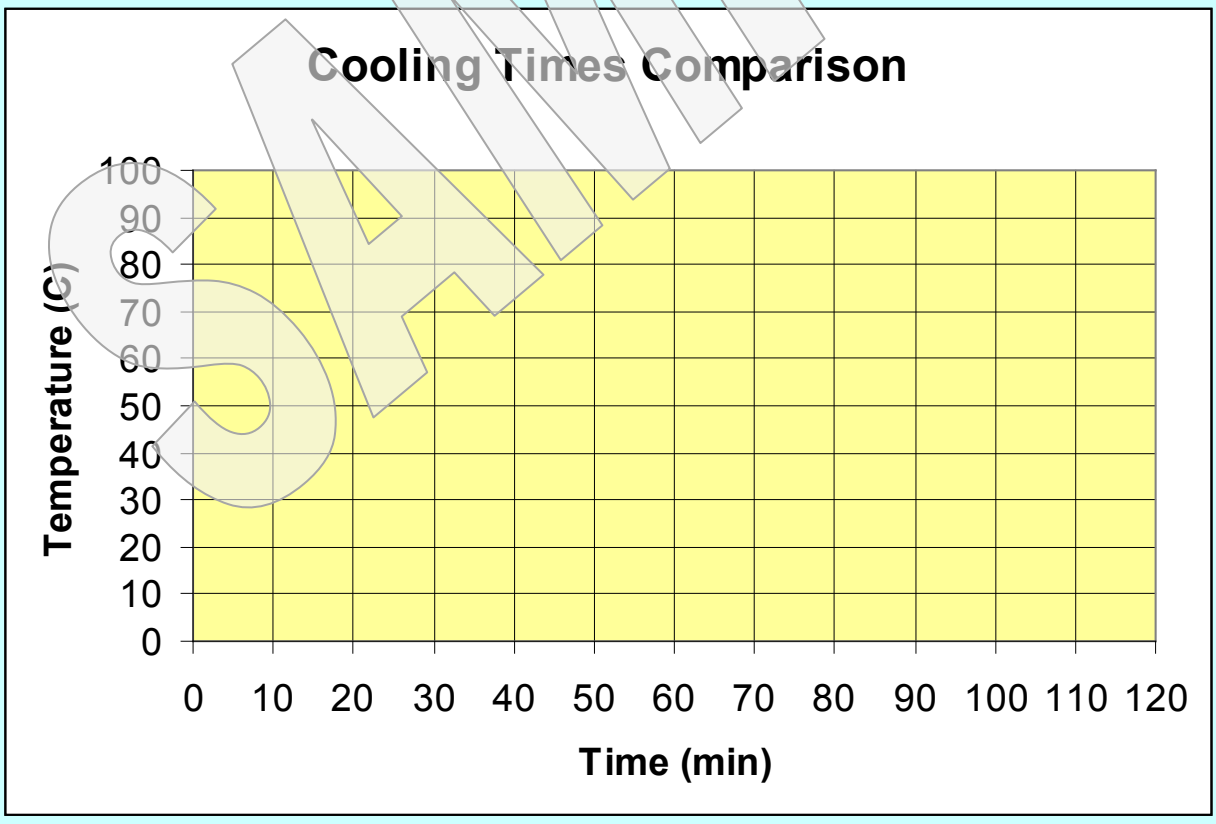
Investigations And Relationships

Calum and his classmates performed a number of experiments. Some of the data is recorded in the introduction to this chapter. Another group in his class investigated the cooling of a hot cup of coffee in a regular cup and in a thermal cup.
This is their data.



Regular Cup		Thermal Cup	
Time (min)	Temperature (^oC)	Time (min)	Temperature (^oC)
0	80	0	80
10	62	10	70
20	50	20	62
30	41	30	55
40	35	40	49
50	31	50	45
60	28	60	41
70	25	70	37
80	24	80	34

Complete the scatter plot using the 2 sets of data. You can use paper and pencil, a spreadsheet, a graphing calculator or graphing software.



Draw a line or smooth curve of best fit through each set of points.

Work with a partner.

What is the same about the 2 graphs?

Explain your answers.

What is different?

