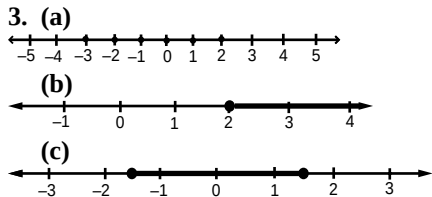


Cumulative Review Test 2

Functions, page 389

1. (a) i. domain = R , range = R
 ii. This relationship is a function because each x -value corresponds to a unique y -value.
 (b) i. domain = R , range = $\{y \mid y > 0, y \in R\}$
 ii. This relationship is a function because its graph passes the vertical line test.
 (c) i. domain = (approx.) $\{x \mid 0.98 \leq x \leq 3.02, x \in R\}$
 range = $\{y \mid -1.8 \leq y \leq 4.8, y \in R\}$
 ii. This is not a function because it fails the vertical line test.
 (d) i. domain = $\{1, 2, 3, 4\}$, range = $\{5, 12, 23, 31\}$
 ii. This is not a function because 3 maps onto 12 and 31.
 (e) i. domain = $\{-1, 0, 3, 4, 5\}$, range = $\{2, 4, 5, 6, 9\}$
 ii. This is not a function because 3 maps onto 5 and 6.
 (f) i. domain = $\{x \mid x \geq -\frac{5}{2}, x \in R\}$, range = $\{y \mid y \leq 0, y \in R\}$
 ii. This is a function because each x value corresponds to a unique y value.
 (g) i. domain = $\{x \mid x \leq -3, x \in R\}$, range = R
 ii. This is not a function because it fails the vertical line test.
 (h) i. domain = $\{x \mid -3 \leq x \leq 3, x \in R\}$,
 range = $\{y \mid -3 \leq y \leq 3, y \in R\}$
 ii. This is not a function because it fails the vertical line test.

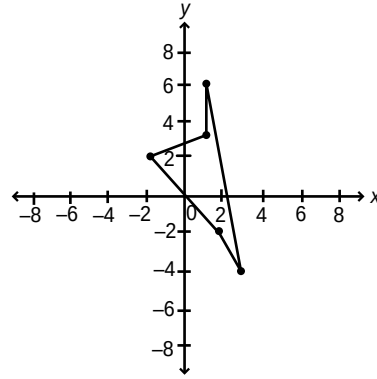
2. (a) $f(x) = -3x + 8$
 $f(4) = -3(4) + 8$
 $= -12 + 8$
 $= -4$
 (b) $f(x) = 14$
 $14 = -3x + 8$
 $6 = -3x$
 $x = -2$
 (c) $f^{-1}(x) = \frac{1}{3}(-x + 8)$
 $f^{-1}(6) = \frac{1}{3}(-6 + 8) = \frac{2}{3}$
 (d) $-3x + 8 = \frac{1}{3}(-x + 8)$
 $-3x + 8 = -\frac{1}{3}x - \frac{8}{3}$
 $-\frac{8}{3}x = -\frac{32}{3}$
 $x = 4$



4. $-33 = 12x - 9$ $123 = 12x - 9$
 $12x = -24$ $12x = 132$
 $x = -2$ $x = 11$

domain = $\{x \mid -2 < x < 11, x \in R\}$

5. (a)



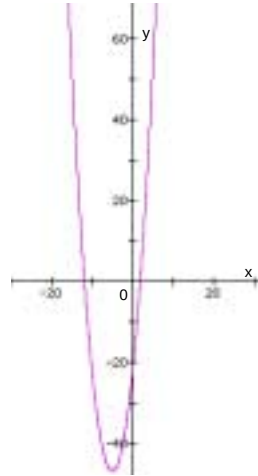
(b) $f(x)$ is not a function because it fails the vertical line test.

6. (a) i. $f(x) = x^2 + 10x - 22$
 $= x^2 + 10x + 25 - 25 - 22$
 $= (x + 5)^2 - 47$

The vertex is at $(-5, -47)$.

ii. domain = R , range = $\{y \mid y \geq -47, y \in R\}$

iii.

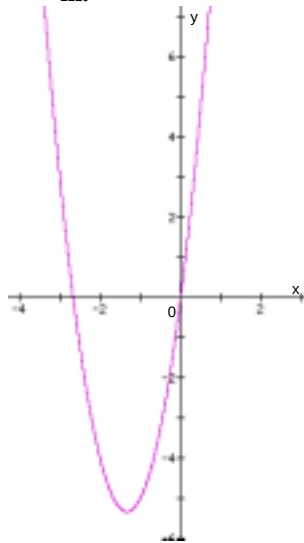


(b) i. $f(x) = 3x^2 + 8x$
 $= 3\left(x^2 + \frac{8}{3}x\right)$
 $= 3\left(x^2 + \frac{8}{3}x + \frac{16}{9} - \frac{16}{9}\right)$
 $= 3\left(x + \frac{4}{3}\right)^2 - \frac{16}{3}$

The vertex is at $\left(-\frac{4}{3}, -\frac{16}{3}\right)$.

ii. domain = R , range = $\{y \mid y \geq -\frac{16}{3}, y \in R\}$

iii.

