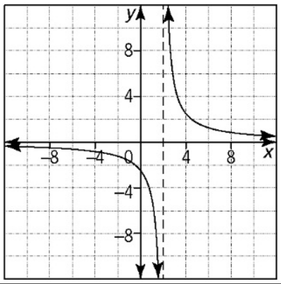
Gr 12 9.1 Solutions

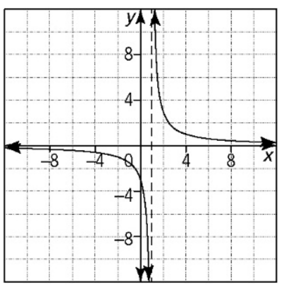
1. a) B **b)** C **c)** D **d)** A

2.



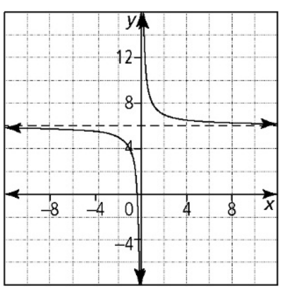
Characteristic	$y = \frac{5}{x-2}$
Non-permissible value	$x = 2$
Behaviour near non-permissible value	As x approaches 2, $\lvert y \rvert$ becomes very large.
End behaviour	As $\lvert x \rvert$ becomes very large, y approaches 0.
Domain	$\{x \mid x \neq 2, x \in \mathrm{R}\}$
Range	$\{y \mid y \neq 0, y \in \mathrm{R}\}$
Equation of vertical asymptote	$x = 2$
Equation of horizontal asymptote	$y = 0$

3. a)



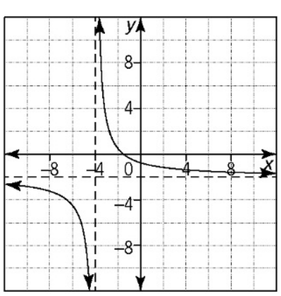
domain: $\{x \mid x \neq 1, x \in \mathrm{R}\}$; range: $\{y \mid y \neq 0, y \in \mathrm{R}\}$; intercept: (0, –3); asymptotes: $x = 1$, $y = 0$

b)



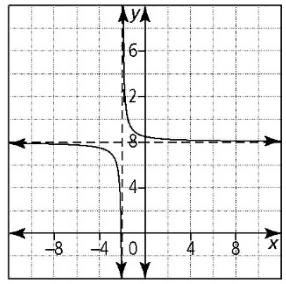
domain: $\{x \mid x \neq 0, x \in \mathrm{R}\}$; range: $\{y \mid y \neq 6, y \in \mathrm{R}\}$; intercept: $\left(-\frac{1}{3}, 0\right)$; asymptotes: $x = 0$, $y = 6$

c)



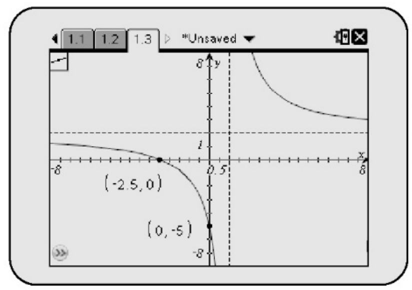
domain: $\{x \mid x \neq -4, x \in \mathrm{R}\}$; range: $\{y \mid y \neq -2, y \in \mathrm{R}\}$; intercepts: (0, –0.75), (–1.5, 0); asymptotes: $x = -4$, $y = -2$

d)



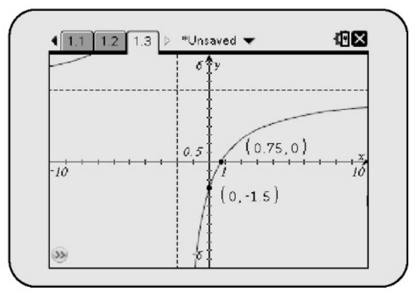
domain: $\{x \mid x \neq -2, x \in \mathrm{R}\}$; range: $\{y \mid y \neq 8, y \in \mathrm{R}\}$; intercepts: (0, 8.5), (–2.125, 0); asymptotes: $x = -2$, $y = 8$

4. a)



asymptotes: $x = 1$, $y = 2$;
intercepts: (–2.5, 0), (0, –5)

b)