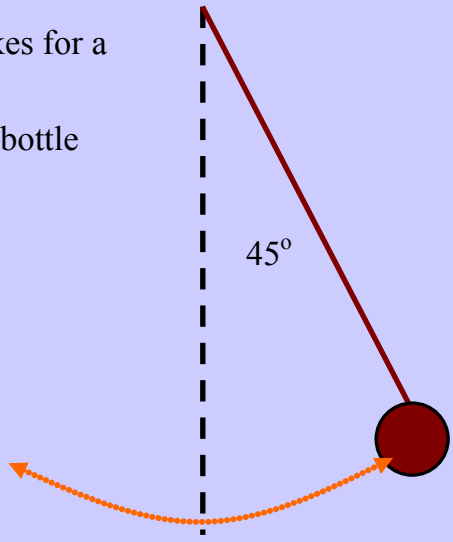
Room temperature is often considered to be 20°C.
How long will it take for the temperature to reach 20°C in each cup?

What do you think the effect will be if you add sugar and milk or cream in the beginning? Discuss. You may wish to try this and repeat the experiment.

Here are some ideas for experiments that you can try in your classroom.

1. Measure and record the temperature of ice water in a plastic cup and in an insulated mug over a 30 min period.
2. Does the length of a pendulum affect the time it takes for a pendulum to make 5 swings?
3. How long will it take for water to drain from a 2 L bottle with (i) one hole (ii) two holes in the bottom

Do you have other ideas? List them below.



Form groups. Choose an experiment to carry out.
Complete the experiment and record your results on the next page.

Names: _____

Description of the Experiment:

Picture of Experiment:

Our Data:

Display your data using a scatter plot or a spreadsheet. You may also copy the display of a graphing calculator here.
Draw a line or smooth curve of best fit.

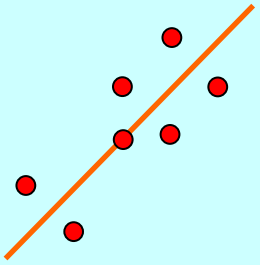
Discuss any factors that might affect the results of your experiment.
How might you change the experiment to account for these factors?

Positive And Negative Correlation

Older students are usually taller. Both age and height increase together.
There is a positive correlation between age and height of a student.

When you walk home from school at a faster rate, it takes less time. As the rate increases, the time decreases. There is a negative correlation between rate of walking and time.

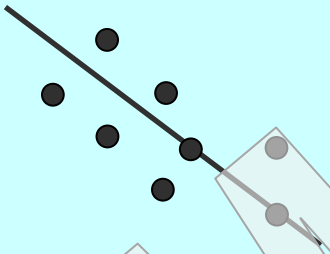
Look at the scatter plots below. Where possible, a line of best fit is shown.



This pattern of points rises to the right.

Does this scatter plot show a positive or negative correlation? _____

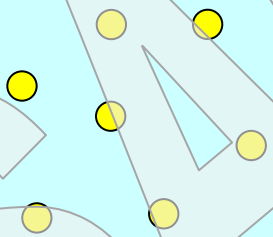
This means that both quantities _____ together.



This pattern of points falls to the right

This scatter plot show a _____ correlation.

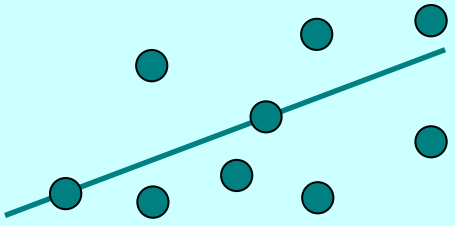
This means that as one quantity increases, the other quantity _____.



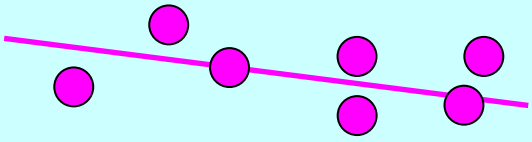
A scatter plot shows _____ correlation when there is no pattern.

The correlation may be weak or strong.

