Linear Equations - Solutions

5.1 Different Forms of Linear Equations

1. **a)** $y - y_1 = m(x - x_1)$ **b)** y-intercept **c)** slope-intercept **d)** $Ax + By = C$ **e)** $-\frac{A}{B}$ **f)** $\frac{C}{B}$

2. **a)** m: $\frac{3}{2}$, y-int: -3 **b)** m: $-\frac{4}{3}$, y-int: 4 **c)** m: $\frac{2}{5}$, y-int: $\frac{7}{5}$ **d)** m: $-\frac{5}{2}$, y-int: 0 **e)** m: $\frac{1}{4}$, y-int: 1 **f)** m: 6, y-int: 3

3. **a)** $y = -2x + 6$ **b)** $y = 3x - 4$ **c)** $y = -\frac{4}{3}x + 4$ **d)** $y = \frac{2}{3}x - 2$ **e)** $y = -\frac{5}{4}x + \frac{3}{4}$ **f)** $y = 2x - \frac{4}{3}$

4. **a)** $2x + y = 1$ **b)** $3x - y = 1$ **c)** $3x - y = 0$ **d)** $2x + 3y = 3$ **e)** $3x - 4y = -20$ **f)** $4x + 10y = 5$

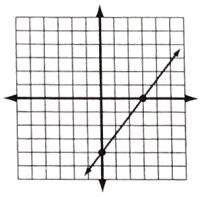
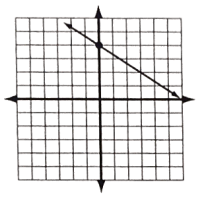
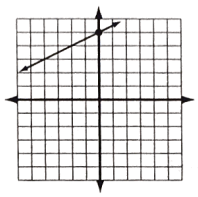
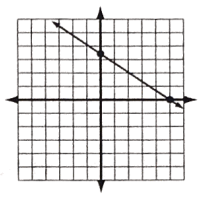
5. **a)** $y = 3x + 5$ **b)** $y = -2x - 2$ **c)** $y = \frac{1}{3}x + \frac{5}{3}$ **d)** $y = -\frac{2}{5}x - \frac{14}{5}$ **e)** $y = \frac{1}{4}x - \frac{4}{3}$ **f)** $y = \frac{1}{2}x + \frac{7}{12}$

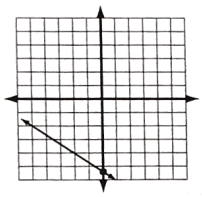
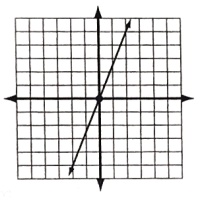
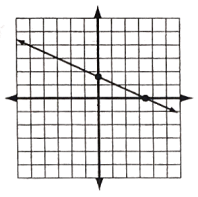
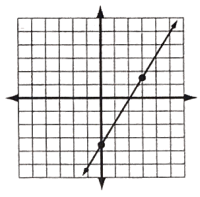
6. **a)** $3x - y = -5$ **b)** $2x + y = -2$ **c)** $x - 3y = -5$ **d)** $2x + 5y = -14$ **e)** $3x - 12y = 16$ **f)** $6x - 12y = -7$

7. **a)** *vi* **b)** *v* **c)** *ii* **d)** *iii* **e)** *v*

8. **a)** *ii* **b)** *iii* **c)** *i* **d)** *iv*

9. **a)** $y = 2x + 2$ **b)** $y = \frac{1}{2}x - 3$ **c)** $y = 3$ **d)** $y = -\frac{2}{3}x - 2$ **e)** $y = -\frac{3}{4}x - \frac{1}{2}$ **f)** $y = 0.4x + 2.3$

