Applying Problem-Solving Strategies, page 398

E. If I play first, I need to choose one of my own cards that is on a diagonal. This will improve my chances because I have one chip in a potential row, column, and diagonal.
If I play second, I will try to block my opponent by playing a card on the diagonal, for the same reason as above.

Mid-Chapter Review, page 400

1. a) 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.
b) This is not a polynomial function since the domain of this graph is not $\{x \mid x \in R\}$.
c) This is a polynomial function since the graph extends from quadrant II to quadrant I, it has 1 *y*-intercept, 0 turning points and 0 *x*-intercepts. It appears to be a constant function.
d) This is a polynomial function since the graph extends from quadrant III to quadrant I, it has 1 *y*-intercept, 2 turning points and 1 *x*-intercept. It appears to be a cubic function.
e) This is not a polynomial function since the graph has infinitely many turning points.
f) This is not a polynomial function since the graph has infinitely many turning points.

2. a) (1a) Degree: 2
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \le 6, y \in R\}$
Constant term: 5
(1c) Degree: 0
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y = 4\}$
Constant term: 4
(1d) Degree: 3
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$
Constant term: –2
b) i) This equation corresponds with graph d, because it is the only cubic graph.
ii) This equation corresponds with graph c, because it is the only constant graph.
iii) This equation corresponds with graph a, because it is the only parabolic graph.

3. a) The degree of this function is 3, and the leading coefficient is –1. Therefore, the graph will extend from quadrant II to quadrant IV.
b) The degree of this function is 3, and the leading coefficient is 3. Therefore, the graph will extend from quadrant III to quadrant I.
c) The degree of this function is 1, and the leading coefficient is 5. Therefore, the graph will extend from quadrant III to quadrant I.
d) The degree of this function is 2, and the leading coefficient is –2. Therefore, the graph will extend from quadrant III to quadrant IV.

4. a) i) Degree: 3
x-intercept: 5
y-intercept: 4
End behaviour: graph extends from quadrant II to quadrant IV
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$
Number of turning points: 2
ii) Degree: 2
x-intercepts: –1.5. 2
y-intercept: –6
End behaviour: graph extends from quadrant II to quadrant I
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \ge -6.25, y \in R\}$
Number of turning points: 1
iii) Degree: 1
x-intercept: 6.5
y-intercept: 2
End behaviour: graph extends from quadrant II to quadrant IV
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$
Number of turning points: 0
iv) Degree: 3
x-intercepts: –1, 3
y-intercept: 9
End behaviour: graph extends from quadrant III to quadrant I
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$
Number of turning points: 2
b) i) Sign of leading coefficient: –
Value of constant term: 4
ii) Sign of leading coefficient: +
Value of constant term: –6
iii) Sign of leading coefficient: –
Value of constant term: 2
iv) Sign of leading coefficient: +
Value of constant term: 9

5. a) Possible number of *x*-intercepts: 0, 1, or 2
y-intercept: 6
End behaviour: graph extends from quadrant III to quadrant IV
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \le \text{maximum}, y \in R\}$
Possible number of turning points: 1

b) Possible number of x-intercepts: 1, 2, or 3
y-intercept: 6
End behaviour: graph extends from quadrant III to quadrant I
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: –1
End behaviour: graph extends from quadrant II to quadrant I
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \geq \text{minimum}, y \in R\}$
Possible number of turning points: 1
d) Possible number of x-intercepts: 1, 2, or 3
y-intercept: 0
End behaviour: graph extends from quadrant III to quadrant I
Domain: $\{x \mid x \in R\}$
Range: $\{y \mid y \in R\}$
Possible number of turning points: 0 or 2

6. a) e.g., Since the function must have two turning points, it must be a cubic function. Since the graph must extend from quadrant III to quadrant I, the leading coefficient must be positive. Since the graph must pass through the origin, it must have a y-intercept of 0. This means that the constant term must be 0. Since the origin is the only x-intercept, the turning points must both lie above or below the x-axis. Therefore a function that satisfies these characteristics is $y = x^3 - 4x^2 + 5x$.
b) e.g., Since the function must extend from quadrant II to quadrant I, it must be a quadratic function with a positive leading coefficient. Since the graph must have a positive leading coefficient and two x-intercepts, the vertex of the parabola must lie below the origin. Therefore a function that satisfies these characteristics is $y = x^2 - 1$.
c) e.g., Since the function must have a degree of 1, the function must be linear. 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 –3, the constant term must be –3. Therefore a function that satisfies these characteristics is $y = -x - 3$.
d) e.g., Since the function must have one turning point, it must be quadratic. Since the function must have only one x-intercept, the vertex of the parabola must lie on the x-axis. Since the function must have a y-intercept of 6, the constant term must be 6. Therefore a function that satisfies these characteristics is $y = 6(x - 1)^2$.
e) e.g., Since the range of the function is restricted, but not restricted to just one value, the function must be quadratic. Since the function must have a range of $y \geq -6$, the y-coordinate of the vertex must be –6 and the leading coefficient must be positive. Since the x-intercepts must be 2 and 6, the equation of the function in factored form is $y = a(x - 2)(x - 6)$, where $a > 0$.
Rearranging the equation into vertex form gives:
$y = a(x - 2)(x - 6)$
$y = a(x^2 - 8x + 12)$
$y = a(x^2 - 8x + 16 - 16) + 12a$
$y = a(x^2 - 8x + 16) - 16a + 12a$
$y = a(x - 4)^2 - 4a$
Since the y-coordinate of the vertex must be –6, we have:
$-6 = -4a$
$a = 1.5$
Therefore a function that satisfies these characteristics is $y = 1.5(x - 4)^2 - 6$.

Lesson 6.3: Modelling Data with a Line of Best Fit, page 407

1. a) e.g., Slope: –1
e.g., y-intercept: 7.5
b) e.g., Slope: 0.1
e.g., y-intercept: 2

2. a) e.g., $y = -x + 7.5$
b) e.g., $y = 0.1x + 2$

3. a) The distance travelled in a car is dependent, because it depends on the average speed of the car. The average speed is independent, because it does not depend on the distance travelled by that car.
b) The size of the family is independent, because it does not depend on the number of cell phones. The number of cell phones is dependent, because it depends on the size of the family.
c) The number of people in a cafeteria is dependent, because it depends on the time of day. The time of day is independent, because it does not depend on the number of people in a cafeteria.
d) The number of hours of daylight is dependent, because it depends on the time of year. The time of year is independent, because it does not depend on the number of hours of daylight.

4. a) e.g., The line of best fit has a negative slope. Approximately the same number of points lie above and below the line. There seems to be a strong representation of the data because all the points are very close to the line of best fit.
b) e.g., I estimate that when $x = 47$, $y = 75$. I used interpolation, because the point is within the domain of the data.
c) e.g., I estimate that when $y = 70$, $x = 52$. I used interpolation, because the point is within the domain of the data.
d) e.g., I estimate that when $x = 15$, $y = 105$. I used extrapolation, because the point is outside the domain of the data.