Prerequisite Skills

Lesson objectives

- I know how to create and use scatter plots
- I can use technology to create a scatter plot
- I can use linear models to solve problems
- I can identify bias
- I can use summary statistics to analyse one-variable data
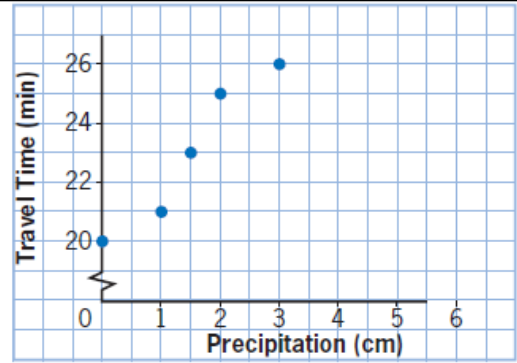
1.1

| Lesson objectives | Teachers' notes | Lesson notes |

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Solutions

1. The graph shows a commuter's travel time in minutes versus the amount of daily precipitation in centimetres.
   a) Describe the trend in the data.
   b) Suggest why this trend may exist.

a) The trend is that as the amount of precipitation increases, commuter's travel time increases too.

b) This trend may exist because as precipitation increases, visibility and speed will decrease leading to an increase in travel time.

2. The table shows Anna-Marie's average speed for a number of running races.
   a) Create a scatter plot of the data.
   b) Describe the trend.
   c) Estimate Anna-Marie's speed for a 750-m race. Explain your method.

| Distance (m)	Average Speed (m/s)
100	8.1
200	7.5
500	6.6
1000	6.1
1500	5.2

a)
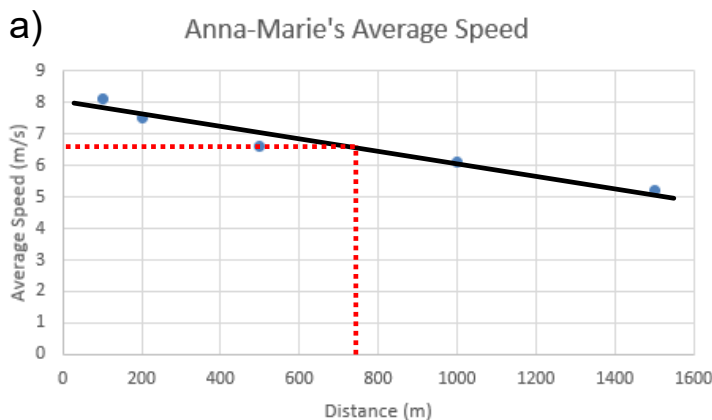
b) The trend is that as the distance of the race increases, Anna-Marie's average speed decreases.

c) Draw a line of best fit and then from the x-axis draw a vertical line up the line of best fit. Once you reach the line of best fit draw a horizontal line across to the y-axis and read the value of the average speed.