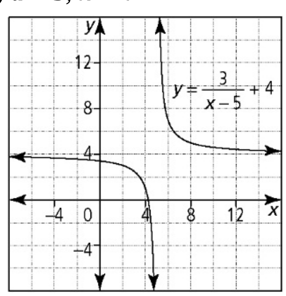


asymptotes: $x = -2$, $y = 4$;
intercepts: (0, –1.5), (0.75, 0)

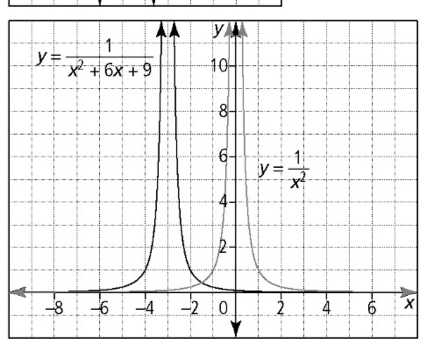
5. a) $y = \frac{3}{x}$ **b)** $y = \frac{4}{x}$ **c)** $y = \frac{2}{x-5}$ **d)** $y = -\frac{2}{x+4}$

6. a) $a = 3$, $k = 4$

b)



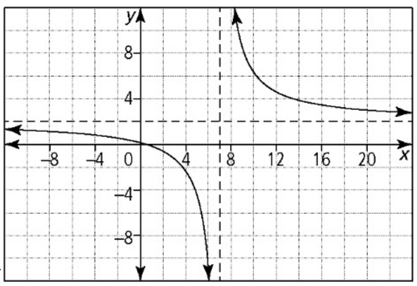
7.



The graph of $y = \frac{1}{x^2 + 6x + 9}$ is the graph of $y = \frac{1}{x^2}$ translated 3 units left.

8.

x	y
–5	0.92
–2	0.56
1	–0.17
4	–2.33
7	undefined
10	6.33
13	4.17
16	3.44
19	3.08



Characteristic	$y = \frac{2x - 1}{x - 7}$
Non-permissible value	$x = 7$
Behaviour near non-permissible value	As x approaches 7, $\lvert y \rvert$ becomes very large.
End behaviour	As $\lvert x \rvert$ becomes very large, y approaches 2.
Domain	$\{x \mid x \neq 7, x \in \mathrm{R}\}$
Range	$\{y \mid y \neq 2, y \in \mathrm{R}\}$
Equation of vertical asymptote	$x = 7$
Equation of horizontal asymptote	$y = 2$

9. a) $t = \frac{d}{s}$

b) $t = \frac{351}{65} = 5.4$, so 5.4 hours or 5 h and 24 min

c) 70.2 km/h

BLM 9–3 Section 9.2 Extra Practice

1. point of discontinuity at $(-3, \frac{1}{10})$ vertical asymptote: $x = 7$

2. You can factor the denominator: $y = \frac{x+2}{(x+2)(x+1)}$.

Since the factor $(x + 2)$ appears in the numerator and denominator, the graph will have a point of discontinuity at $(-2, -1)$. The factor $(x + 1)$ appears in the denominator only, so there will be an asymptote at $x = -1$.

3.

Characteristic	$y = \frac{(x+3)(x-2)}{(x+5)(x+3)}$
Non-permissible value(s)	$x = -5$ and $x = -3$
Feature exhibited at each non-permissible value	asymptote at $x = -5$; point of discontinuity at $(-3, -2.5)$
Behaviour near each non-permissible value	As x approaches -5, $\|y\|$ becomes very large. As x approaches -3, y approaches -2.5.
Domain	$\{x \mid x \neq -3, -5, x \in \mathrm{R}\}$
Range	$\{y \mid y \neq 1, -\frac{5}{2}, y \in \mathrm{R}\}$

4. a)

x	***y***
–0.9	3.1
–0.99	3.01
–0.999	3.001
–0.9999	3.0001
–1	undefined
–1.0001	2.9999
–1.001	2.999
–1.01	2.99
–1.1	2.9

As x approaches -1, y approaches 3.

