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CHAPTER 1

**The Fundamental Concepts**

(1) (a) 8

(b) 85

(c) 1

(d)  $6x^2y^2$

(e)  $7x$

(f)  $\frac{5}{17}$

(g)  $-\frac{1}{4}$



CHAPTER 2

**Equations and Inequalities**

(1) (a)  $x = \frac{10}{3}$

(b)  $a = -9$

(c) All real numbers

(d) All real numbers

(e)  $-3 < x \leq -4$

(f)  $x = 1$  or  $x = -4$

(g)  $x > 1$  or  $x < -\frac{1}{3}$

(h)  $x = -\frac{3}{5}$  or  $-5$

(i)  $x = 2$  or  $-\frac{6}{5}$

(2)  $x = -8$



CHAPTER 3

**Graphing Straight Lines and Functions**

- (1) (a)  $D : \{y \mid y \neq -4\}$
- (b)  $D : \{x \mid x \neq 0\}$
- (c)  $D : \{z \mid z \neq 5\}$
- (d)  $D : \{x \mid x \in \mathbb{R}\}$
- (e)  $D : \{x \mid x \in \mathbb{R}\}$
- (f)  $D : \{x \mid x = 1, 4, 7\}$
- (2) (a)  $f(3) = -2$
- (b)  $f(-5) = 4$
- (c)  $f(-3) = 4$
- (d)  $f(0) = 0$
- (e)  $x = 0, 5$
- (3) (a) Relation
- (b) Function
- (c) Relation
- (d) Relation
- (e) Function
- (f) Function
- (4) (a)  $f(x^2) = 3x^4 + 4$
- (b)  $g(x - 2) = \sqrt{2x - 3}$
- (c)  $g(4) - f(-2) = -5$

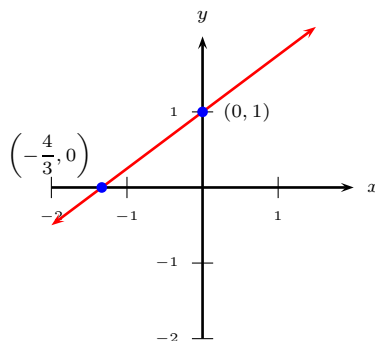


CHAPTER 4

**Equations of a Line and Linear Systems in Two Variables**

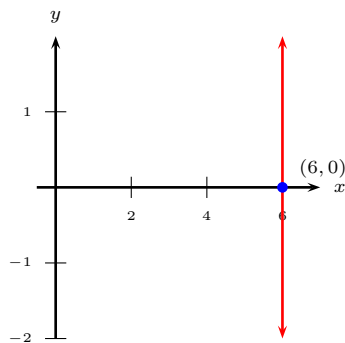
- (1) (a)  $m = \frac{5}{6}$   
(b)  $m = 0$   
(c)  $m = -\frac{1}{3}$   
(d)  $m$  is undefined
- (2) (a)  $m = -\frac{8}{3}$   
(b)  $m = -\frac{21}{4}$   
(c)  $m$  is undefined  
(d)  $m = 0$
- (3) (a)  $(0, 6)$  and  $(-10, 0)$   
(b)  $\left(0, \frac{1}{2}\right)$  and  $\left(-\frac{15}{4}, 0\right)$   
(c)  $y = 3$   
(d)  $x = 7$
- (4) (a)

$$y = \frac{3}{4}x + 1$$



(b)

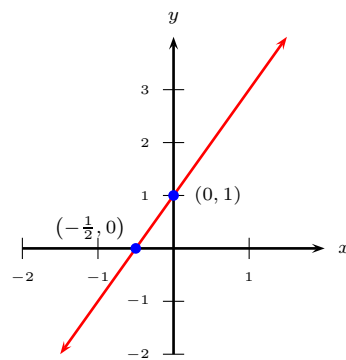
$$x = 6$$



(c)

$$3y - 6x = 3$$

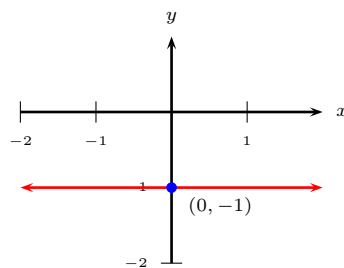
$$y = 2x + 1$$



(d)

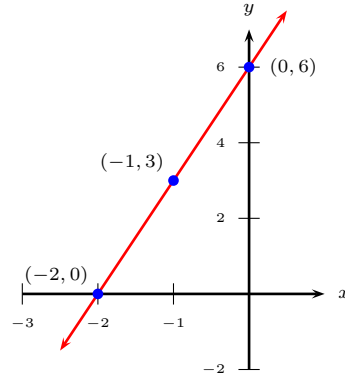
$$y + 1 = 0$$

$$y = -1$$



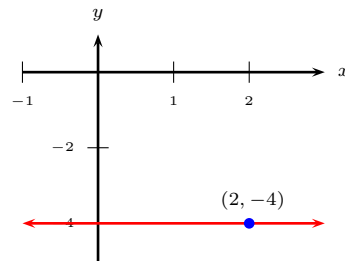
(e)