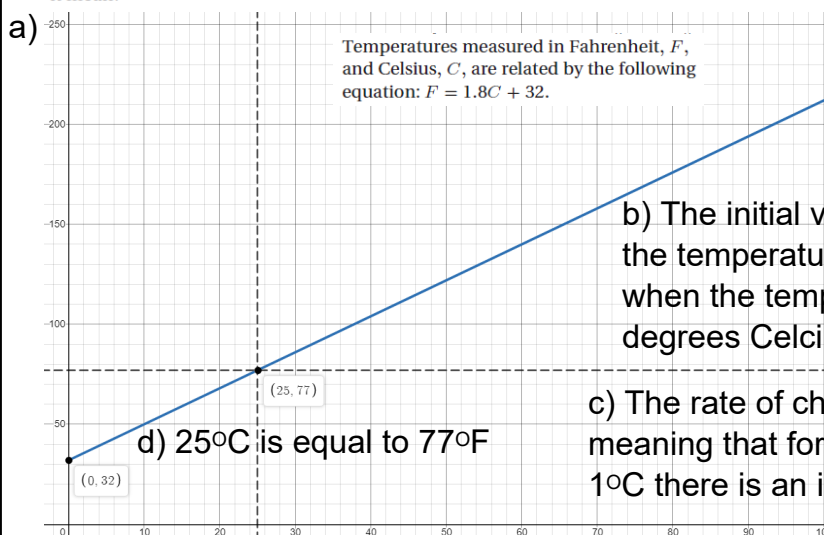Average speed for a 750 m race = 6.5 m/s

3. **a)** Use a graphing calculator to create a scatter plot for the data.

   b) Is there a trend in the scatter plot? If so, describe it.

Goals	Assists
21	30
18	24
35	30
12	13
27	37
6	9
40	55
32	31

a)
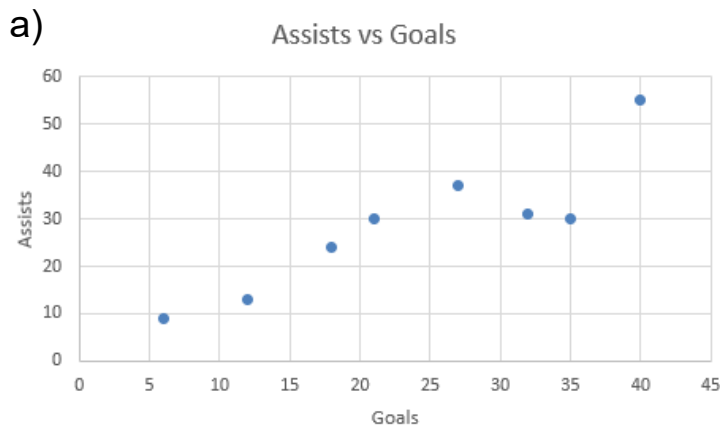
Assists vs Goals

b) The trend is that as goals increase, assists also increase. It is a positive trend. However, there are two outliers [(32,31) and (35,30)].

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4. **a)** Graph the relation for $C = 0°$ to $C = 100°$.
   b) Identify the initial value. Explain what it means.
   c) Identify the rate of change. What does it mean?
   d) Use the graph to convert 25 °C to degrees Fahrenheit.
   e) Check your answer using the equation.
   f) Which method do you prefer, and why?

a)

Temperatures measured in Fahrenheit, F, and Celsius, C, are related by the following equation: $F = 1.8C + 32$.

$(25, 77)$

d) 25°C is equal to 77°F

$(0, 32)$

b) The initial value is 32. This is the temperature in Fahrenheit when the temperature is zero degrees Celcius.

c) The rate of change is 1.8 - meaning that for every increase of 1°C there is an increase of 1.8°F.

e) F = 1.8C + 32

   F = 1.8(25) + 32

   F = 45 + 32

   F = 77

5. a) Use the equation to convert 50 °F to degrees Celsius.
   b) Check your answer using the graph.
   c) Which method do you prefer, and why?

Temperatures measured in Fahrenheit, F, and Celsius, C, are related by the following equation: $F = 1.8C + 32$.
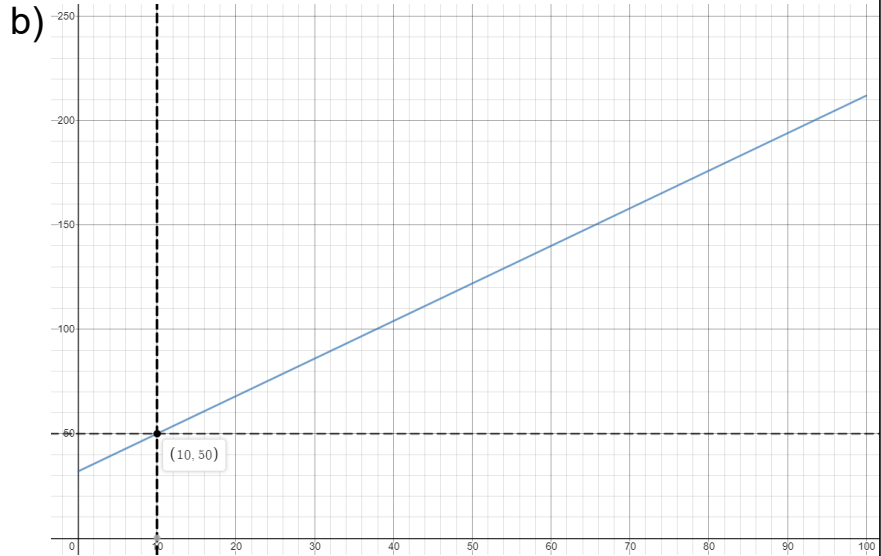
a) F = 1.8C + 32