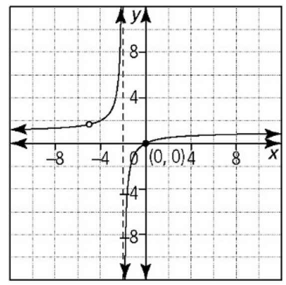
b)

x	***y***
1.9	–4.238 095 24
1.99	–4.472 636 82
1.999	–4.497 251 37
1.9999	–4.499 725 01
2	undefined
2.0001	–4.500 275 01
2.001	–4.502 751 38
2.01	–4.527 638 19
2.1	–4.789 473 68

x	***y***
3.9	–109
3.99	–1 099
3.999	–10 999
3.9999	–109 999
4	undefined
4.0001	110 001
4.001	11 001
4.01	1 101
4.1	111

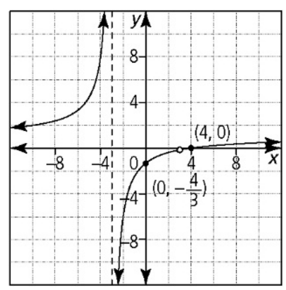
As x approaches 2, y approaches -4.5, and as x approaches 4, $|y|$ becomes very large, approaching negative infinity or positive infinity.

5. a) vertical asymptote: $x = -2$; point of discontinuity at $(-5, \frac{5}{3})$;
x-intercept: (0, 0); y-intercept: (0, 0)

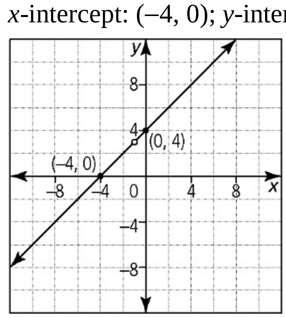


b) vertical asymptote: $x = -3$; point of discontinuity at $(3, -\frac{1}{16})$;

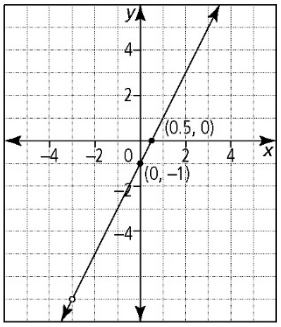
x-intercept: (4, 0); y-intercept: $(0, -\frac{4}{3})$



c) no vertical asymptote; point of discontinuity at $(-1, 3)$;
x-intercept: $(-4, 0)$; y-intercept: (0, 4)



d) no vertical asymptote; point of discontinuity at $(-3, -7)$;
x-intercept: (0.5, 0); y-intercept: $(0, -1)$



6.

Characteristic	$y=\dfrac{x^2-3x}{3x-9}$	$y=\dfrac{x^2+3x}{3x-9}$
Non-permissible value(s)	$x=3$	$x=3$
Feature exhibited at each non-permissible value	point of discontinuity	asymptote
Behaviour near each non-permissible value	As x approaches 3, y approaches 1.	As x approaches 3, $\|y\|$ becomes very large.

7. a) C; Example: In factored form, the rational function has two non-permissible values in the denominator, which do not appear in the numerator. Therefore, the graph with two asymptotes is the most appropriate choice.
b) B; Example: In factored form, the rational function has one non-permissible value that appears in both the numerator and denominator, and another non-permissible value that is only in the denominator. Therefore, the graph with one asymptote and one point of discontinuity is the most appropriate choice.
c) A; Example: In factored form, one non-permissible value appears in the numerator and denominator. Therefore, the graph has a point of discontinuity, but no asymptote.

8. a) $y=\dfrac{(x-3)(x+2)}{(x-3)}$ or $y=\dfrac{x^2-x-6}{x-3}$
b) $y=\dfrac{(x-2)(x+2)}{(x+2)}$ or $y=\dfrac{x^2-4}{x+2}$
c) $y=\dfrac{(x+4)}{(4-x)(4+x)}$ or $y=\dfrac{x+4}{16-x^2}$
d) $y=\dfrac{(x+5)}{(x+3)(x+5)}$ or $y=\dfrac{x+5}{x^2+8x+15}$

