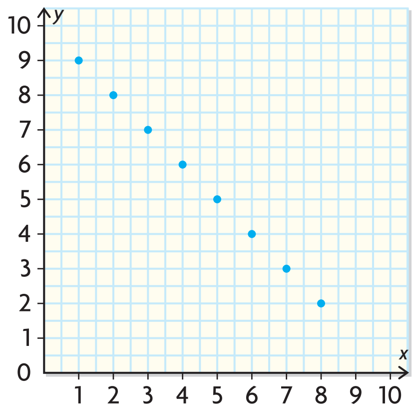
6 Chapter Review

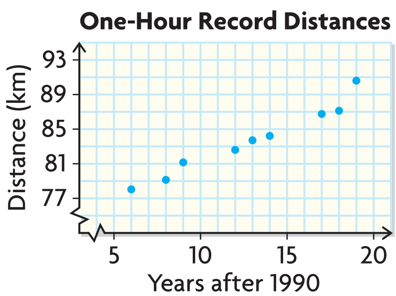
FREQUENTLY ASKED Questions

Q: Why is it better to use the regression function when interpolating from a set of data, rather than just using the data?

A: Sometimes, just using the data to interpolate may provide a reasonably accurate estimate. It depends on the data. If the data does not have much scatter, then just reading the points may provide an accurate estimate.



However, most real-life data has some scatter. To interpolate from the scatter plot below, you should use regression, which is a statistical analysis. Regression will produce an equation that will minimize the error in your estimate. With technology, you can perform regression easily. You can use the regression equation or line/curve of best fit to interpolate or extrapolate data values.



Study *Aid*

- See Lesson 6.3.
- Try Chapter Review Question 6.

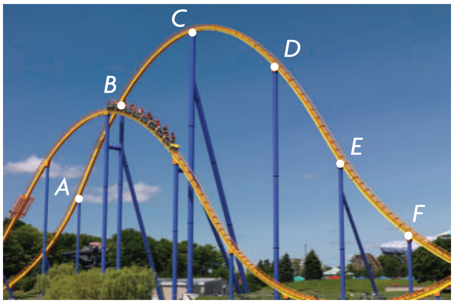
Study Aid

- See Lesson 6.4, Examples 1 and 2.
- Try Chapter Review Questions 7 to 9.

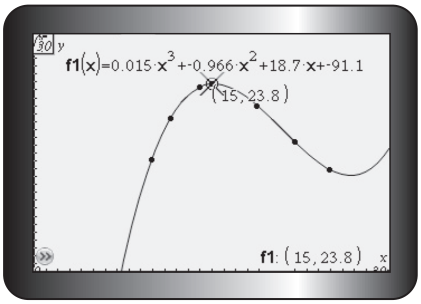
Q: How can you solve a problem involving a data set that can be modelled using a polynomial function?

A: Using a spreadsheet program or the statistical functions on a calculator, you can perform a linear, quadratic, or cubic regression to determine the line or curve of best fit and the equation of the regression function that represents the relationship between the given data. You can interpolate or extrapolate values by tracing along the graph or by substituting values into the equation of the regression function.

For example, the following points are marked on the track below: $A(9.9, 14.1)$, $B(11.5, 19.4)$, $C(14.0, 23.4)$, $D(18.8, 21.0)$, $E(22.0, 16.4)$, and $F(24.9, 12.9)$. In each point, the x-coordinate is the horizontal distance from the point of reference, and the y-coordinate is the vertical distance, both measured in metres. You can use cubic regression to estimate the maximum height of the roller coaster.



First, you need to plot the data and determine the curve of best fit using cubic regression. Then you can trace along the graph to the turning point, where the curve goes from increasing to decreasing.



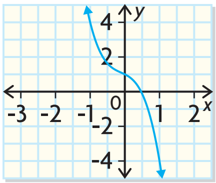
The maximum height of the roller coaster is 23.8 m on this stretch of track.