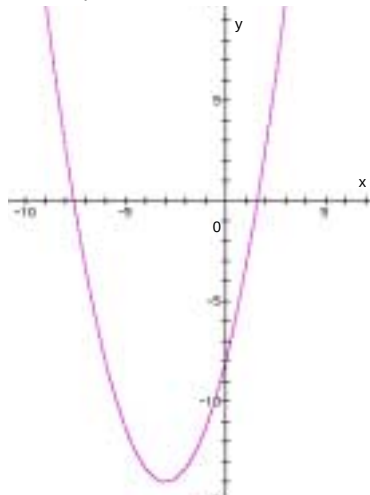


$$\begin{aligned} \text{(c) i. } f(x) &= \frac{2}{3}x^2 + 4x - 8 \\ &= \frac{2}{3}(x^2 + 6x - 12) \\ &= \frac{2}{3}(x^2 + 6x + 9 - 9 - 12) \\ &= \frac{2}{3}(x + 3)^2 - 14 \end{aligned}$$

The vertex is at $(-3, -14)$.

ii. domain $= R$, range $= \{y \mid y \geq -14, y \in R\}$

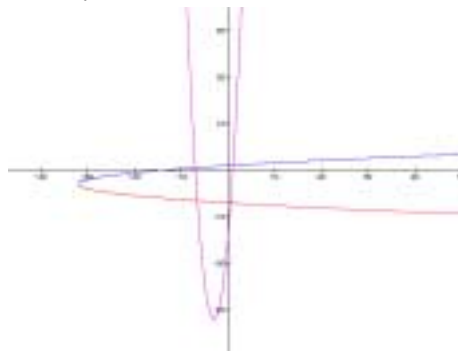
iii.



$$\begin{aligned} 7. \text{ (a) i. } y &= 2x^2 + 12x - 14 \\ x &= 2y^2 + 12y - 14 \\ 2y^2 + 12y &= x + 14 \\ 2(y^2 + 6y) &= x + 14 \\ y^2 + 6y &= \frac{x+14}{2} \\ y^2 + 6y + 9 - 9 &= \frac{x+14}{2} \\ (y+3)^2 &= \frac{x+14}{2} + 9 \\ y+3 &= \pm \sqrt{\frac{x+14}{2}} + 9 - 3 \end{aligned}$$

$$\therefore g^{-1}(x) = \pm \sqrt{\frac{x+14}{2}} + 9 - 3$$

ii.



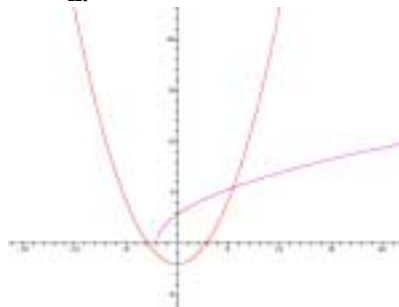
iii. domain $[g(x)] = R$, range $[g(x)] = \{y \mid y \geq -32, y \in R\}$

domain $[g^{-1}(x)] = \{x \mid x \geq -32, x \in R\}$,

range $[g^{-1}(x)] = R$

$$\begin{aligned} \text{(b) i. } y &= \sqrt{4x+8} \\ y^2 &= 4x+8 \\ x^2 &= 4y+8 \\ 4y &= x^2-8 \\ y &= \frac{x^2-8}{4} \\ \therefore g^{-1}(x) &= \frac{x^2-8}{4} \end{aligned}$$

ii.



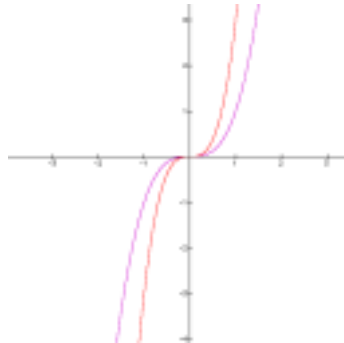
iii. domain $[g(x)] = \{x \mid x \geq -2, x \in R\}$,

