9.1

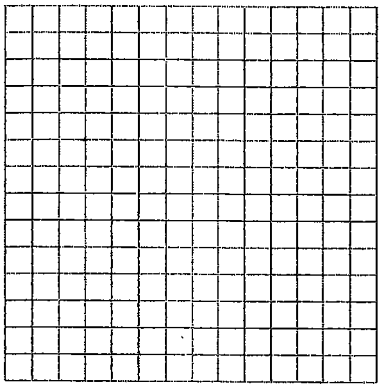
Check Your Understanding

Practise

1. Graph each function using a table of values. Identify the asymptotes.

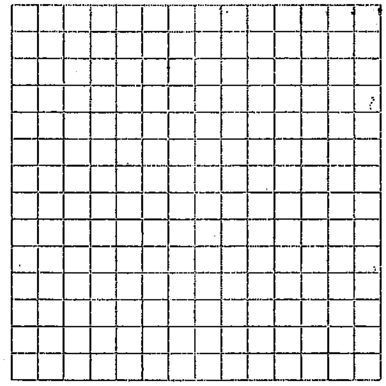
a) $y = \frac{6}{x}$

x	y



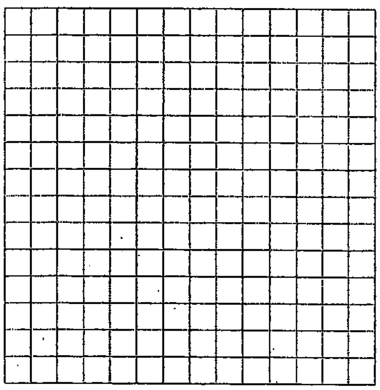
b) $y = \frac{-4}{x}$

x	y

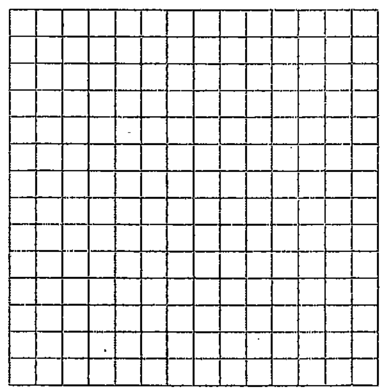


2. Graph each function using transformations. Label the asymptotes

a) $y = \frac{2}{x+1} - 3$

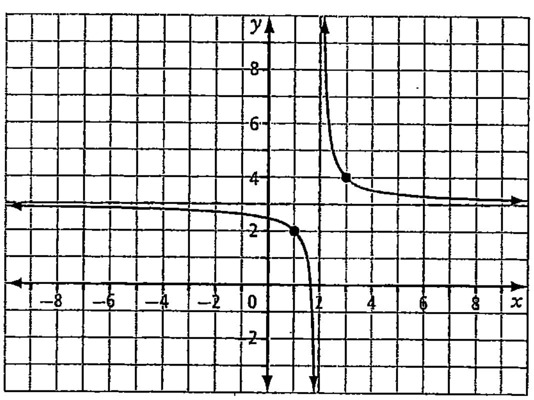


b) $y = \frac{-3}{x-2} + 1$



5. Write the equation of each function in the form of $y = \frac{a}{x-h} + k$.

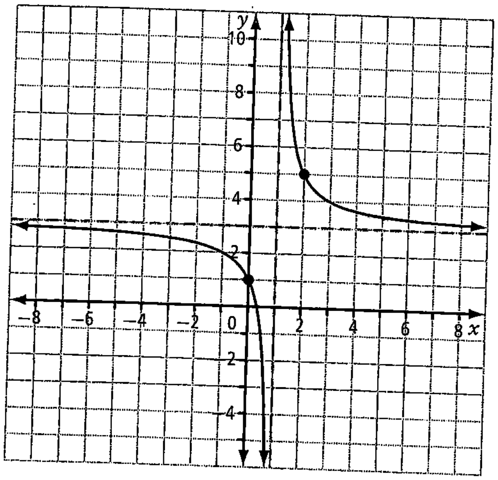
a)