10. **a)**  **b)**  **c)**  **d)** 

e)  **f)**  **g)**  **h)** 

11. **a)** standard form: $5x - 2y = -4$; slope-intercept form: $y = \frac{5}{2}x + 2$; point-slope form: $y - 2 = \frac{5}{2}(x - 0)$

b) standard form: $5x - 6y = 12$; slope-intercept form: $y = \frac{5}{6}x - 2$; point-slope form: $y + 2 = \frac{5}{6}(x - 0)$

c) standard form: $x + 2y = -1$; slope-intercept form: $y = -\frac{1}{2}x - \frac{1}{2}$; point-slope form: $y - 1 = -\frac{1}{2}(x + 3)$

d) standard form: $4x + 3y = 5$; slope-intercept form: $y = -\frac{4}{3}x + \frac{5}{3}$; point-slope form: $y - 3 = -\frac{4}{3}(x + 1)$

e) standard form: $10x + 3y = 5$; slope-intercept form: $y = -\frac{10}{3}x - \frac{5}{3}$; point-slope form: $y - 5 = -\frac{10}{3}(x + 1)$

f) standard form: $3x - 4y = -11$; slope-intercept form: $y = \frac{3}{4}x + \frac{11}{4}$; point-slope form: $y + 1 = \frac{3}{4}(x + 5)$

5.2 Special Cases of Linear Equations

1. **a)** *iii* **b)** *vi* **c)** *i* **d)** *ii* **e)** *v* **f)** *iv*

2. **a)** *iv* **b)** *ii* **c)** *iii* **d)** *i*

3. **a)** $y = 2$ **b)** $y = -2$ **c)** $x = -2$ **d)** $x = 2$

4. **a)** $y = 1$ **b)** $x = 1$ **c)** $y = 0$ **d)** $x = 0$ **e)** $y = b$ **f)** $x = b$

5. **a)** $x = 3$ **b)** $x = -2$ **c)** $y = 6$ **d)** $y = -4$

6. **a)** parallel **b)** parallel **c)** neither **d)** neither **e)** perpendicular **f)** perpendicular **g)** neither **h)** perpendicular

7. **a)** $y = x + 2$ **b)** $y = -\frac{3}{8}x - \frac{1}{8}$ **c)** $y = -2x - 7$ **d)** $y = \frac{2}{5}x - \frac{8}{5}$ **e)** $y = -\frac{4}{9}x + \frac{2}{3}$ **f)** $y = -\frac{2}{3}x$
g) $y = \frac{3}{2}x - 6$ **h)** $y = -\frac{15}{34}x - \frac{383}{85}$ **i)** $y = 5$ **j)** $x = 3$

8. **a)** undefined **b)** $(0, 0)$ **c)** $y = 0$ **d)** $\frac{8}{3}$ **e)** 8 **f)** $\frac{2}{3}$ **g)** -10 **h)** a vertical line **i)** a horizontal line **j)** $y = x$
k) $y = -x$ **l)** $y = b$ **m)** $x = a$ **n)** $\frac{c}{b}$ **o)** $\frac{c}{a}$ **p)** $-\frac{a}{b}$

9. $(b, 0)$, $(0, a)$

12. The graphs are perpendicular.

13. Use the two points to find the slope, then substitute the slope and the coordinates from one of the points into the point-slope equation.

14. y-value is 2, x-values are all the real numbers.

15. -3

16. 20° C

17. $a = 2,\ b = -1$

18. $a = 4,\ b = -3$

5.3 Equations of Parallel and Perpendicular Lines

1. **a)** $3, -\frac{1}{3}$ **b)** $-2, \frac{1}{2}$ **c)** $-\frac{2}{3}, \frac{3}{2}$ **d)** $\frac{3}{5}, -\frac{5}{3}$ **e)** $\frac{2}{3}, -\frac{3}{2}$ **f)** $-3, \frac{1}{3}$ **g)** $5, -\frac{1}{5}$ **h)** undefined, 0
i) 0, undefined **j)** $\frac{1}{2}, -2$ **k)** $\frac{9}{4}, -\frac{4}{9}$ **l)** $\frac{1}{7}, -7$

2. **a)** $2x - y = 0$ **b)** $x - 2y = 0$ **c)** $3x - y = 0$ **d)** $2x + 5y = -4$ **e)** $4x + y = -21$ **f)** $4x + 3y = 14$
g) $4x - 3y = -7$ **h)** $3x + 2y = -10$ **i)** $x = -5$ **j)** $y = 2$ **k)** $8x + 9y = -23$ **l)** $10x - 12y = 13$

