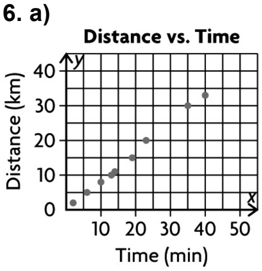
3. a) e.g., Since the function must have two turning points, the function must be cubic. Since the function must extend from quadrant II to quadrant IV, the leading coefficient must be negative. Since the function must have a y-intercept of –6, the constant term must be –6. Therefore a function that satisfies these characteristics is $y = -x^3 - 6x^2 - 11x - 6$.
b) e.g., Since the function must have degree 2, it must be quadratic. Since the function extends from quadrant III to quadrant IV, the leading coefficient must be negative. Since the function must have x-intercepts of –2 and 4, the equation of the function in factored form must be $y = a(x + 2)(x - 4)$, where $a < 0$. By letting $a = -1$ and expanding this equation, a function that satisfies these characteristics is $y = -x^2 + 2x + 8$.
4. a) The degree of this function is 2, and the leading coefficient is 2. Thus, the graph extends from quadrant II to quadrant I. The y-intercept is 12, and the possible number of x-intercepts is 0, 1, or 2. The possible number of turning points is 1. The domain is $\{x \mid x \in R\}$ and the range is $\{y \mid y \geq 4, y \in R\}$.
b) The degree of this function is 3, and the leading coefficient is –1. This means that the graph extends from quadrant II to quadrant IV. The y-intercept is –1, and the possible number of x-intercepts is 1, 2, or 3. The possible number of turning points is 0 or 2. The domain is $\{x \mid x \in R\}$ and the range is $\{y \mid y \in R\}$.

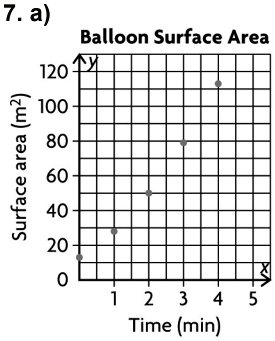
5. e.g., The line of best fit will have a slope of about –1, and the y-intercept will be about 120. About the same number of points lie above and below the line.

6. a)



b) The linear regression equation is
$y = 0.844\ldots x - 0.308\ldots$.
c) i) $y = 0.844\ldots x - 0.308\ldots$
$25 = 0.844\ldots x - 0.308\ldots$
$x = 29.975\ldots$
It took 30 min to drive 25 km.
ii) $y = 0.844\ldots x - 0.308\ldots$
$y = 0.844\ldots(45) - 0.308\ldots$
$y = 37.685\ldots$
Toby could've travelled 38 km in 45 min.
iii) From the linear regression equation, the average speed is 0.844… km/min.
0.844… km/min = (0.844… km/min)(60 min/h)
= 50.659… km/h
His average speed for the trip was 50.7 km/h.

7. a)



b) The quadratic regression equation is
$y = 3.214\ldots x^2 + 12.242\ldots x + 12.828\ldots$
c) e.g., Interpolate: when $x = 1.5$ min:
$y = 3.214\ldots x^2 + 12.242\ldots x + 12.828\ldots$
$y = 3.214\ldots(1.5)^2 + 12.242\ldots(1.5) + 12.828\ldots$
$y = 38.425$
The surface area of the balloon at 1.5 min is about 38.4 m^2.
Extrapolate: when $x = 5$ min:
$y = 3.214\ldots x^2 + 12.242\ldots x + 12.828\ldots$
$y = 3.214\ldots(5)^2 + 12.242\ldots(5) + 12.828\ldots$
$y = 154.4$
The surface area of the balloon at 5 min is about 154.4 m^2.

Chapter Review, page 427

1. a) This is a polynomial function since the graph extends from quadrant II to quadrant IV, it has 1 y-intercept, 0 turning points and 1 x-intercept. It appears to be a cubic function.
b) This is not a polynomial function, because it is not a function at all. For a curve to be a function, every x-value must have only one corresponding y-value, which is not true for this curve.
c) This is not a polynomial function because it has no x-intercepts but it is not a constant function.
d) This is a polynomial function since the graph extends from quadrant III to quadrant I, it has 1 y-intercept, no turning points and 1 x-intercept. It appears to be a linear function.
e) This is a polynomial function since the graph extends from quadrant III to quadrant IV, it has 1 y-intercept, 1 turning point and 2 x-intercepts. It appears to be a quadratic function.
f) This is not a polynomial function since the graph has infinitely many turning points.