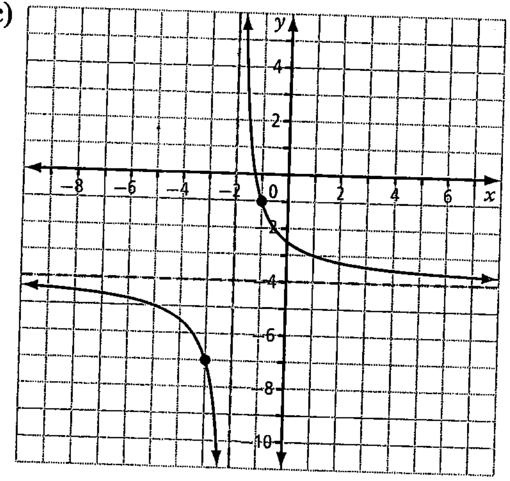
For the graph of $y = \frac{1}{x}$, what is the relationship between the intersection of the asymptotes and the point (1, 1)? How can you use this knowledge to determine a vertical stretch?

The vertical asymptote provides the ________ parameter. The horizontal asymptote provides the ________ parameter.

5. b)



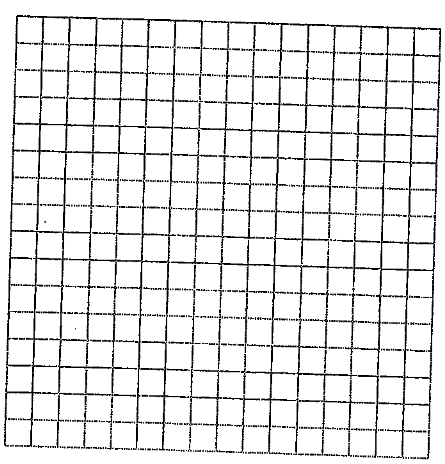
c)

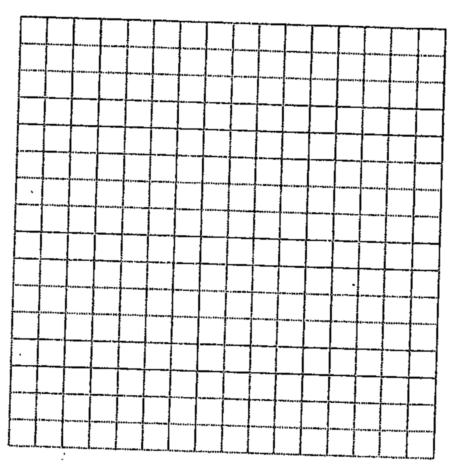


6. Write each equation in the form $y = \dfrac{a}{x-h} + k$. Then, graph the function using transformations. Indicate the asymptotes.

a) $y = \dfrac{7x-23}{x-4}$

b) $y = \dfrac{-5x-1}{x+2}$





9.2

Check Your Understanding

Practise

1. Determine whether the following functions have points of discontinuity, vertical asymptotes, or both. Explain how you made your determination.

   a) $f(x) = \frac{x + 5}{x + 4}$

   b) $f(x) = \frac{x^2 - 5x + 6}{x - 3}$

   c) $f(x) = \frac{x^2 - x - 12}{x^2 - 5x + 4}$

   d) $f(x) = \frac{x^2 - 4x - 5}{x^2 - 5x + 6}$

2. For each function, predict the location of any points of discontinuity, vertical asymptotes, x-intercepts, and y-intercepts.

   a) $f(x) = \frac{x + 1}{x - 4}$

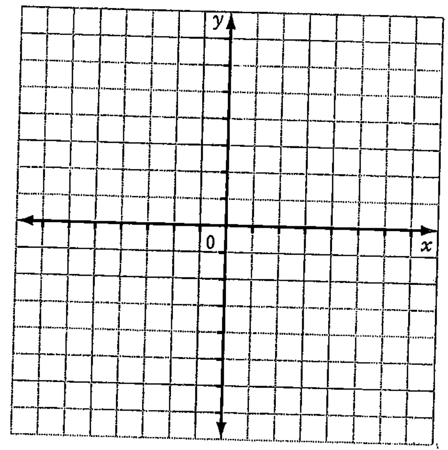
   b) $f(x) = \frac{x^2 + 7x + 12}{x + 3}$