3. **a)** $x + 2y = 0$ **b)** $2x + y = 0$ **c)** $x + 3y = 10$ **d)** $5x - 2y = -10$ **e)** $x - 4y = -18$ **f)** $3x - 4y = 23$
g) $3x + 4y = -24$ **h)** $2x - 3y = 15$ **i)** $y = 2$ **j)** $x = -5$ **k)** $9x - 8y = -44$ **l)** $18x + 15y = -1$

4. **a)** $2x - 3y = 14$ **b)** $2x + y = -14$ **c)** $x + 3y = 5$ **d)** $6x - 5y = 45$

5. **a)** $3x + 2y = 8$ **b)** $x - 2y = 3$ **c)** $3x - y = 5$ **d)** $5x + 6y = 7$

6. $9x + 12y = -40$

7. $x - 3y = -9$

8. $6x + 21y = 10$

9. $3x + 2y = -10$

10. $2x - 3y = 0$

11. $2x + 6y = 9$

12. $y - 4 = \frac{3}{4}(x - 3) \rightarrow 3x - 4y = -25$

13. $y = \frac{1}{2}x$ and $y = -2x + 10$; Diagonals are perpendicular to each other.

5.4 Linear Applications and Modelling

1. \$104 000

2. 289

3. **a)** 41.6% in 1994 **b)** 28.3% in 2012

4. $V = -3420N + 36\,000$

5. $V = 410\,000 + 41\,000N$

6. \$413.33

7. \$1520

8. \$3950

9. $27 600

10. $88.50

11. 987

12. $V = 246\,000 - 16\,400N$

13. **a)** $C = 1.12s + 20$ **b)** $1744.80 **c)** $930

14. **a)** $C = 1200 + 0.40n$ **b)** 900 **c)** 12 000

15. **a)** $240 **b)** $C = 3.8n + 240$ **c)** $1000 **d)** 1860

16. **a)** $C = 5.75n + 21.55$ **b)** $58.93 **c)** 4.2 pounds

5.5 Function Notation

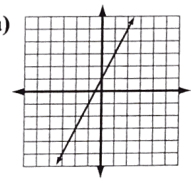
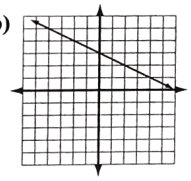
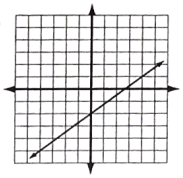
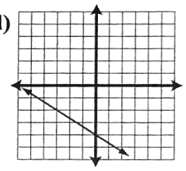
1.

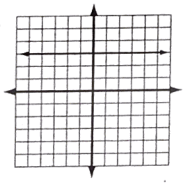
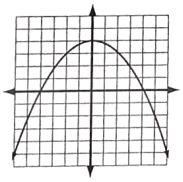
x	$-2x + 3$	$g(x)$	(x, y)
2	-1	-1	$(2, -1)$
-4	11	11	$(-4, 11)$
$2c$	$-4c + 3$	$-4c + 3$	$(2c, -4c + 3)$
$c - 2$	$-2c + 7$	$-2c + 7$	$(c - 2, -2c + 7)$
$0.5c + 1$	$-c + 1$	$-c + 1$	$(0.5c + 1, -c + 1)$

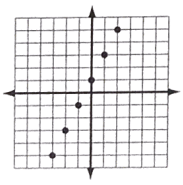
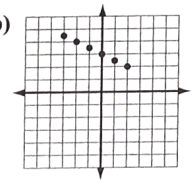
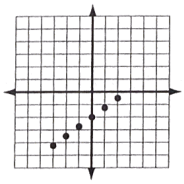
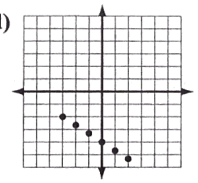
2. **a)** 7 **b)** -14 **c)** $3k - 2$ **d)** $6x - 5$ **e)** $3x + 3h - 2$ **f)** $3x + 3h - 4$

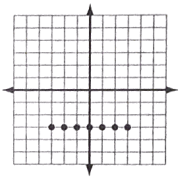
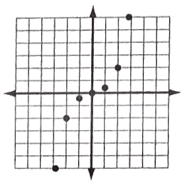
3. **a)** 17 **b)** -11 **c)** $4k + 5$ **d)** $8x + 1$ **e)** $4x + 4h + 5$ **f)** $4x + 4h + 10$