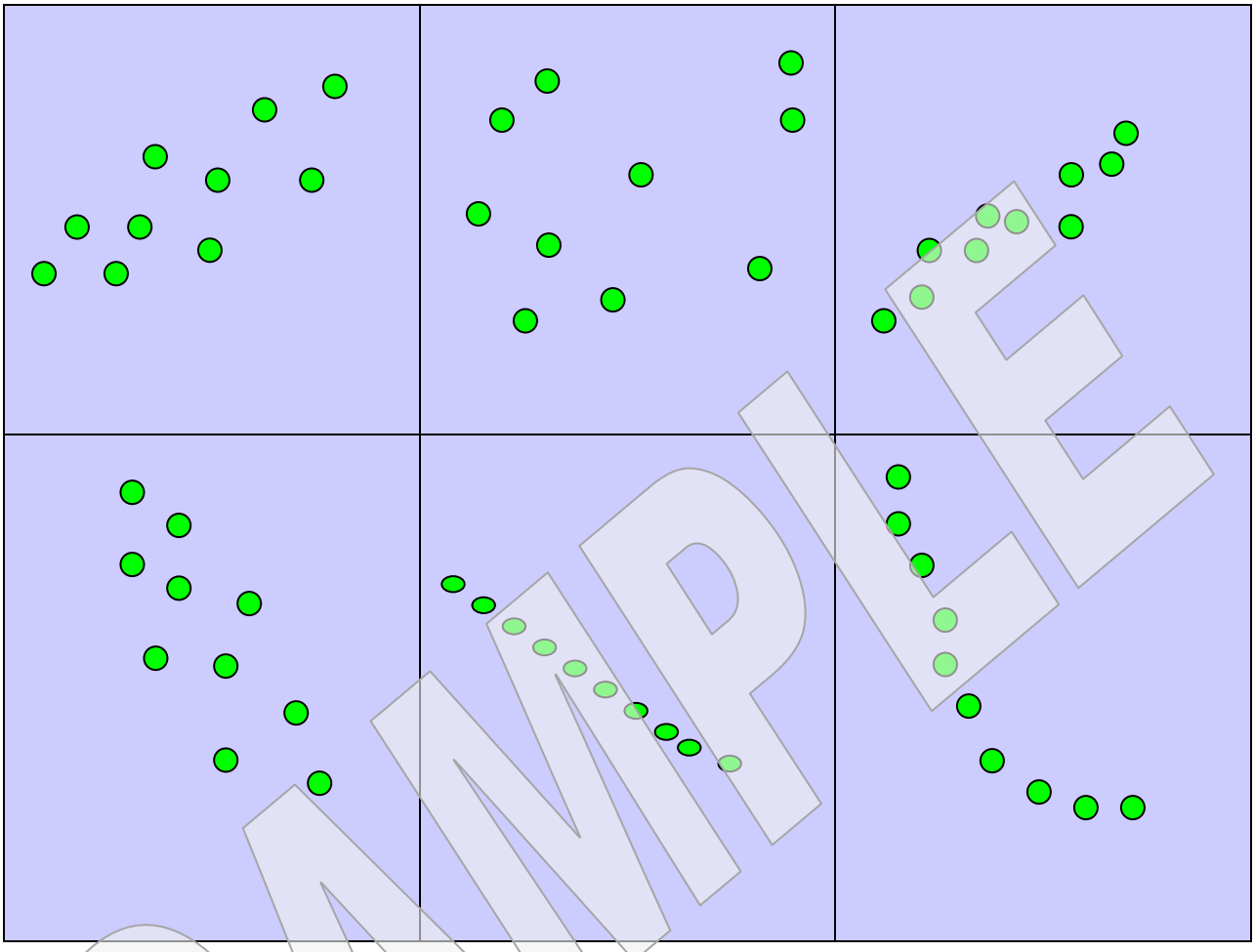
Weak _____ correlation



Strong _____ correlation



1. Look at the scatter plots below.
   Describe each relation as no correlation, positive, negative, strong, weak, linear, non-linear.
   Draw a line or smooth curve of best fit where appropriate.



2. Draw a scatter plot to represent each correlation.
   Draw a line or smooth curve of best fit.

weak positive linear	strong negative linear	strong positive non-linear

Read and complete a hypothesis for each situation.
Draw a line or curve of best fit for each scatter plot.
Describe the correlation for each scatter plot. Use words like no correlation, positive, negative; strong, weak; linear, non-linear. Was your hypothesis correct?

1. Do players who weigh more hit more home runs?

My hypothesis:

I think that the weight of a player

_____

_____

Type of correlation:

Is my hypothesis correct? Explain.

This data set was taken from a Toronto Blue Jays team.
What other factors will affect the number of home runs that a player hits?

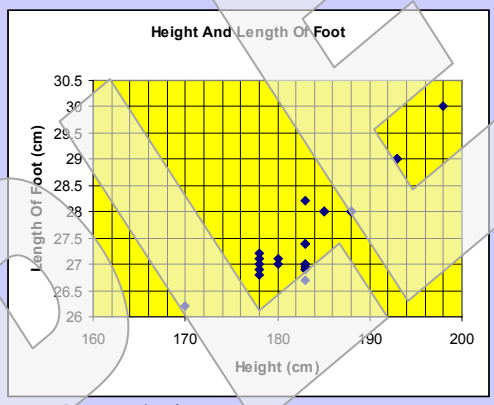
How could you redesign this survey (on weight and number of home runs) to take these other factors into consideration? Describe your method.