$$P(-1, 3) \quad m = 3$$



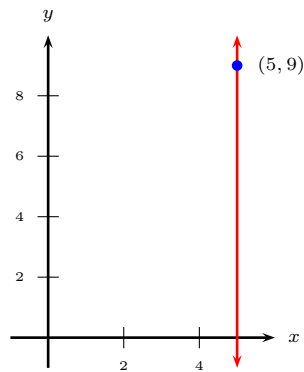
(f)

$$P(2, -4) \quad m = 0$$



(g)

$$P(5, 9) \quad m \text{ is undefined}$$



$$(5) \text{ (a) } y = \frac{1}{5}x - \frac{19}{5}$$

$$\text{(b) } y = -\frac{3}{2}x + \frac{17}{2}$$

$$\text{(c) } y = 3$$

$$\text{(d) } x = 7$$

(e)  $y = \frac{3}{5}x + \frac{47}{5}$

(f)  $y = -2x + 9$

(g)  $y = \frac{4}{5}x - 4$

(h)  $x = -3$

(i)  $x = -1$

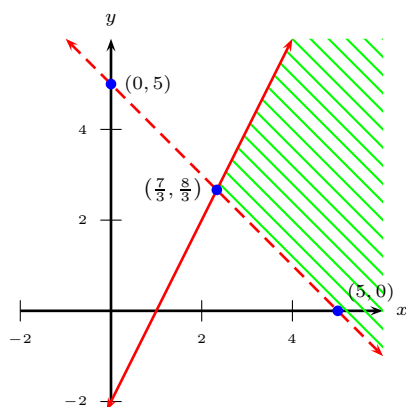
(6) (a) (18, 4)

(b) (2, -1)

(c) (-2, -7)

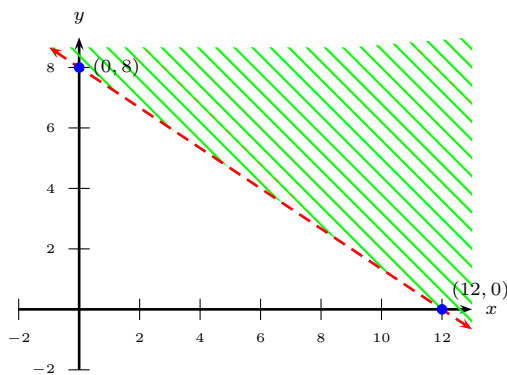
(7) (a)

$$\begin{cases} x + y > 5 \\ 2x - y \geq 2 \end{cases}$$



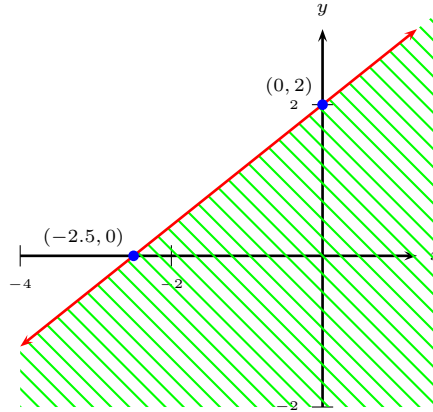
(b)

$$2x + 3y > 24$$



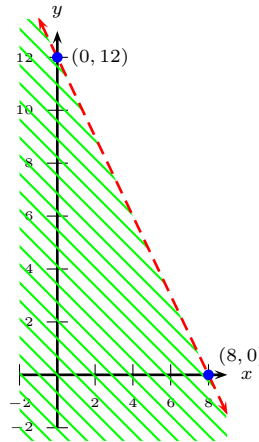
(c)

$$5y - 4x \leq 10$$



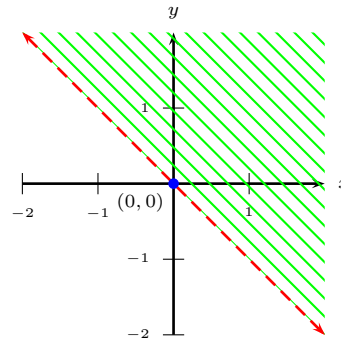
(d)

$$\frac{x}{2} + \frac{y}{3} < 4$$



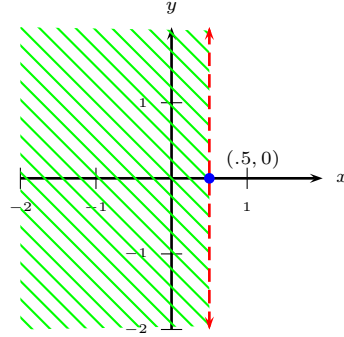
(e)

$$x > -y$$



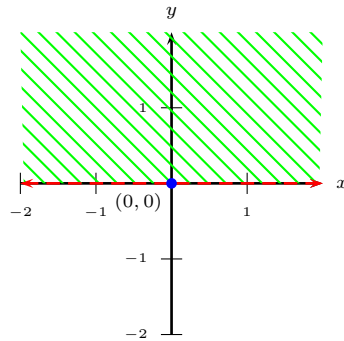
(f)