   c) $f(x) = \frac{x^2 - 7x + 10}{x^2 - 4x - 5}$

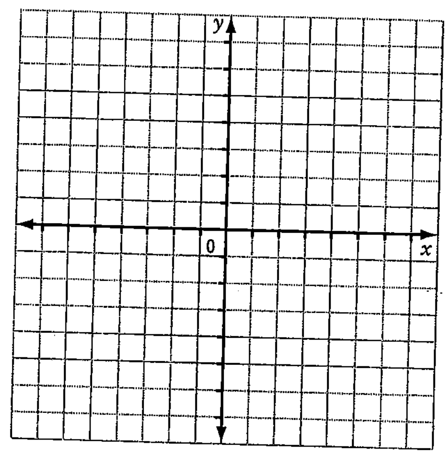
   d) $f(x) = \frac{x^2 + 6x + 8}{x^2 - 5x - 6}$

4. Identify any characteristics that are needed to sketch the graph. Then, sketch the function.

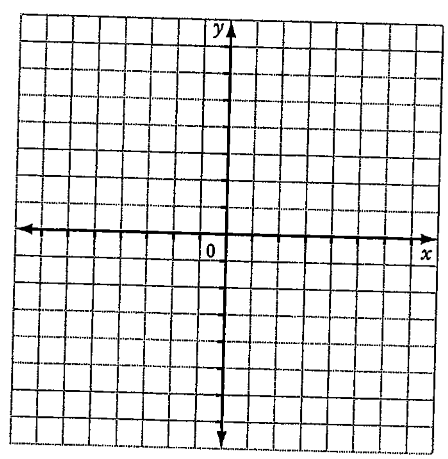
a) $f(x) = \dfrac{x+3}{x-2}$



b) $f(x) = \dfrac{x^2-5x+6}{x-2}$



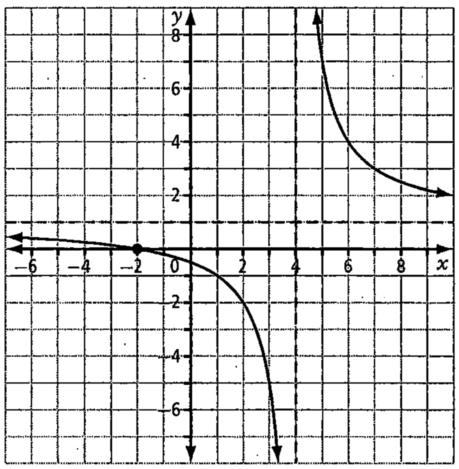
c) $f(x) = \dfrac{x^2+3x-4}{x^2+2x-8}$



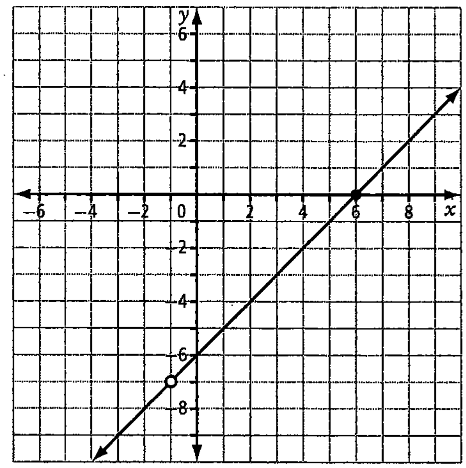
Apply

5. Write an equation for each rational function graphed below.

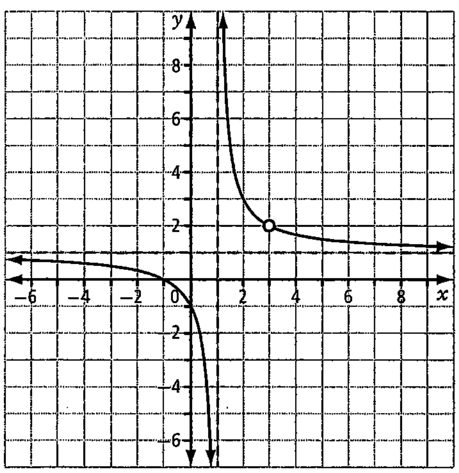
a)



b)



c)