    50 = 1.8C + 32

    18 = 1.8C

    18/1.8 = C

    10 = C

    50ᵒF = 10ᵒC

b)

(10, 50)

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6. A student council surveys the football team to see if they should ask the principal for an increase in the football program's budget.

a) How is bias present in this study?

b) What could be done to remove the bias?

Literacy Link

Bias occurs when data are collected or presented unfairly. It can lead to an inaccurate interpretation of the results of a statistical study.

a) Bias is present in this situation because the school council is only asking the football team if they should have a budget increase. This is an example of sampling bias.

b) One way to remove bias would be to ask the whole student body, not just the football team.

7. A radio talk show host asks callers if they think the current government should be unseated. Identify any potential sources of bias.

Literacy Link

Bias occurs when data are collected or presented unfairly. It can lead to an inaccurate interpretation of the results of a statistical study.

People who usually call into radio shows have extreme points of view. Those who are neither here nor there on a topic don't bother to call in. This is an example of non-response bias.

It is also an example of sampling bias because only those who listen to the radio show have the potential to respond. The listeners are unlikely to fairly represent the whole population.

8. The chart shows the heights of the players of a high school basketball team.

a) Determine the mean, median, and mode.

b) Explain why these measures of central tendency are not all equal.

c) Determine the standard deviation and z-score for a height of 1.9 m.

Player	Height (m)
Sarah	1.8
Jessica	1.5
Tina	1.5
Latisha	1.5
Uma	1.4
Kyla	1.9
Mina	1.4
Luisa	1.6
Sangita	1.5
Caroline	1.9

a) Mean = Total ÷ # of Players

$\quad\quad$ = 16 ÷ 10

$\quad\quad$ = 1.6 metres

Median = 1.4, 1.4, 1.5, 1.5, (1.5, 1.5,) 1.6, 1.8, 1.9, 1.9

$\quad\quad$ = 1.5 metres

Mode = 1.5 metres (occurs 4 times)

b) Outliers have a greater effect on the mean than the median or mode. 7 of the 10 values are from 1.4 to 1.6. The other 3 are all larger so that is why, in this case, the mean is higher than the median and mode.

c)

Height (m)	x^2
1.4	1.96
1.4	1.96
1.5	2.25
1.5	2.25
1.5	2.25
1.5	2.25
1.6	2.56
1.8	3.24
1.9	3.61
1.9	3.61

Mean =	1.6
Sum x^2 =	25.94
n =	10
n x (mean^2) =	25.60
Standard deviation =	0.1844

$$z = \frac{x - \mu}{\sigma}$$

z = (1.9 - 1.6)/0.1844

z = 1.626...

Note: This is a population, **NOT** a sample, because all members of the team are accounted for.

9. The box plot summarizes students' quiz
   scores out of 10.
   a) Determine the range of scores.
   b) Determine the median score.
   c) What is the interquartile range and
      what does it represent?

a) Range = Max - Min

      = 10 - 3

      = 7

b) Median = Middle value (line inside the "box")

      = 7

c) IQR = Upper quartile - lower quartile (IQR = width of the "box")

      = 8 - 6

      = 2