$$x < \frac{1}{2}$$



(g)

$$\frac{y}{3} > 0$$



(8) 5 quarters, 8 dimes, and 3 nickles

(9) 9lbs of \$2.20 and 6 lbs. of \$2.60

(10) \$15,550 at 12 % and \$11,500 at 8%

## Polynomial Expressions and Functions

- (1) (a) Degree: 5; Coefficient: 2  
 (b) Degree: 4; Coefficient: -5  
 (c) Degree: 2; Coefficient:  $-\frac{1}{3}$   
 (d) Degree: 3
- (2) (a)  $-x^3 - x^2 + 4x + 3$   
 (b)  $-2x^4 - 2x^3 - x^2 + 4x + 3$   
 (c)  $-7z^2 - 5z$   
 (d)  $-18ba^3 + 6a^2b^3 - 15ab^2$   
 (e)  $15m^2 + 14m - 8$   
 (f)  $3z^2 + 2zw - 4w^2$   
 (g)  $9r^4 - 30r^2 + 25$   
 (h)  $x^3 - 8$   
 (i)  $4x^8 - 9$   
 (j)  $m^4 - 4m^3 + 14m^2 - 20m + 25$   
 (k)  $3x^2 - 5$  remainder 13  
 (l)  $4y^2 - \frac{8}{3}y + \frac{4}{9}$  remainder  $\frac{1}{9}$
- (3) (a)  $x = -d\frac{4}{9}$  and  $x = -1$   
 (b)  $x > 8$   
 (c)  $x = \frac{9 \pm 3\sqrt{17}}{2}$   
 (d)  $\{x \mid x \in \left(-5, -\frac{5}{4}\right] \cup (0, 1) \cup [2, \infty)\}$

- (e) no solution
- (f)  $x = \frac{E - IR}{I}$
- (g)  $x = \frac{2 + y}{1 - 2y}$
- (4) (a)  $4x(1 - 2x)(1 + 2x)$  or  $-4x(2x - 1)(2x + 1)$
- (b)  $7(x^2 + 7)$
- (c)  $(3a - b)(2x + 5)$
- (d)  $(7x + 2)(x + 3)$
- (e)  $(a - 2)(a + 2)(a^2 + 2a + 4)(a^2 - 2a + 4)$
- (f)  $(5x + 2)(2x - 3)$
- (g)  $(3x + 2)(2x - 3)$
- (h)  $(3c - 5d)(a + 2b)$
- (i)  $(2x - 1)(2x + 15)$
- (j)  $(2x + y + 1)(2x - y + 1)$
- (k)  $2x(x - 4)(x + 2)$
- (l)  $(7x - 2y)(7x + 2y)$
- (m) Not factorable
- (n)  $(a - 1)(a + 1)(a + 4)$
- (5) (a)  $\pm \frac{\sqrt{30}}{2}$
- (b)  $y = 0$  and  $\frac{1}{2}$
- (c)  $x = -\frac{1}{2}, 5$
- (d)  $x = 0, -1$
- (e)  $a = -6, 0, 2$
- (f)  $x = 1, 5$
- (6) (a)  $S(2) = 48$