6. Write an equation of a possible rational function with the following characteristics.

a) point of discontinuity: $(-4, -6)$
x-intercept: 2

b) point of discontinuity: $(3, 2)$
vertical asymptote: $x = 1$
x-intercept: -1

c) vertical asymptotes: $x = 4$ and $x = -3$
x-intercept: 0

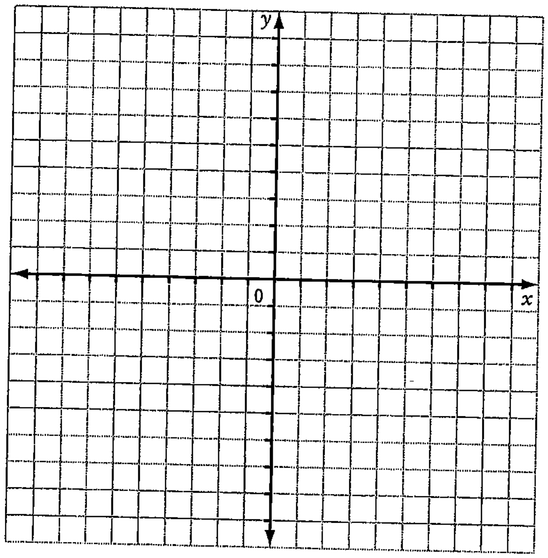
d) vertical asymptote: $x = 7$
x-intercepts: -1 and -3

Chapter 9 Review

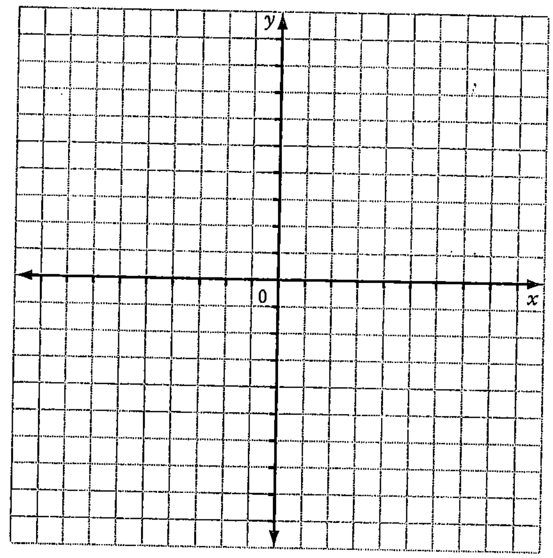
9.1 Exploring Rational Functions Using Transformations, pages 297–304