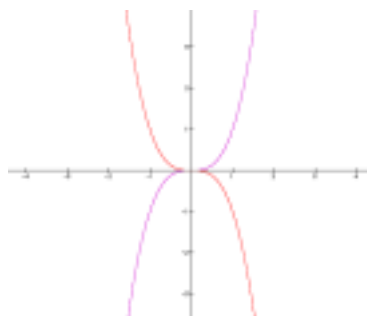
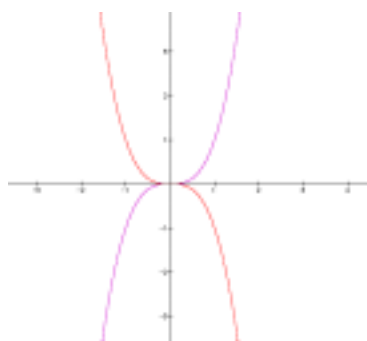
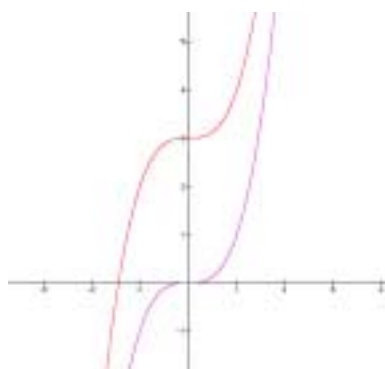
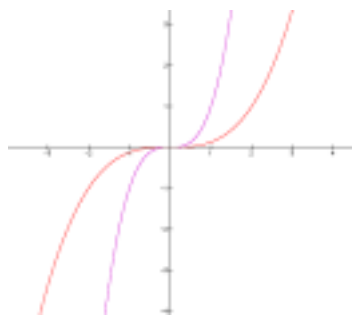
range $[g(x)] = \{y \mid y > 0, y \in R\}$

domain $[g^{-1}(x)] = R$,

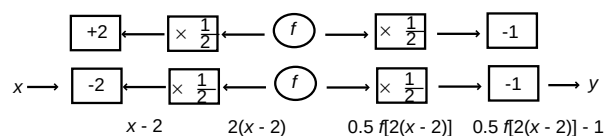
range $[g^{-1}(x)] = \{y \mid y \geq -2, y \in R\}$

8.





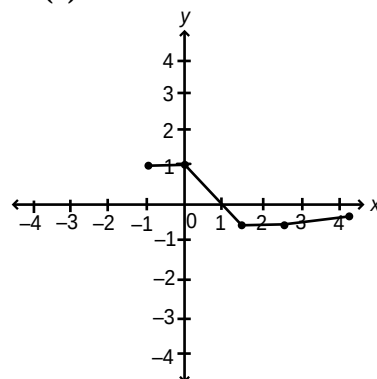
9. (a)



(b) domain = $\{x \mid -1 \leq x \leq 4, x \in \mathbb{R}\}$
 range = $\{y \mid -0.5 \leq y \leq 0.5, y \in \mathbb{R}\}$

(c) $f(4) = 0.25$

(d)



$(-4, 3) \rightarrow (-1, 0.5)$

$(-2, 3) \rightarrow (0, 0.5)$

$(1, 1) \rightarrow (1.5, -0.5)$

$(3, 1) \rightarrow (2.5, -0.5)$

$(6, 2.5) \rightarrow (4, 0.25)$

10. (a) Let $R(x)$ be the revenue function.

$$R(x) = x[p(x)]$$

$$R(x) = x(-4x + 28)$$

$$\therefore R(x) = -4x^2 + 28x$$

(b) Let $P(x)$ be the profit function.

$$P(x) = R(x) - C(x)$$

$$P(x) = (-4x^2 + 28x) - (4x + 12)$$

$$\therefore P(x) = -4x^2 + 24x - 12$$

(c) $P(x) = -4x^2 + 24x - 12$

$$= -4(x^2 + 6x - 3)$$

$$= -4(x^2 + 6x + 9 - 9 - 3)$$

$$= -4(x + 3)^2 + 48$$

where the vertex is at $(-3, 48)$

$\therefore$ profits will be maximized at $x = -3$.

(d) To break even, we must equate revenue to cost;

i.e profits = 0

$$P(x) = -4x^2 + 24x - 12 = 0$$

$$x^2 - 6x + 3 = 0$$

$$x = \frac{6 \pm \sqrt{(36) - 4(1)(3)}}{2}$$

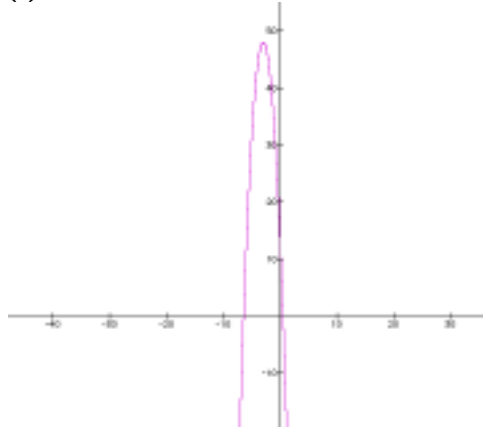
$$= \frac{6 \pm \sqrt{24}}{2}$$

$$= \frac{6 \pm 2\sqrt{6}}{2}$$

$$= 3 + \sqrt{6} \text{ or } 3 - \sqrt{6}$$

$$= 5.45 \text{ or } 0.55$$

(e)



11.