(b)  $t = 3$  seconds



CHAPTER 6

**Rational Expressions and Functions**

(1) (a)  $\{y \in \mathbb{R} \mid y \neq \frac{9}{2}\}$

(b)  $\{x \in \mathbb{R} \mid x \neq 0\}$

(c)  $\{z \mid z \in \mathbb{R}\}$

(d)  $\{x \in \mathbb{R} \mid x \neq -2\}$

(2) (a)  $\frac{z-2}{2z(z-3)}$

(b)  $\frac{x+1}{x-3}$

(c)  $\frac{3}{(m-n)^2}$

(d)  $\frac{-a-b}{a-b}$  or  $\frac{a+b}{b-a}$

(e) 2

(f)  $\frac{6-2x}{(x+3)(x-2)(x+2)}$

(g)  $\frac{x-2}{(x-4)(x-6)}$

(3)  $\frac{36}{17}$  or  $2\frac{2}{17}$  hours



**Exponents and Radicals**

(1) (a)  $100x^6y^2$

(b)  $-\frac{4b^2y^2}{3ax^2}$

(c)  $x^{1/4}$  or  $\sqrt[4]{x}$

(d)  $b^{13/15}$

(e)  $-\frac{2x^4y}{9}$

(f)  $a^{1/2}$  or  $\sqrt{a}$

(g)  $\frac{1}{y^4}$

(h)  $x^{5/2}y$

(i)  $\frac{1}{3}$

(j)  $\frac{1+x^2}{yx}$

(k)  $\frac{9r^4s^{10}}{25}$

(l)  $x - x^{4/3}$

(2) (a) -5

(b)  $\frac{1}{8}$

(c) 8

(d) -1

(e) 27

(f) no real solution

- (g) 4
- (h) 125
- (3) (a)  $4\sqrt[5]{a^3}$
- (b)  $\sqrt[b]{y^a}$
- (c)  $\sqrt[3]{13}$
- (d)  $\sqrt[b]{z(a-b)}$
- (4) (a)  $17^{1/2}$
- (b)  $x^{2/3}$
- (c)  $x^3$
- (d)  $x^{m/n}$
- (5) (a)  $2x^2y^2\sqrt[3]{7y}$
- (b)  $2m^2p^3\sqrt[5]{2m}$
- (c)  $14abc\sqrt[3]{a^2c}$
- (d)  $3(x-y)^2$
- (e)  $136\sqrt{2y}$
- (f)  $4x^3\sqrt{x}$
- (g)  $x\sqrt{10}$
- (h)  $2y\sqrt{2x}$
- (i)  $\sqrt[6]{x^5}$
- (j)  $4x - 10\sqrt{x}$
- (k)  $1 - 3\sqrt[3]{x} + 3\sqrt[3]{x^2} - x$  or  $1 - 3x^{1/3} + 3x^{2/3} - x$
- (l)  $\frac{2\sqrt[3]{3}}{3}$
- (m)  $\frac{\sqrt{5}}{5}$
- (n)  $5\sqrt{2}$
- (o)  $\sqrt{2} + 1$

(p)  $\frac{3y^2\sqrt{2}}{2}$

(q)  $\frac{r^2s^3}{2}$

(r)  $2x\sqrt[3]{y^2}$

(s)  $4 - \sqrt[3]{100}$

(t)  $\sqrt{7} - \sqrt{2}$

(u)  $12 - 6\sqrt{11}$

(v)  $(\sqrt{a} - \sqrt{b})(a + b)$

(6) (a)  $-i$

(b)  $-i$

(c)  $1$

(d)  $-5 - 5i$

(e)  $2 + \sqrt{2}i$

(f)  $2 - 11i$

(g)  $(5 + \sqrt{2}) + (4 + 2y)i$

(h)  $1 + 3i$

(i)  $-\frac{7}{17} - \frac{23}{17}i$

(7) (a)  $x = 4$

(b)  $x = 121$

(c)  $x = 19$

(d)  $x = \frac{30}{4}$

(e)  $x = 5$

(f)  $x = 2$

(g)  $x = 2$

(h)  $x = 6$



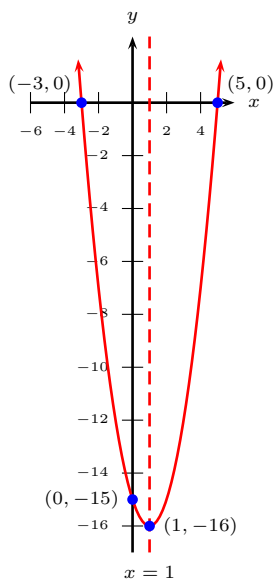
**Quadratic Functions and Equations**

- (1) (a)  $x = \pm 5\sqrt{3}i$
- (b)  $x = 0$  or  $x = \pm \frac{\sqrt{3}}{2}$
- (c)  $x = \pm \frac{2\sqrt{5}}{5}i$
- (d)  $x = 0$  or  $x = -5$
- (e)  $x = 2$
- (f)  $x = \frac{1}{64}$
- (g)  $x = \pm 3$  or  $x = \pm 2$
- (h)  $x = 64$  or  $x = 1$
- (i)  $x = -1$  or  $x = 2$  or  $x = 5$
- (j)  $x = 3 \pm 2\sqrt{5}$
- (k)  $x = 1 \pm \frac{\sqrt{3}}{2}$
- (l)  $x = 2 \pm \frac{\sqrt{2}}{2}i$
- (m)  $x = -4$  or  $x = 5$
- (2) (a) 2 real distinct roots
- (b) complex conjugate pair

(3) (a)

$$y = x^2 - 2x - 15$$

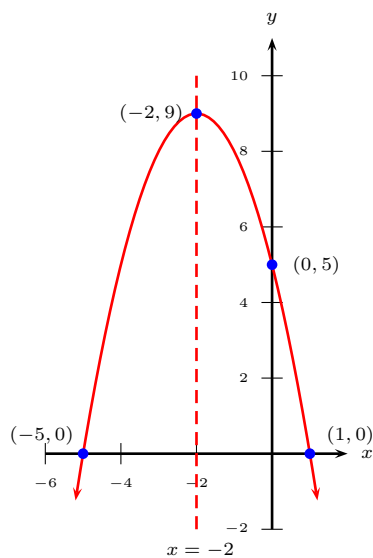
$y$ -int:  $(0, -15)$   
 $x$ -int:  $(-3, 0)$  and  $(5, 0)$   
 vertex:  $(1, -16)$   
 Axis of symmetry:  $x = 1$



(b)

$$f(x) = 5 - 4x - x^2$$

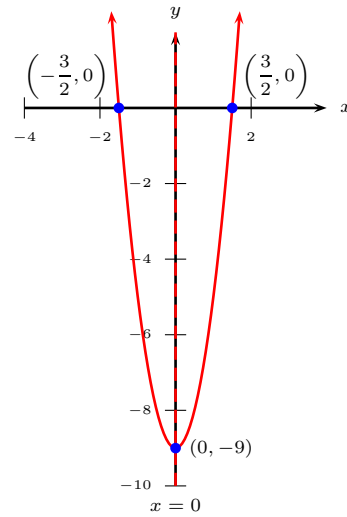
$y$ -int:  $(0, 5)$   
 $x$ -int:  $(-5, 0)$  and  $(1, 0)$   
 vertex:  $(-2, 9)$   
 Axis of symmetry:  $x = -2$