1. Graph each function using transformations. Label the important parts of the graph.

a) $y = \frac{3}{x-4} + 2$

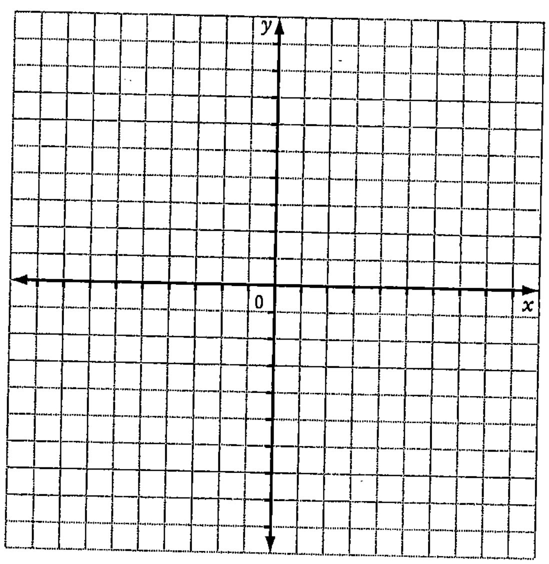


b) $y = \frac{7}{x-1} - 2$

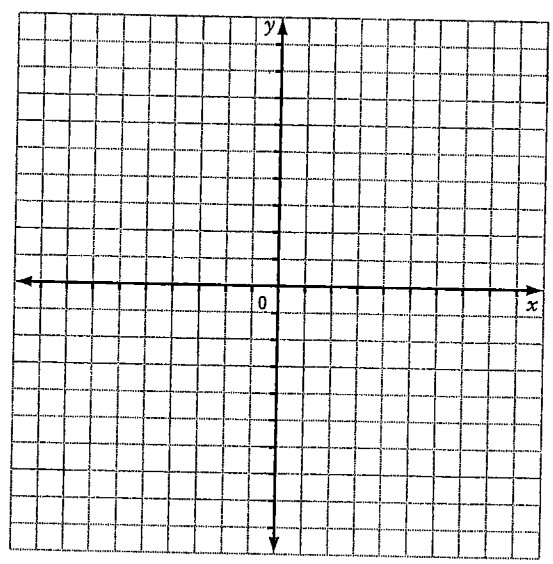


2. Graph the following functions without technology. Label all the important parts.

a) $f(x) = \frac{4x+5}{x-3}$



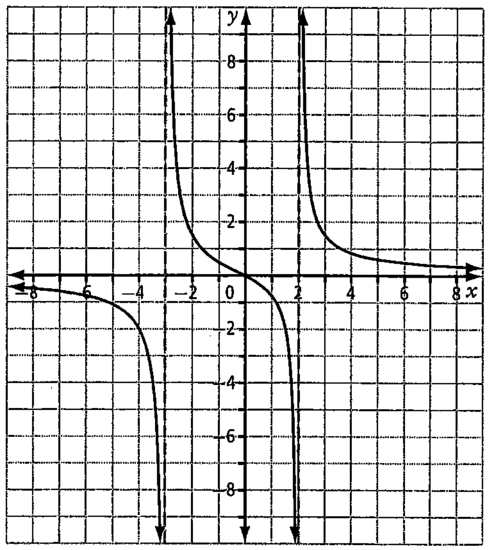
b) $f(x) = \frac{-2x+5}{x-3}$



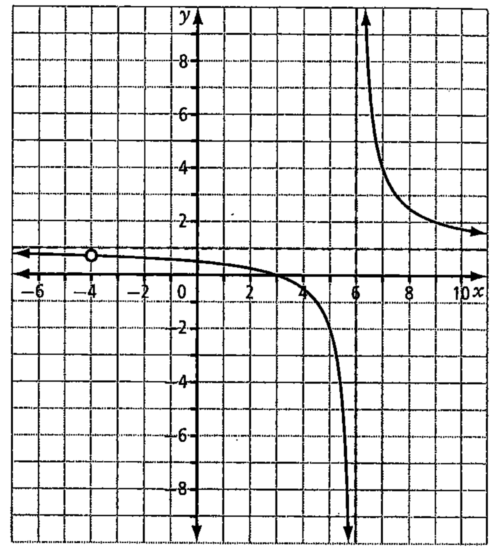
9.2 Analysing Rational Functions, pages 305–313

3. Match the graph of each rational function with the most appropriate equation. Give reasons for each choice.

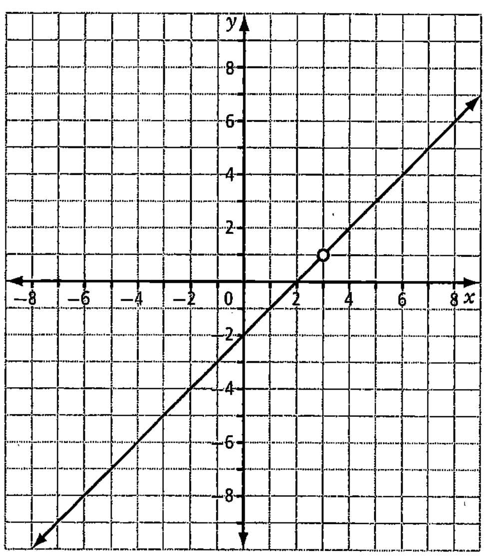
a)