2. How does the height of a person affect his/her foot length?

My hypothesis:

I think that _____

_____.



Type of correlation:

Is my hypothesis correct? Explain.

Choose any point on the line of best fit.

The ordered pair is (_____,_____).

Estimate the percent that the foot size is of the height.

Write an equation to describe the relationship.

F = _____%xh or F = 0.___h

Measure the height of 2 students in your class.

Height: Student _____ cm Student _____cm

Use your equation to predict their foot lengths.

Foot Length: Student _____ Student _____

Check by measuring.
How accurate were your predictions?

If the foot length is 16.5 cm, how tall is the person?

Trends

A trend is a general direction in which something moves, generally over time.

Look at the information in the table.

Internet Users At Home	% Of Individuals		
	2005	2007	2009
E-mail	91.3	92.0	93.0
Booking Travel	63.1	66.1	66.2
Obtaining Music	36.6	44.5	46.6

The trend for E-mail Users At Home can be described as

"continuing to increase, approaching 100%".

Describe the trends for:

Booking Travel:

Obtaining Music

Compare with a partner. Discuss the wording in describing each trend.

How do you think the winning times in Track Events have changed over the last 10 Summer Olympics? Do you think that the times have increased or decreased?

Why do you think this? Discuss with a partner.

Complete your hypothesis to describe this trend.

I think that the times in the last 10 Summer Olympics have _____ in Track Events.

Look at the winning times for the Men's 100 m Track event in the table.
If there have been other Summer Olympics after 2008, record the times in the table.

Use a spreadsheet, graphing calculator or paper and pencil.

Create a scatter plot with this data.
Draw a line or smooth curve of best fit.

Describe the trend.

Extend your line of best fit to predict the times for the next 4 Summer Olympics.
Record your predictions in the table.

How realistic do you think your predictions are? Discuss with your partner.

Year	Winning Time (sec)
1972	10.14
1976	10.06
1980	10.25
1984	9.99
1988	9.92
1992	9.96
1996	9.84
2000	9.87
2004	9.85
2008	9.69

Investigate another Track Event over the same years to see if the same trend occurs?

Work with a partner.
Choose another Track Event. Use the Internet to find the winning Olympic times.
Create a scatter plot and draw the line or smooth curve of best fit.

Does this trend support your hypothesis? Explain.

Sometimes trends may be expected, but the data does not support the expectations.

Recent health studies suggest that eating large amounts of beef and pork (red meat) may lead to an increased risk of certain types of cancer.
How would you expect the consumption of red meat to have changed over this period?

Write this as a hypothesis.

I expect that the consumption of red meat has _____ over the last few years.
Now look at the data in the table.

Use a spreadsheet, graphing calculator or paper and pencil.

Create a scatter plot.
Sketch your results below.

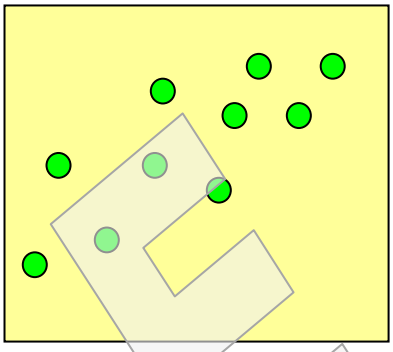
Year	Red Meat/Person (kg)
2004	61.23
2005	56.55
2006	56.76
2007	58.48
2008	55.52

Draw a line or curve of best fit.
Does the graph and data support your hypothesis? If not, why not? Explain.

Chapter Test

Multiple Choice: Circle the correct answer for each.