(c)

$$y = 4x^2 - 9$$

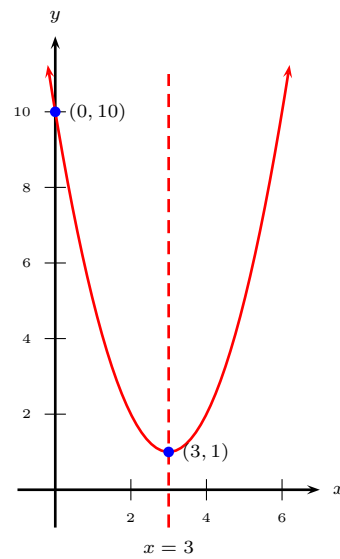
$y$ -int:  $(0, -9)$   
 $x$ -int:  $\left(-\frac{3}{2}, 0\right)$  and  $\left(\frac{3}{2}, 0\right)$   
 vertex:  $(1, -9)$   
 Axis of symmetry:  $x = 0$



(d)

$$y = x^2 - 6x + 10$$

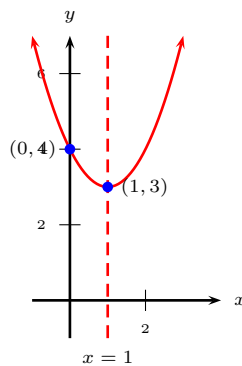
$y$ -int:  $(0, 10)$   
 $x$ -int: None  
 vertex:  $(3, 1)$   
 Axis of symmetry:  $x = 3$



(e)

$$g(x) = (x - 1)^2 + 3$$

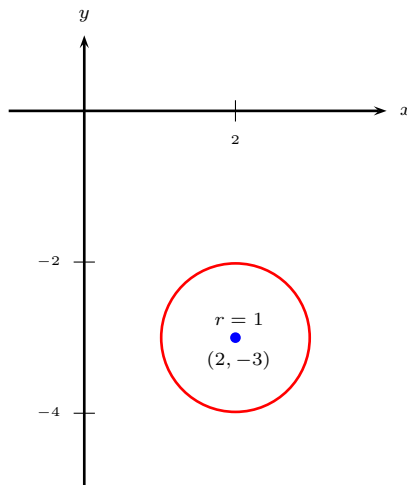
$y$ -int:  $(0, 4)$   
 $x$ -int: None  
 vertex:  $(1, 3)$   
 Axis of symmetry:  $x = 1$

(4) (a) Maximum  $(2, 5)$ (b) Minimum  $(-2, -3)$ 

(5) (a)

$$x^2 + y^2 - 4x + 6y + 12 = 0$$

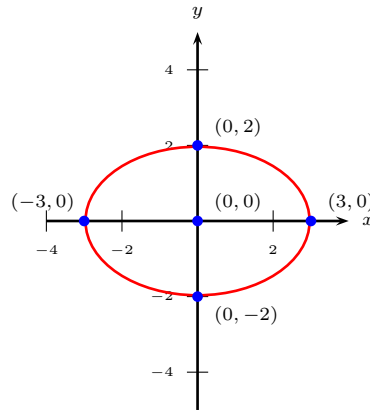
Circle:  $(x - 2)^2 + (y + 3)^2 = 1$   
 Center:  $(2, -3)$   
 Radius:  $r = 1$



(b)

$$\frac{x^2}{9} + \frac{y^2}{4} = 1 : \text{Ellipse}$$

Center:  $(0, 0)$   
 $x$ -int:  $(-3, 0)$  and  $(3, 0)$   
 $y$ -int:  $(0, -2)$  and  $(0, 2)$



(6) Distance =  $\sqrt{97}$ , Midpoint =  $(\frac{1}{2}, 5)$

(7) (a)  $x^2 + (y - 3)^2 = 34$

(b)  $(x - 2)^2 + (y - 2)^2 = 25$

(8) (a)  $\{x \mid x \in (-\infty, -5) \cup (1, \infty)\}$

(b)  $\{x \mid x \in (-\infty, -2) \cup (-1, 1)\}$

(9) (a)  $\{x \mid x \in (-\infty, -2] \cup [6, \infty)\}$

(b)  $\{x \mid x \in [-5, 1]\}$

(10) Width: 5, Length: 17

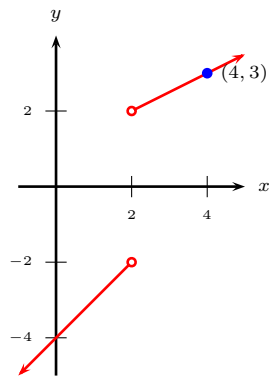


CHAPTER 9

More on Functions

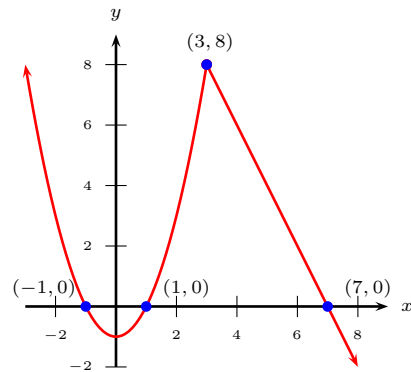
(1) (a)

$$f(x) = \begin{cases} x - 4 & \text{if } x < 2 \\ \frac{1}{2}x + 1 & \text{if } x > 2 \end{cases}$$