Unit Price	Unit Sold	Revenue
\$40	5000	\$200 000
\$41	4900	\$200 900
\$42	4800	\$201 600
\$43	4700	\$202 100
\$44	4600	\$202 400
\$45	4500	\$202 500
\$46	4400	\$202 400
\$47	4300	\$202 100
\$48	4200	\$201 600
\$49	4100	\$200 900
\$50	4000	\$200 000
\$51	3900	\$198 900
\$52	3800	\$197 600
\$53	3700	\$196 100
\$54	3600	\$194 400
\$55	3500	\$192 500
\$56	3400	\$190 400
\$57	3300	\$188 100
\$58	3200	\$185 600

$\therefore$ the unit price that will maximize the total revenue is at \$45 with a revenue of \$202 500.

12.(a) $f(x) = 4x^2 + 12x + 9$

$$\begin{aligned} \text{i. } x &= \frac{-12 \pm \sqrt{12^2 - 4(4)(9)}}{2(4)} \\ &= \frac{-12 \pm \sqrt{144 - 144}}{8} \\ &= \frac{-12 \pm 0}{8} \\ &= \frac{-3}{2} \quad \therefore \text{there is one zero} \end{aligned}$$

ii. The graph touches the x-axis at one point.

(b) $g(x) = -2(x - 0.5)^2 + 12.5$

$$\begin{aligned} \text{i. } g(x) &= -2(x^2 - x + 0.25) + 12.5 \\ &= -2x^2 + 2x - 0.5 + 12.5 \\ &= -2x^2 + 2x + 12 \\ &= (-2x + 6)(x + 2) \end{aligned}$$

$$\begin{aligned} -2x + 6 &= 0 & x + 2 &= 0 \\ -2x &= -6 & x &= -2 \\ x &= 3 & & \end{aligned}$$

$\therefore$ there are two zeros.

ii. The graph intersects the x-axis at two points.

(c) $h(x) = -3(x + 1.9)^2$

$$\begin{aligned} \text{i. } h(x) &= -3(x^2 + 3.8x + 3.61) \\ &= -3x^2 - 11.4x - 10.83 \end{aligned}$$

$$\begin{aligned} x &= \frac{11.4 \pm \sqrt{11.4^2 - 4(-3)(-10.83)}}{2(-3)} \\ &= \frac{11.4 \pm \sqrt{129.96 - 129.96}}{-6} \\ &= \frac{11.4}{-6} \quad \therefore \text{there is one zero.} \end{aligned}$$

ii. The graph touches the x-axis at one point.

13.(a) $2x^2 + 5x - 3 = 0$

$$\begin{aligned} x &= \frac{-5 \pm \sqrt{5^2 - 4(2)(-3)}}{2(2)} \\ &= \frac{-5 \pm \sqrt{25 + 24}}{4} \\ &= \frac{-5 \pm \sqrt{49}}{4} \\ &= \frac{-5 \pm 7}{4} \\ &= \frac{-5 + 7}{4} \text{ or } x = \frac{-5 - 7}{4} \\ \therefore x &= \frac{1}{2} \text{ or } -3 \end{aligned}$$

(b) $3x^2 + 48 = 0$

$$\begin{aligned} 3x^2 &= -48 \\ x^2 &= -16 \\ x^2 &= 16(i^2) \\ x &= \sqrt{16i^2} \\ x &= \pm 4i \end{aligned}$$

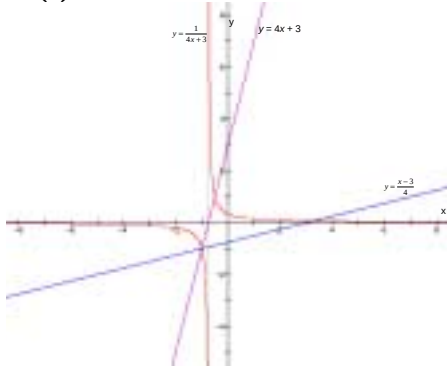
(c) $3x^2 - 2x + 3 = 0$

$$\begin{aligned} x &= \frac{2 \pm \sqrt{2^2 - 4(3)(3)}}{2(3)} \\ &= \frac{2 \pm \sqrt{-32}}{6} \\ &= \frac{2 \pm 4\sqrt{2}i}{6} \\ &= \frac{1 \pm 2\sqrt{2}i}{3} \end{aligned}$$