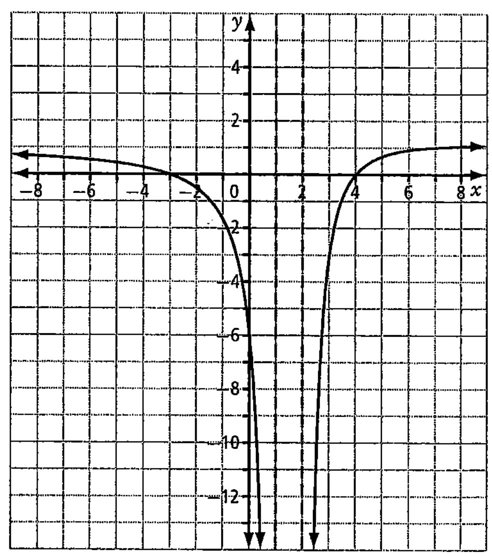
b)



c)



d)



A $f(x) = \dfrac{x^2 + x - 12}{x^2 - 2x - 24}$

B $g(x) = \dfrac{x^2 - x - 12}{x^2 - 3x + 2}$

C $h(x) = \dfrac{x^2 - 5x + 6}{x - 3}$

D $j(x) = \dfrac{3x}{x^2 + x - 6}$

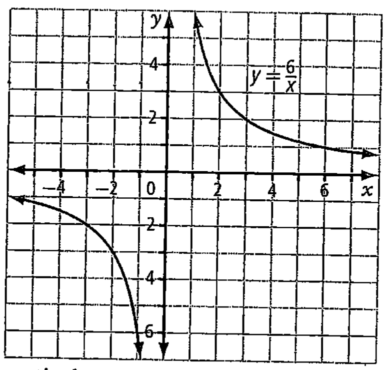
4. For each function, predict the location of any points of discontinuity, vertical asymptotes, and intercepts.

a) $f(x) = \dfrac{2x + 1}{x + 5}$ b) $f(x) = \dfrac{x^2 - 8x + 12}{x - 2}$

Chapter 9 Answers

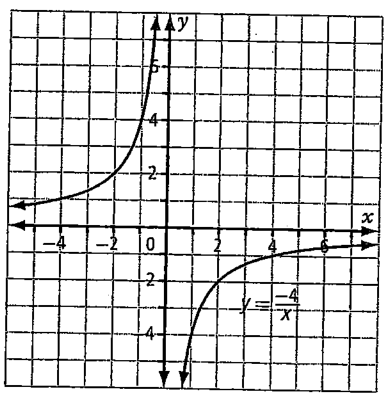
9.1 Exploring Rational Functions Using Transformations, pages 297–304

1. a)



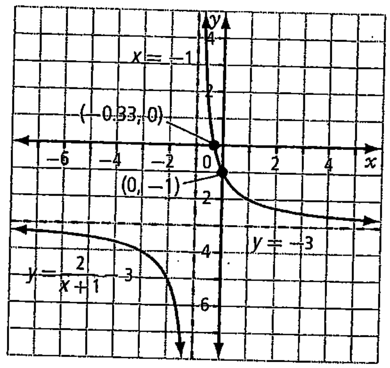
vertical asymptote: $x = 0$
horizontal asymptote: $y = 0$

b)

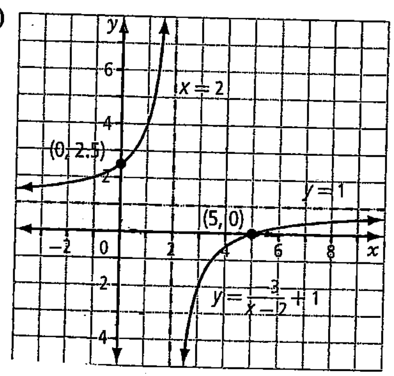


vertical asymptote: $x = 0$
horizontal asymptote: $y = 0$

2. a)



b)