(b)

$$g(x) = \begin{cases} x^2 - 1 & \text{if } -3 \leq x \leq 3 \\ 14 - 2x & \text{if } x > 3 \end{cases}$$



(2) (a) (a)  $f(0) = 9$

(b)  $f(2) = 3$

(c)  $f(-6)$  is undefined

(b) (a)  $(f + g)(0) = 4$

(b)  $(f - g)(1) = 2$

$$(c) \left(\frac{f}{g}\right)(-2) = 11$$

$$(c) (a) f(g(4)) = 10$$

$$(b) g(f(x+1)) = \sqrt{2x^2 + 4x + 9}$$

$$(c) f(f(-2)) = 86$$

$$(d) (a) h(-1) = 5$$

$$(b) h(0) = 1$$

$$(c) h(1) = 5$$

$$(e) (a) \frac{f(x+h) - f(x)}{h} = 10x + 5h + 1$$

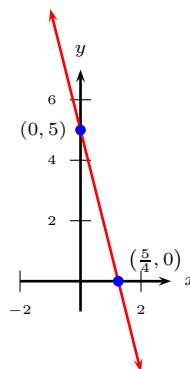
$$(b) \frac{f(-3) - f(1)}{15} = \frac{12}{5}$$

$$(3) (a)$$

$$y = 5 - 4x$$

$$y\text{-int: } (0, 5)$$

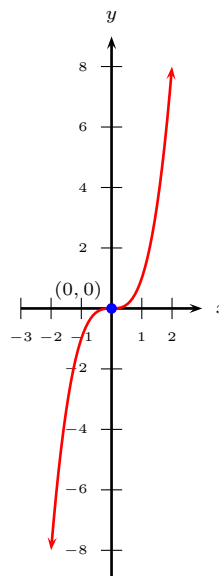
$$x\text{-int: } \left(\frac{5}{4}, 0\right)$$



$$(b)$$

$$y = x^3$$

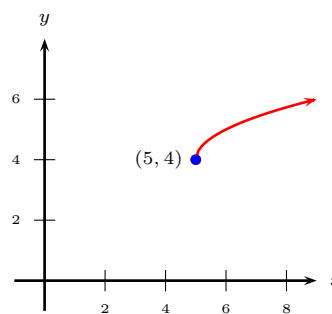
$y$  - int: (0, 0)  
 $x$  - int: (0, 0)



(c)

$$y = \sqrt{x-5} + 4$$

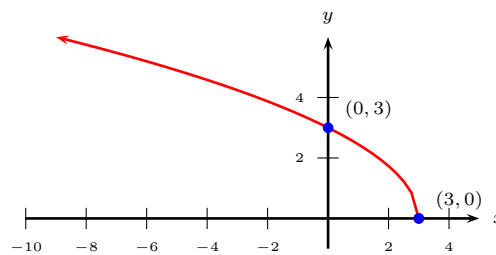
$y$  - int: None  
 $x$  - int: None



(d)

$$y = \sqrt{9-3x}$$

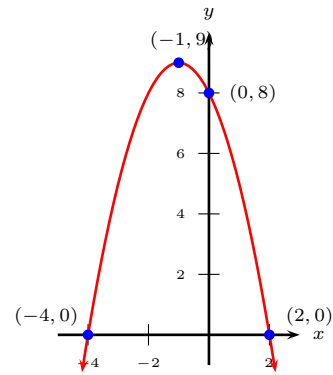
$y$  - int: (0, 3)  
 $x$  - int: (3, 0)



(e)

$$y = 8 - 2x - x^2$$

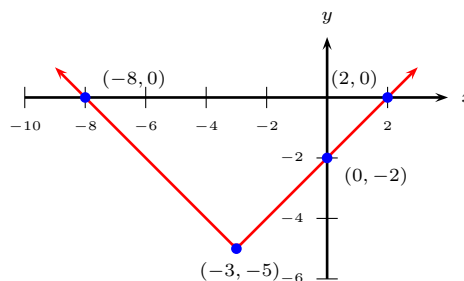
$y$  - int:  $(0, 8)$   
 $x$  - int:  $(3, 0)$  and  $(2, 0)$   
Vertex:  $(-1, 9)$