(d) $5x^2 - 4x + 20 = 0$

$$\begin{aligned} x &= \frac{4 \pm \sqrt{4^2 - 4(5)(20)}}{2(5)} \\ &= \frac{4 \pm \sqrt{16 - 400}}{10} \\ &= \frac{4 \pm \sqrt{-384}}{10} \\ &= \frac{4 \pm 8\sqrt{6}i}{10} \\ x &= \frac{2 \pm 4\sqrt{6}i}{5} \\ x &= \frac{2 \pm 4\sqrt{6}i}{5} \end{aligned}$$

14.(a)



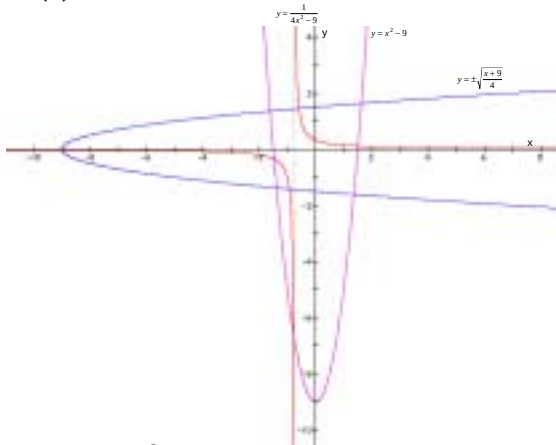
$$y = 4x + 3; \text{domain} = R, \text{range} = R$$

$$y = \frac{1}{4x+3}; \text{domain} = \{x \mid x \neq -\frac{3}{4}, x \in R\},$$

$$\text{range} = \{y \mid y \neq 0, y \in R\}$$

$$y = \frac{(x-3)}{4}; \text{domain} = R, \text{range} = R$$

(b)



$$y = 4x^2 - 9; \text{domain} = R, \text{range} = \{y \mid y \geq -9, y \in R\}$$

$$y = \frac{1}{4x^2 - 9}$$

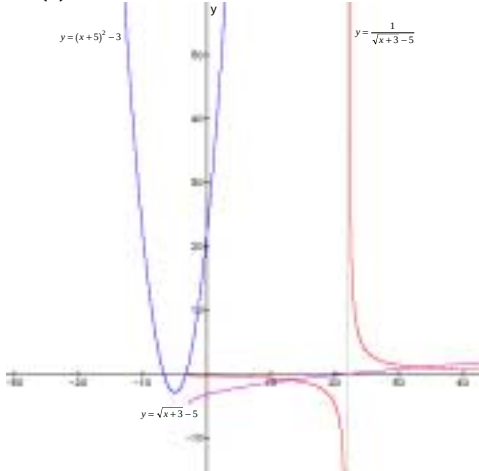
$$\text{domain} = \{x \mid x \neq \pm 1.5, x \in R\}$$

$$\text{range} = \{y \mid y \neq 0, y \in R\}$$

$$y = -\sqrt{\frac{x+9}{4}}$$

$$\text{domain} = \{x \mid x \geq -9, x \in R\}, \text{range} = R$$

(c)