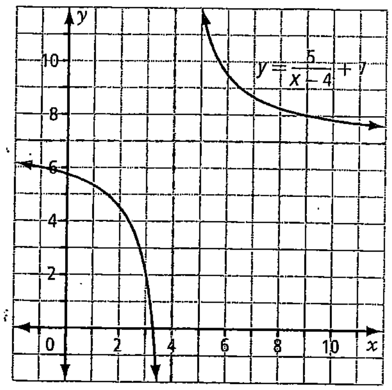


5. a) $y = \dfrac{1}{x-2} + 3$

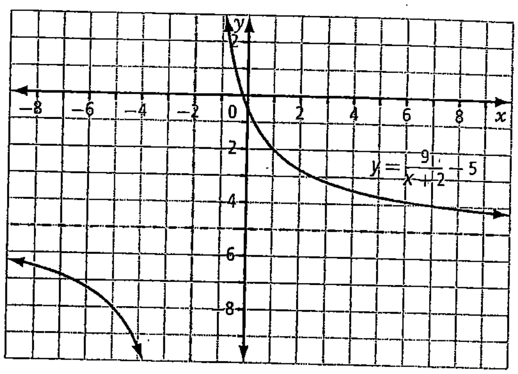
b) $y = \dfrac{2}{x-1} + 3$

c) $y = \dfrac{3}{x+2} - 4$

6. a) $y = \frac{5}{x-4} + 7$



b) $y = \frac{9}{x+2} - 5$



9.2 Analysing Rational Functions, pages 305–313

1. a) vertical asymptote; the numerator and denominator have no common factors

   b) point of discontinuity; the numerator and denominator have a common factor and simplify to become a linear function

   c) both; the numerator and denominator have a common factor and simplify to become a rational function

   d) vertical asymptote; the numerator and denominator have no common factors

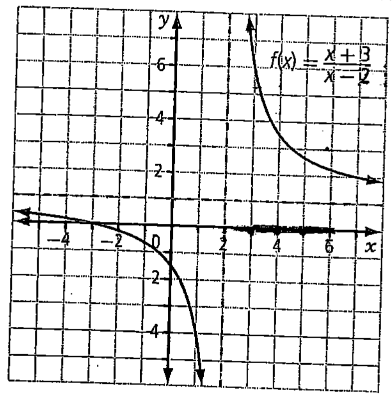
2. a) vertical asymptote: $x = 4$; x-intercept: -1; y-intercept: -0.25

   b) point of discontinuity: $(-3, 1)$; no vertical asymptotes; x-intercept: -4; y-intercept: 4

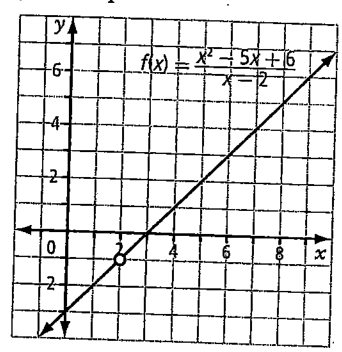
   c) point of discontinuity: $(5, 0.5)$; vertical asymptote: $x = -1$; x-intercept: 2; y-intercept: -2

   d) no points of discontinuity; vertical asymptotes: $x = 6$, $x = -1$; x-intercepts: -2, -4; y-intercept: $-\frac{4}{3}$

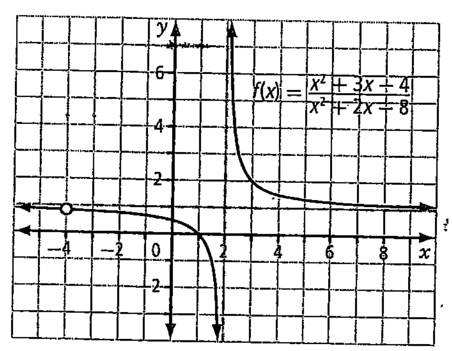
4. a) vertical asymptote: $x = 2$; horizontal asymptote: $y = 1$; x-intercept: -3; y-intercept: $-\frac{3}{2}$



   b) point of discontinuity: $(2, -1)$; x-intercept: 3; y-intercept: -3



   c) vertical asymptote: $x = 2$; horizontal asymptote: $y = 1$; x-intercept: 1; y-intercept: $\frac{1}{2}$; point of discontinuity: $\left(-4, \frac{5}{6}\right)$