(f)

$$f(x) = |x + 3| - 5$$

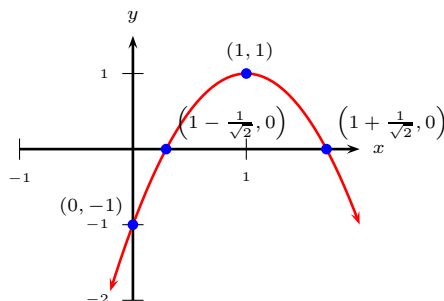
$y$  - int:  $(0, -2)$   
 $x$  - int:  $(-8, 0)$  and  $(2, 0)$   
 Vertex:  $(-3, -5)$



(g)

$$g(x) = -2(x - 1)^2 + 1$$

$y$  - int:  $(0, -1)$   
 $x$  - int:  $(1 - \frac{1}{\sqrt{2}}, 0)$  and  $(1 + \frac{1}{\sqrt{2}}, 0)$   
 Vertex:  $(1, 1)$



(4) (a)  $\{x \mid x < 6\}$

(b)  $\{x \mid x \neq 3, x \neq 2\}$

(c)  $\{x \mid x \neq \pm 3, x \neq 5\}$

(5) (a)

$$F = \{(5, -2), (-2, 5), (6, -5)\}$$

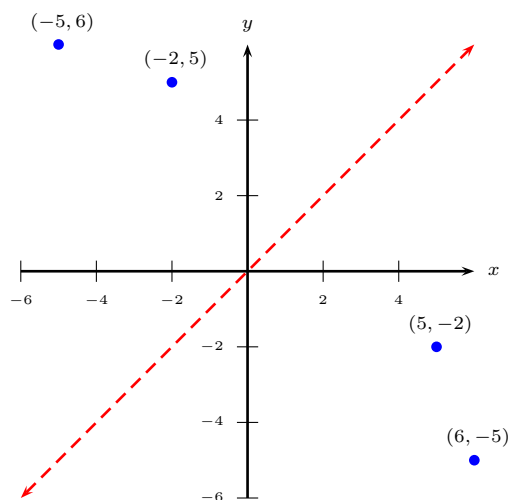
$$D : \{x \mid x = -2, 5, 6\}$$

$$R : \{y \mid y = -5, -2, 5\}$$

$$F^{-1} = \{(-2, 5), (5, -2), (-5, 6)\}$$

$$D : \{x \mid x = -5, -2, 5\}$$

$$R : \{y \mid y = -2, 5, 6\}$$



(b)

$$g(x) = 3x - 2$$

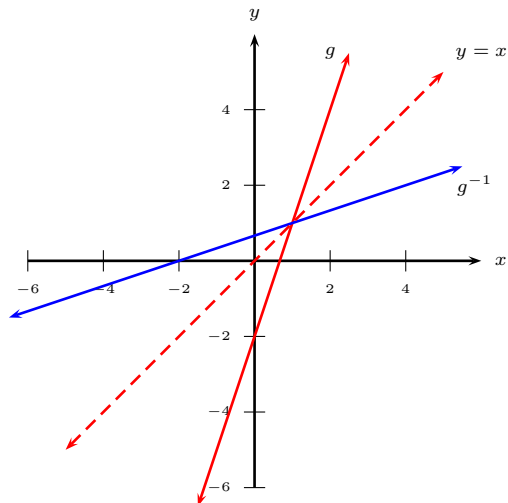
$$D : \{x \mid x \in \mathbb{R}\}$$

$$R : \{y \mid y \in \mathbb{R}\}$$

$$g^{-1}(x) = \frac{1}{3}x + \frac{2}{3}$$

$$D : \{x \mid x \in \mathbb{R}\}$$

$$R : \{y \mid y \in \mathbb{R}\}$$



(c)

$$y = x^2 - 4$$

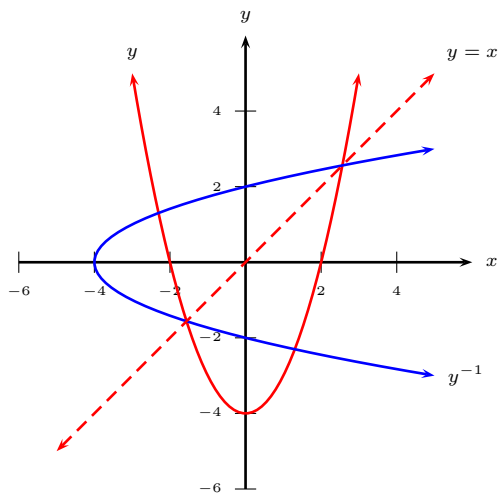
$$D : \{x \mid x \in \mathbb{R}\}$$

$$R : \{y \mid y \in x \geq -4\}$$

$$y^{-1} = \pm\sqrt{x+4}$$

$$D : \{x \mid x \in x \geq -4\}$$

$$R : \{y \mid y \in \mathbb{R}\}$$

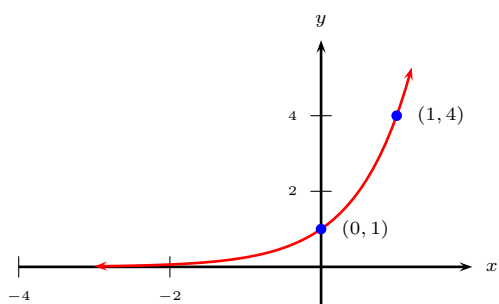


CHAPTER 10

## Exponential and Logarithmic Functions

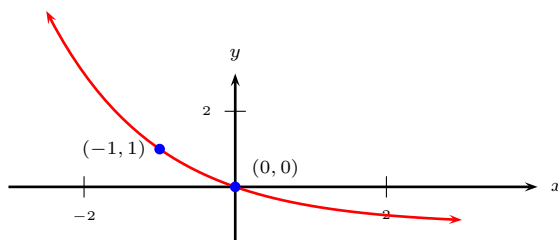
(1) (a)