$$y = \sqrt{x+3} - 5; \text{domain} = \{x \mid x \geq -3, x \in R\},$$

$$\text{range} = \{y \mid y \geq -5, y \in R\}$$

$$y = \frac{1}{\sqrt{x+3}-5}; \text{domain} = \{x \mid x \neq -22, x \in R\},$$

$$\text{range} = \{y \mid y \neq 0, y \in R\}$$

$$y = (x+5)^2 - 3; \text{domain} = \{x \mid x \in R\},$$

$$\text{range} = \{y \mid y \geq -3, y \in R\}$$

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

i. $2x+4=0$

$$2x = -4$$

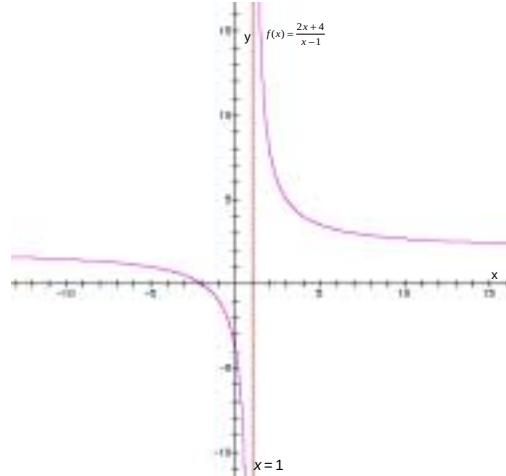
$$x = -2$$

ii. $x-1=0$

$$x = 1$$

iii. domain = $\{x \mid x \neq 1, x \in R\}$

iv. range = $\{y \mid y \neq 2, y \in R\}$



(b) $g(x) = \frac{-2x}{x^2 - 6x + 9}$

i. $-2x = 0$

$$x = 0$$

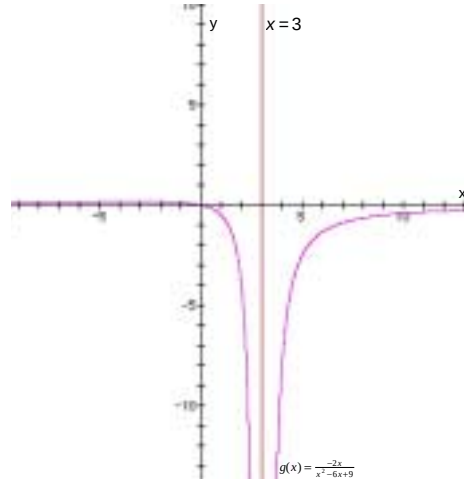
ii. $x^2 - 6x + 9 = 0$

$$(x-3)^2 = 0$$

$$x = 3$$

iii. domain = $\{x \mid x \neq 3, x \in R\}$

iv. range = $\{y \mid y \neq 0, y \in R\}$



(c) $h(x) = \frac{x^2 - x - 30}{x+2}$

i. $x^2 - x - 30 = 0$

$$(x-6)(x+5) = 0$$

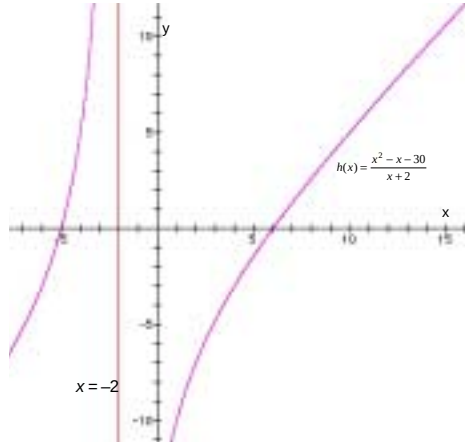
$$x = 6, x = -5$$

ii. $x + 2 = 0$

$x = -2$

iii. domain = $\{x \mid x \neq -2, x \in \mathbb{R}\}$

iv. range = $\{y \mid y \in \mathbb{R}\}$



16. (a) $(2x^4 - 3x^2 - 6) + (6x^4 - x^3 + 4x^2 + 5)$
 $= 2x^4 - 3x^2 - 6 + 6x^4 - x^3 + 4x^2 + 5$
 $= 8x^4 - x^3 + x^2 - 1$

(b) $(x^2 - 4)(2x^2 + 5x - 2)$
 $= 2x^4 + 5x^3 - 2x^2 - 8x^2 - 20x + 8$
 $= 2x^4 + 5x^3 - 10x^2 - 20x + 8$

(c) $-7x(x^2 + x - 1) - 3x(2x^2 - 5x + 6)$
 $= -7x^3 - 7x^2 + 7x - 6x^3 + 15x^2 - 18x$
 $= -13x^3 + 8x^2 - 11x$

(d) $-2x^2(3x^3 - 7x + 2) - x^3(5x^3 + 2x - 8)$
 $= -6x^5 + 14x^3 - 4x^2 - 5x^6 - 2x^4 + 8x^3$
 $= -5x^6 - 6x^5 - 2x^4 + 22x^3 - 4x^2$

(e) $-2x[5x - (2x - 7)] + 6x[3x - (1 + 2x)]$
 $= -2x(5x - 2x + 7) + 6x(3x - 1 - 2x)$
 $= -10x^2 + 4x^2 - 14x + 18x^2 - 6x - 12x^2$
 $= -20x$

(f) $(x + 2)^2(x - 1)^2 - (x - 4)^2(x + 4)^2$
 $= (x^2 + 4x + 4)(x^2 - 2x + 1) - (x^2 - 8x + 16)$
 $(x^2 + 8x + 16)$
 $= x^4 - 2x^3 + x^2 + 4x^3 - 8x^2 + 4x + 4x^2 - 8x + 4$
 $- (x^2 - 8x + 16)(x^2 + 8x + 16)$
 $= x^4 + 2x^3 - 3x^2 - 4x + 4 - [x^4 + 8x^3 + 16x^2 - 8x^3$
 $- 64x^2 - 128x + 16x^2 + 128x + 256]$
 $= x^4 + 2x^3 - 3x^2 - 4x + 4 - (x^4 - 32x^2 + 256)$
 $= x^4 + 2x^3 - 3x^2 - 4x + 4 - x^4 + 32x^2 - 256$
 $= 2x^3 + 29x^2 - 4x - 252$

(g) $(x^2 + 5x - 3)^2$
 $= (x^2 + 5x - 3)(x^2 + 5x - 3)$
 $= x^4 + 5x^3 - 3x^2 + 5x^3 + 25x^2 - 15x - 3x^2 - 15x + 9$
 $= x^4 + 10x^3 + 19x^2 - 30x + 9$