5. a) $f(x) = \frac{x+2}{x-4}$ or $f(x) = \frac{6}{x-4} + 1$

   b) $f(x) = \frac{x^2 - 5x - 6}{x+1}$ or $f(x) = \frac{(x-6)(x+1)}{x+1}$

   c) $f(x) = \frac{x^2 - 2x - 3}{x^2 - 4x + 3}$ or $f(x) = \frac{(x+1)(x-3)}{(x-1)(x-3)}$

6. a) Example: $f(x) = \frac{(x-2)(x+4)}{(x+4)}$

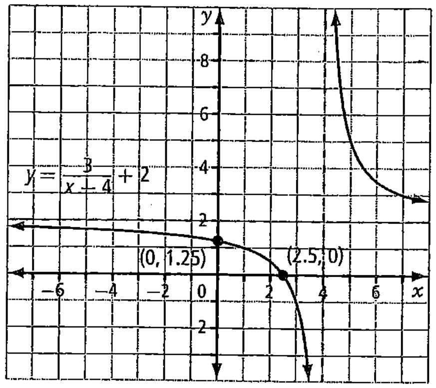
   b) Example: $f(x) = \frac{(x+1)(x-3)}{(x-1)(x-3)}$

   c) Example: $f(x) = \frac{x}{(x-4)(x+3)}$

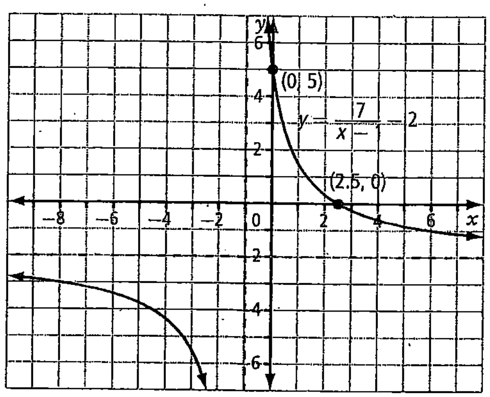
   d) Example: $f(x) = \frac{(x+1)(x+3)}{x-7}$

Chapter 9 Review, pages 321–323

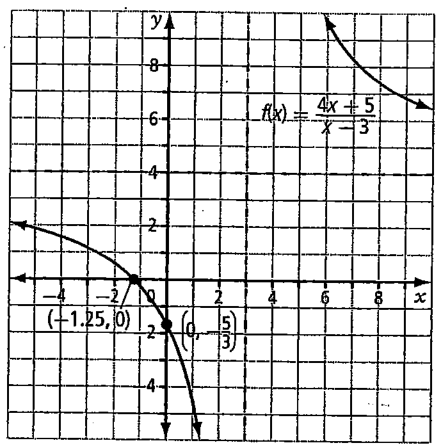
1. a)



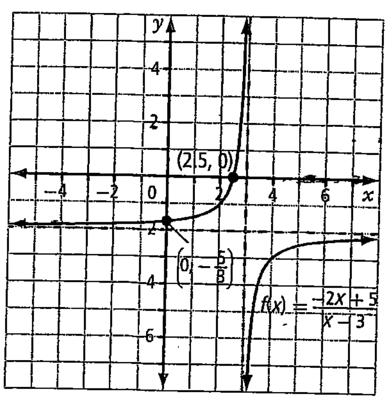
b)



2. a)



b)



3. a) vertical asymptotes at $x = -3$ and $x = 2$, no points of discontinuity, x-intercept of 0; D

b) vertical asymptote at $x = 6$, point of discontinuity $(-4, 0.7)$, x-intercept of 3; A

c) point of discontinuity at $(3, 1)$, no vertical asymptotes, x-intercept of 2; C

d) vertical asymptotes at $x = 1$ and $x = 2$, no points of discontinuity, x-intercepts of -3 and 4; B