$$y = 4^x$$



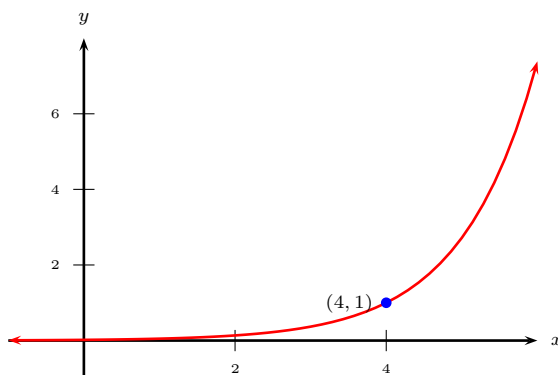
(b)

$$y = \left(\frac{1}{2}\right)^x - 1$$



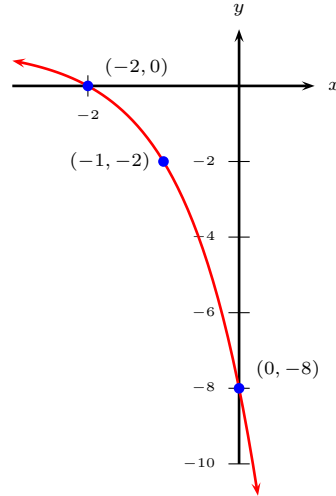
(c)

$$y = e^{x-4}$$



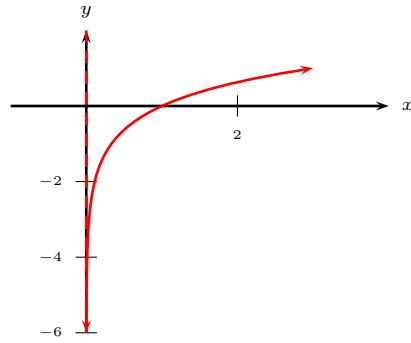
(d)

$$y = -3^{x+2} + 1$$



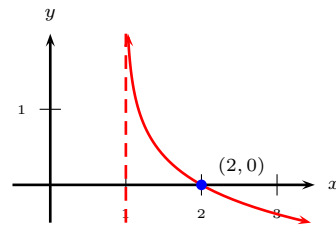
(e)

$$f(x) = \log_3 x$$



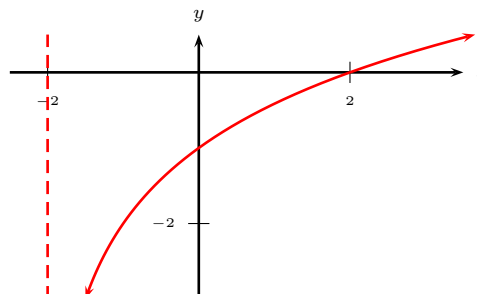
(f)

$$f(x) = -\log_6(x - 1)$$



(g)

$$y = -2 + \log_2(x + 2)$$



(2) (a)  $\log_2 8 = 3$

(b)  $\log_4 2 = \frac{1}{2}$

(c)  $\log_4 \frac{1}{16} = -2$

(d)  $\log_{17} 1 = 0$

(3) (a)  $8^2 = 64$

(b)  $5^0 = 1$

(c)  $10^{-3} = 0.001$

(d)  $9^{1/2} = 3$

(4) (a) 2

(b)  $\left(\frac{2}{3}\right)$

(c) 0

(d) undefined

(5) (a)  $\log_b \left(\frac{x^3}{y^6}\right)$

(b)  $\log_b(x + z)$

(c)  $\log_b 36x^4$

(6) (a)  $\log_b u - 5 \log_b v - \frac{3}{2} \log_b w$

(b) cannot be simplified any further

(c)  $\frac{3}{2} \log_b x + \frac{5}{2} \log_b y - \frac{7}{2} \log_b z$

(d)  $\frac{1}{3} \log_b x + \frac{1}{3} \log_b y$

(7) (a)  $x = \ln 20$

(b)  $x = -\frac{4}{3}$

(c)  $x = -\frac{7}{3}$

(d)  $x = -5$

(e)  $x = \frac{\ln 4}{\ln 5}$

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

(g)  $x = 4$

(h)  $x = 1, x = 2$

(i)  $x = 5$

(j)  $x = 500$

(k)  $x = 4$

(l)  $x = 3$

(m)  $x = 1, x = 7$

(8)  $t = 15.4$