17.(a) $\frac{2x + 4}{x^2 - 4} = \frac{2(x + 2)}{(x - 2)(x + 2)}, x \neq \pm 2$
 $= \frac{2}{x - 2}, x \neq \pm 2$

(b) $\frac{18p^2q^2}{-6p^{-1}q^3} = \frac{18p^3q^2}{-6q^3}, q \neq 0$
 $= \frac{-3p^3}{q}, q \neq 0$

(c) $\frac{25x^2 - 9}{4x^2 + x - 3} \times \frac{8x - 6}{5x^2 + 8x + 3}$
 $= \frac{(5x - 3)(5x + 3)}{(4x - 3)(x + 1)} \times \frac{2(4x - 3)}{(5x + 3)(x + 1)}, x \neq -1, -\frac{3}{5}, \frac{3}{4}$
 $= \frac{2(5x - 3)}{(x + 1)^2}, x \neq -1, -\frac{3}{5}, \frac{3}{4}$

(d) $\frac{a^2 - 3a - 10}{a^2 - a + 12} \div \frac{a^2 - 5a - 15}{a^2 + 7a + 12}$
 $= \frac{a^2 - 3a - 10}{a^2 - a + 12} \times \frac{a^2 + 7a + 12}{a^2 - 5a - 15}$
 $= \frac{(a - 5)(a + 2)}{(a - 4)(a + 3)} \times \frac{(a + 3)(a + 4)}{a^2 - 5a - 15}, a \neq -3, 4, -2.11, 7.11$
 $= \frac{(a - 5)(a + 2)(a + 4)}{(a - 4)(a^2 - 5a - 15)}, a \neq -3, 4, -2.11, 7.11$

(e) $\frac{a^2 + 6ab + 8b^2}{a^2 + 14ab + 20b^2} \times \frac{a^2 + 5ab - 6b^2}{a^2 - ab - 6b^2} \times \frac{a^2 + 2ab - 15b^2}{a^2 + 8ab + 12b^2}$
 $= \frac{(a + 4b)(a + 2b)}{a^2 + 14ab + 20b^2} \times \frac{(a + 6b)(a - b)}{(a - 3b)(a + 2b)} \times \frac{(a + 5b)(a - 3b)}{(a + 6b)(a + 2b)}$
 $= \frac{(a + 4b)}{a^2 + 14ab + 20b^2} \times \frac{(a - b)}{(a + 2b)} \times (a + 5b)$

Solving for a and b :

$a^2 + 14ab + 20b^2 = 0$

$a = \frac{-14b \pm \sqrt{196b^2 - 4(1)(20b^2)}}{2}$

$= \frac{-14 \pm \sqrt{116b^2}}{2}$

$= \frac{-14b \pm 2b\sqrt{29}}{2}$

$= -7 \pm b\sqrt{29}$

AND

$20b^2 + 14ab + a^2 = 0$

$b = \frac{-14a \pm \sqrt{196a^2 - 4(20)(a^2)}}{2(20)}$

$= \frac{-14a \pm \sqrt{116a^2}}{40}$

$= \frac{-14a \pm 2a\sqrt{29}}{40}$

$= -\frac{7}{20} \pm \frac{a\sqrt{29}}{20}$

$\therefore a \neq -2b, -7 \pm b\sqrt{29}$

$b \neq -\frac{1}{2}a, -\frac{7}{20} \pm \frac{a\sqrt{29}}{20}$

(f) $\frac{2}{b + 7} + \frac{3}{4 - 3b} = \frac{2(4 - 3b) + 3(b + 7)}{(b + 7)(4 - 3b)}, b \neq -7, \frac{4}{3}$
 $= \frac{8 - 6b + 3b + 21}{(b + 7)(4 - 3b)}$
 $= \frac{29 - 3b}{(b + 7)(4 - 3b)}, b \neq -7, \frac{4}{3}$

$$\begin{aligned}
 \text{(g)} \quad & \frac{3}{(x^2 - x - 12)} - \frac{2}{x^2 - 16} \\
 &= \frac{3(x^2 - 16) - 2(x^2 - x - 12)}{(x^2 - x - 12)(x^2 - 16)} \\
 &= \frac{3x^2 - 48 - 2x^2 + 2x + 24}{(x - 4)(x + 3)(x - 4)(x + 4)}, \quad x \neq -3, \pm 4 \\
 &= \frac{x^2 + 2x - 24}{(x - 4)^2(x + 3)(x + 4)} \\
 &= \frac{(x + 6)(x - 4)}{(x - 4)^2(x + 3)(x + 4)} \\
 &= \frac{(x + 6)}{(x - 4)(x + 3)(x + 4)}, \quad x \neq \pm 4, -3
 \end{aligned}$$