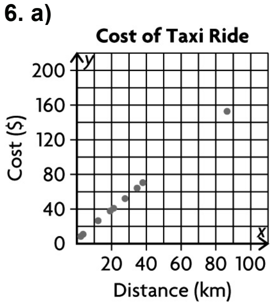
2. a) This is not a polynomial function, because there is a variable in the denominator of a fraction.
b) Possible number of x-intercepts: 1, 2, or 3
y-intercept: –4
Domain: $\{x \mid x \in R\}$; Range: $\{y \mid y \in R\}$
Possible number of turning points: 0 or 2
c) Possible number of x-intercepts: 0, 1, or 2
y-intercept: –32
Domain: $\{x \mid x \in R\}$; Range: $\{y \mid y \leq 0, y \in R\}$
Possible number of turning points: 1
d) This is not a polynomial function, because there is a variable under a square root sign.

3. a) y-intercept: –1
End behaviour: graph extends from quadrant III to quadrant IV.
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \leq \text{maximum}, y \in R\}$
b) y-intercept: 5
End behaviour: graph extends from quadrant III to quadrant I.
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$
c) y-intercept: 0
End behaviour: graph extends from quadrant II to quadrant I.
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \geq -9, y \in R\}$
d) y-intercept: 5
End behaviour: graph extends from quadrant III to quadrant I.
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$

4. a) The degree of this function is 2, and the leading coefficient is –0.5. This means that the graph extends from quadrant III to quadrant IV. The y-intercept is –4.5, and there are 0 x-intercepts. There is one turning point. The domain is $\{x \mid x \in R\}$ and the range is $\{y \mid y \leq -4, y \in R\}$.
b) The degree of this function is 3, and the leading coefficient is 2. This means that the graph extends from quadrant III to quadrant I. The y-intercept is 0, and there are 3 x-intercepts. There are 2 turning points. The domain is $\{x \mid x \in R\}$ and the range is $\{y \mid y \in R\}$.

5. a) e.g., The slope of the line of best fit will be about 0.2, and the y-intercept will be about 0.3.
b) e.g., The slope of the line of best fit will be about –2, and the y-intercept will be about 5.5.

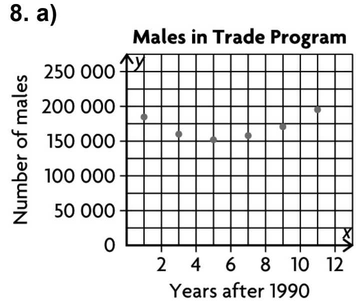
6. a)



As the distance increases, the cost increases in a linear relationship.
b) The regression equation is $y = 1.711\ldots x + 4.956\ldots$.
c) i) $y = 1.711\ldots x + 4.956\ldots$
$y = 1.711\ldots(50) + 4.956\ldots$
$y = 90.513\ldots$
It will cost about $90.51 to travel 50 km.
ii) From the linear regression equation, the fixed cost for any trip is about $4.96.

7. a) The maximum height of the roller coaster is 22 m.
b) $h(t) = -9.8t^2 + 22$
$11 = -9.8t^2 + 22$
$-11 = -9.8t^2$
$1.122\ldots = t^2$
$1.059\ldots = t$
It takes about 1.06 s to reach half the maximum height.

8. a)



b) The quadratic regression equation is
$y = 1471.495\ldots x^2 - 16\,364.017\ldots x + 198\,121.986\ldots$
c) When $x = 2$, $y = 171\,280$
When $x = 4$, $y = 156\,210$
When $x = 6$, $y = 152\,912$
When $x = 8$, $y = 161\,386$
When $x = 10$, $y = 181\,631$

9. a) The cubic regression equation is
$y = 7.062\ldots x^3 - 77.357\ldots x^2 + 1069.994\ldots x + 7208.231\ldots$.
b) When $x = 11$, $y = 19\,018$
When $x = 12$, $y = 21\,113$
When $x = 13$, $y = 23\,561$
20 000 females entered a trade program in 2002.

10. a) The quadratic regression function is $y = -5x^2 + 20$.
b) $y = -5x^2 + 20$
$10 = -5x^2 + 20$
$-10 = -5x^2$
$2 = x^2$
$1.414\ldots = x$
The stone was 10 m above the water after 1.4 s.

Chapter Task, page 429

Part 1

A. We used a 2 L soda container and a 4 L milk jug. The nail we used made a 2 mm hole in each lid.

B. The 50 mL scale was too small, so we marked a 100 mL scale instead.

F. Let V represent the volume of water, in mL, left in the container at time t, in seconds. Sample data:

***t* (s)**	0	37	84	134	204	370
***V* (mL)**	500	400	300	200	100	0