9. Example: $y=\dfrac{-12(2x+5)}{(x-2)(2x+5)}$

BLM 9–4 Section 9.3 Extra Practice

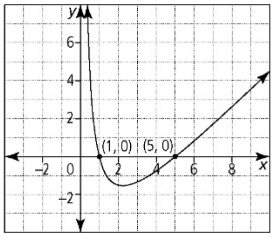
1. a) $x = \frac{3}{5}$ **b)** $x = 5$ **c)** $x = 24$ **d)** $x = 4$

2. a) $x = 10$ and $x = -4$ **b)** $x = 7$ and $x = 1$

c) $x = 10$ and $x = -3$ **d)** $x = \frac{3}{2}$ and $x = -2$

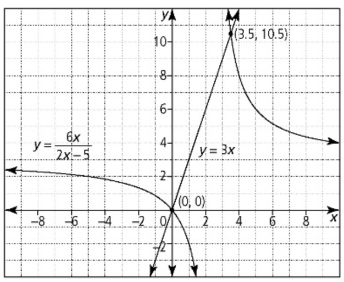
3. a) $x = 5$ and $x = 1$

b)

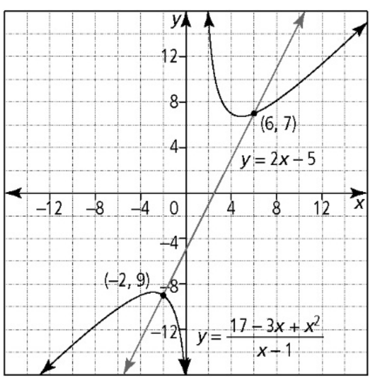


c) The value of the function is 0 when the value of x is 1 or 5. The x-intercepts of the graph of the function are the same as the roots of the corresponding equation.

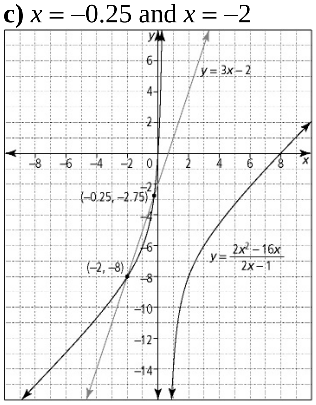
4. a) $x = 0$ and $x = 3.5$



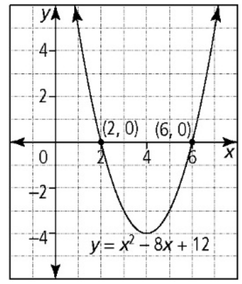
b) $x = -2$ and $x = 6$



c) $x = -0.25$ and $x = -2$

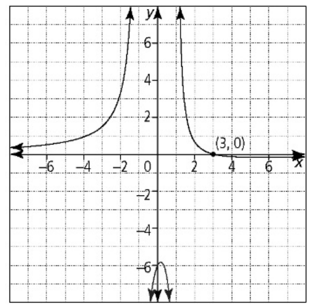


5. a) $0 = x^2 - 8x + 12$



$x = 2$ and $x = 6$

b) $y = \frac{6 - 2x}{x^2 - 1}$

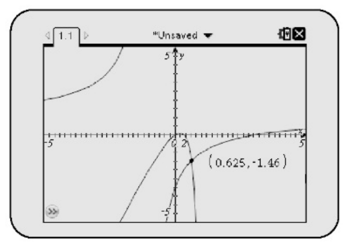


$x = 3$

6. a) $x \approx 0.76$ and $x \approx 5.24$ **b)** $x \approx -2.79$ and $x \approx 1.79$

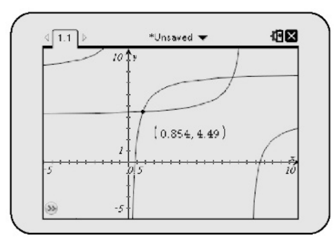
c) $x \approx 0.53$ and $x \approx 4.87$

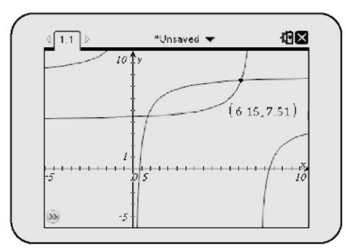
7. a)



$x \approx 0.63$

b)





$x \approx 0.85$ and $x \approx 6.15$

8. The solution $n = 3$ is a non-permissible value, so there is no solution.

9. Carmen: 36 h; James: 45 h