$$\begin{aligned}
 \text{(h)} \quad & \frac{a+b}{a} - \frac{a-b}{ab+b^2} - \frac{2a+b}{b} \\
 &= \frac{(a+b)(ab+b^2)(b) - (a-b)ab - (2a+b)(a)(ab+b^2)}{ab(ab+b^2)} \\
 &= \frac{(ab+b^2)(ab+b^2) - (a^2b - ab^2) - (2a^2 + ab)(ab+b^2)}{ab(ab+b^2)} \\
 &= \frac{a^2b^2 + 2ab^3 + b^4 - a^2b + ab^2 - 2a^2b - 2ab^2 - a^2b^2 - ab^2}{ab(ab+b^2)} \\
 &= \frac{b^4 + 2ab^3 - 3a^2b - 2ab^2}{ab(ab+b^2)} \\
 &= \frac{b(b^3 + 2ab^2 - 3a^2 - 2ab)}{ab(ab+b^2)} \\
 &= \frac{b^3 + 2ab^2 - 3a^2 - 2ab}{ab(a+b)} \\
 &\therefore a \neq 0, -b \\
 &\quad b \neq 0, -a
 \end{aligned}$$

18.U

$$\begin{aligned}
 \text{(a)} \quad & (-4i)^2 = 16i^2 \\
 &= 16(-1) \\
 &= -16 \\
 \text{(b)} \quad & 2i^9 = 2i^8 \times i \\
 &= 2(i^2)^4 \times i \\
 &= 2(-1)^4 \times i \\
 &= 2i \\
 \text{(c)} \quad & (2 - 7i)(2 + 7i) = 4 - 49i^2 \\
 &= 4 - 49(-1) \\
 &= 4 + 49 \\
 &= 53
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad & (-3 - 4i) + (2 - 3i) - (4 - 5i) \\
 &= -3 - 4i + 2 - 3i - 4 + 5i \\
 &= -5 - 2i
 \end{aligned}$$

$$\begin{aligned}
 \text{(e)} \quad & \frac{3-5i}{8+3i} \\
 &= \frac{3-5i}{8+3i} \times \frac{8-3i}{8-3i} \\
 &= \frac{24 - 49i + 15i^2}{64 - 9i^2} \\
 &= \frac{24 - 49i + 15(-1)}{64 - 9(-1)} \\
 &= \frac{9 - 49i}{55} \\
 &= \frac{9}{55} - \frac{49}{55}i
 \end{aligned}$$

$$\begin{aligned}
 \text{(f)} \quad & [-i + (3 - 5i)]^3 \\
 &= (-i + 3 - 5i)^3 \\
 &= (-6i + 3)^3 \\
 &= (3 - 6i)(3 - 6i)(3 - 6i) \\
 &= (9 - 36i + 36i^2)(3 - 6i) \\
 &= 27 - 54i - 108i + 216i^2 + 108i^2 - 216i^3 \\
 &= 27 - 162i + 324i^2 - 216i^3 \\
 &= 27 - 162i - 324(-1) - 216(-1)i \\
 &= 351 - 162i + 216i \\
 &= 351 + 54i
 \end{aligned}$$

$$\begin{aligned}
 \text{(g)} \quad & \frac{(-1+4i)^2}{(2+i)(3+i)} \\
 &= \frac{1 - 8i + 16i^2}{(2+i)(3+i)} \\
 &= \frac{6 + 2i + 3i + i^2}{(2+i)(3+i)} \\
 &= \frac{1 - 8i + 16(-1)}{6 + 5i + (-1)} \\
 &= \frac{1 - 8i - 16}{5 + 5i} \\
 &= \frac{-15 - 8i}{5 + 5i} \times \frac{5 - 5i}{5 - 5i} \\
 &= \frac{-75 + 35i + 40i^2}{25 - 25i^2} \\
 &= \frac{-75 + 35i + 40(-1)}{25 - 25(-1)} \\
 &= \frac{-115 + 35i}{50} \\
 &= \frac{-23 + 7i}{10} \\
 &= -\frac{23}{10} + \frac{7}{10}i
 \end{aligned}$$

$$\begin{aligned}
 \text{(h)} \quad & \frac{(6-3i) - (7+2i)}{(2+3i) + (2-i)} \\
 &= \frac{6 - 3i - 7 - 2i}{2 + 3i + 2 - i} \\
 &= \frac{-1 - 5i}{4 + 2i} \times \frac{4 - 2i}{4 - 2i} \\
 &= \frac{-4 - 18i + 10i^2}{16 - 4i^2} \\
 &= \frac{-4 - 18i - 10}{16 + 4} \\
 &= \frac{-14 - 18i}{20} \\
 &= \frac{-7 - 9i}{10} \\
 &= -\frac{7}{10} - \frac{9}{10}i
 \end{aligned}$$