1. How would you describe the correlation shown in this scatter plot?

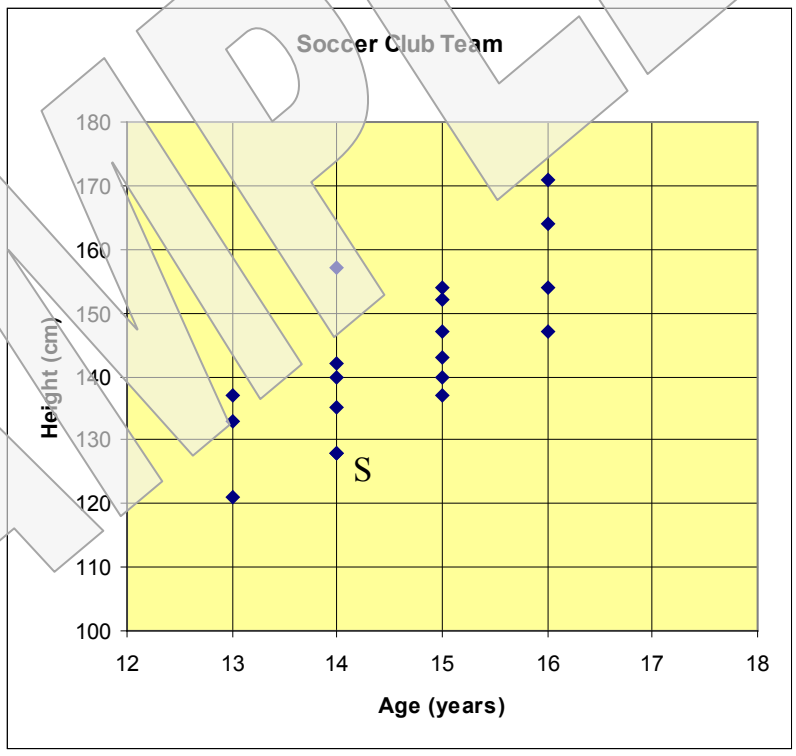


A.	Strong Negative	B.	Strong Positive
C.	Weak Negative	D.	Weak Positive

2. Look at the scatter plot of the ages and heights of players on a club Soccer team.

Serena's height is labelled S in the scatter plot.

How many team members are younger but taller than Serena?



A. 1
B. 2
C. 3
D. 4

3. The height of the first rebound of a SuperBall can be described by the equation

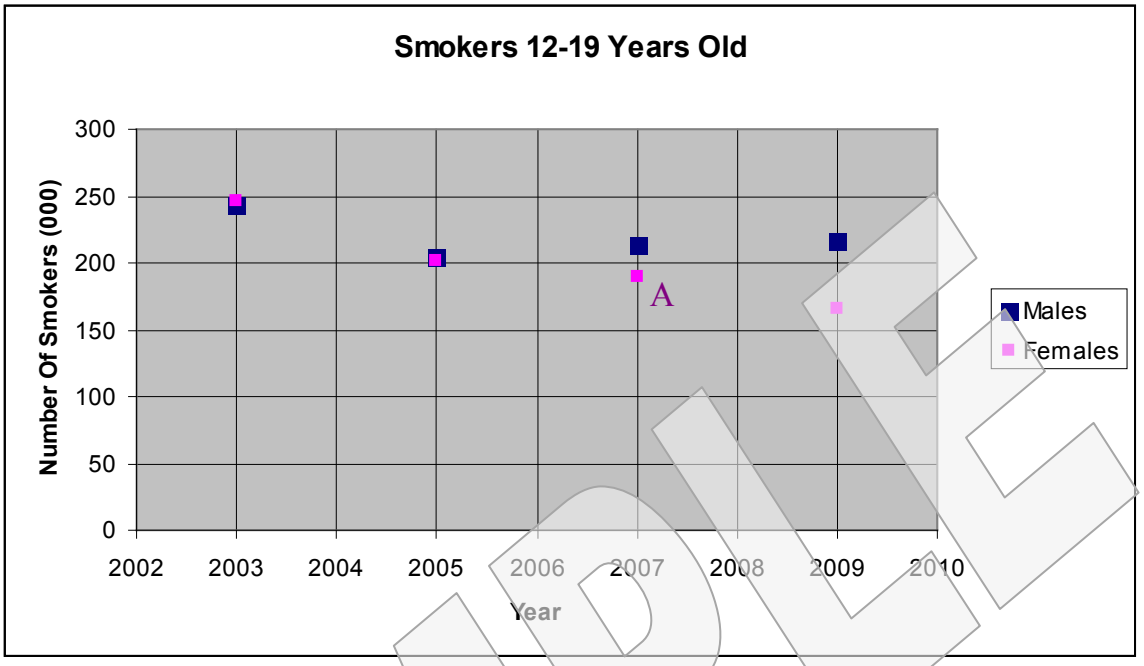
$$R = 0.87\,h$$

If the ball rebounds 35 cm, from what height was it dropped?

A.	30 cm	B.	40 cm	C.	60 cm	D.	90 cm

Short Answer: Write your answers in the spaces provided.

4. This scatter plot shows the number of teen-age smokers from 2003 to 2009.



Estimate the ordered pair labelled A? (_____ , _____)

Explain the meaning of this ordered pair?

Look at the graph for the males.
Is there a trend? If yes, describe the trend. If no, explain.

Look at the graph for the females. Draw a line of best fit. Justify the type of line you drew.

Is there a trend? If yes, describe the trend. If no, explain.