PRACTISING

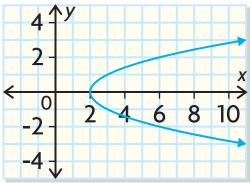
Lesson 6.1

1. Decide which graphs represent polynomial functions. Explain how you decided.

a)



b)



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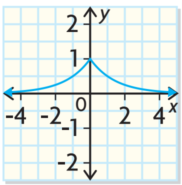

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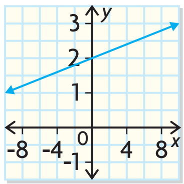

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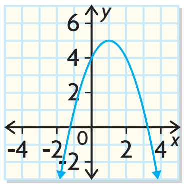

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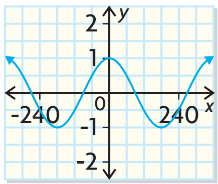


2. For each function that is a polynomial function, use its equation to determine the possible number of x-intercepts, the y-intercept, the domain, the range, and the possible number of turning points.

a) $f(x) = \frac{3}{x} + 2$

b) $k(x) = x^3 - 4$

c) $g(x) = -2(x + 4)^2$

d) $h(t) = \sqrt{(t^2 - 3)}$

Lesson 6.2

3. Determine the y-intercept, the end behaviour, the domain, and the range of each polynomial function.

a) $f(x) = -x^2 + x - 1$

b) $j(x) = 3x^3 - 2x + 5$

c) $p(x) = x(x - 6)$

d) $r(x) = 2x + 5$

4. Describe the characteristics of the graph of each polynomial function.

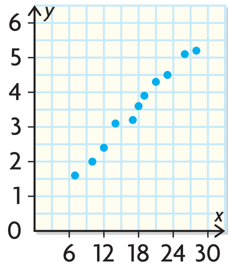
a) $g(x) = -\frac{1}{2}(x + 1)^2 - 4$

b) $f(x) = 2x^3 - x^2 - x$

Lesson 6.3

5. Estimate the slope and y-intercept of the line of best fit for each scatter plot.

a)



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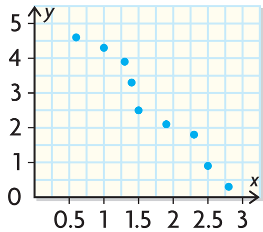

6. The cost of a taxi ride in Calgary, for several distances, is given in the table below.

Distance (km)	Cost ($)
37.95	70.49
2.22	8.40
86.47	152.77
3.55	10.89
19.16	37.76
34.66	64.16
21.17	40.93
12.22	26.55
27.72	52.09

a) Create a scatter plot, and describe the relationship that you observe.

b) Determine the equation of the linear regression function that models the data.

c) Use your equation to estimate

i) the cost of a 50 km trip

ii) the fixed cost for any taxi trip

Lesson 6.4

7. The height of a roller coaster after cresting its first hill can be represented by the function

$$h(t) = -9.8t^2 + 22$$

where h represents the height in metres and t represents the time in seconds.

a) Determine the maximum height of the roller coaster.

b) Determine the time it takes the roller coaster to reach half of its maximum height.

8. The following table shows the number of males who entered a trade program in Canada in the odd-numbered years after 1990.

Years After 1990	Number of Males
1	184 705
3	160 020
5	151 945
7	157 875
9	170 710
11	195 220

Statistics Canada

a) Create a scatter plot for the data.

b) Determine the equation for the quadratic regression function that models the data.

c) Use your equation to interpolate the values for the even-numbered years.

9. The following table shows the number of females who entered a trade program in Canada in selected years after 1990.

Years After 1990	Number of Females
1	8 245
5	11 425
7	13 305
9	15 675
13	24 280
15	28 755
17	38 070

Statistics Canada

a) Determine the equation for the cubic regression function that models the data.

b) Use your equation to estimate the year in which the number of females who entered a trade program was 20 000.

10. A stone is dropped from a bridge into a river below. The table of values shows the time, in seconds, and the height of the stone above the water, in metres.

Time (s)	Position (m)
0.0	20.00
0.5	18.75
1.0	15.00
1.5	8.75
2.0	0.00

a) Determine the equation for the quadratic regression function that models the data.

b) Use your equation to determine when the stone was 10 m above the water.