4. **a)** $x = 1$ **b)** $x = -1$ **c)** $x = \frac{14}{5}$ **d)** $x = \frac{7}{5}$ **e)** $x = \frac{2 - a}{5}$ **f)** $x = a - 1$

5. **a)**  **b)**  **c)**  **d)** 

e)  **f)** 

6. **a)**  **b)**  **c)**  **d)** 

e)  **f)** 

7. **a)** π **b)** $\frac{16\pi}{3}$ **c)** $2\pi h$ **d)** $2\pi h + 4\pi$

8. **a)** πh **b)** $\frac{16\pi h}{3}$ **c)** $2\pi h^2$ **d)** $2\pi h^2 + 4\pi h$

9. **a)** $\frac{\pi}{4}$ **b)** $\frac{64\pi}{9}$ **c)** πh^2 **d)** $\pi h^2 + 4\pi h + 4\pi$

10. **a)** $\frac{\pi h}{4}$ **b)** $\frac{64\pi h}{9}$ **c)** πh^3 **d)** $\pi h^3 + 4\pi h^2 + 4\pi h$

11. **a)** domain: $\{-2, 0, 2, 4\}$ range: $\{-2, 0, 2, 4\}$ $f(2)$: 0 $f(x) = 2$: $x = 0$
b) domain: $-3 \le x \le 5$ range: $-4 \le y \le 4$ $f(2)$: 1 $f(x) = 2$: $x = 3$
c) domain: all real numbers range: 3 $f(2)$: 3 $f(x) = 2$: $\varnothing$ (no solution)
d) domain: $-1 \le x < 3$ range: $\{-1, 0, 1, 2\}$ $f(2)$: 2 $f(x) = 2$: $2 \le x < 3$

12. **a)** D: $\{-2, -1, 0, 1\}$ R: $\{-3, -1, 1, 3\}$ **b)** D: $\{-4, -2, 0, 4\}$ R: $\{1, 3, 4, 5\}$
c) D: $\{-1, 1, 3, 5\}$ R: $\{-5, -3, -1, 1\}$ **d)** D: $\{-2, 0, 2, 4\}$ R: $\{-2, -1, 0, 1\}$

13. **a)** $f(x) = -4x - 3$ **b)** $f(x) = \frac{8}{3}x - \frac{4}{3}$ **c)** $f(x) = \frac{2}{5}x + \frac{21}{5}$ **d)** $f(x) = -2x$ **e)** $f(x) = 2$ **f)** $f(x) = -\frac{10}{9}x - \frac{1}{9}$

14. **a)** 3 **b)** 3 **c)** -2 **d)** $\frac{(x+h)^2 - x^2}{h} = \frac{x^2 + 2xh + h^2 - x^2}{h} = \frac{2xh + h^2}{h} = 2x + h$

15. **a)** 86° F **b)** 32° F **c)** -40° F

16. **a)** 100 m **b)** 60.8 m **c)** 3.2 sec

17. **a)** 6 atm **b)** 275.2 ft

18. **a)** 140° C **b)** 14.6 km

5.6 Chapter Review

1. **a)** m: $\frac{2}{5}$, y-int: $-\frac{7}{5}$ **b)** m: -5, y-int: -2

2. **a)** $y = 6x - 3$ **b)** $y = -\frac{2}{5}x + \frac{7}{5}$

3. **a)** $2x + 3y = 12$ **b)** $15x + 5y = 2$

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

5. **a)** $2x + 3y = 5$ **b)** $12x + 3y = -4$

6. **a)** $4x + y = -3$ **b)** $x + 3y = 2$

7. **a)** standard form: $x + y = -1$; slope-intercept form: $y = -x - 1$; point-slope form: $y + 3 = -1(x - 2)$
b) standard form: $3x - y = -1$; slope-intercept form: $y = 3x + 1$; point-slope form: $y + 2 = 3(x + 1)$

8. **a)** $y = -2$ **b)** $x = 2$

9. **a)** $x = -2$ **b)** $y = 5$ **c)** $x = a$ **d)** $y = b$

10. **a)** neither **b)** perpendicular **c)** neither **d)** parallel

11. **a)** $7x - y = -22$ **b)** $2x + 3y = -13$

12. **a)** $\frac{3}{4}$, $-\frac{4}{3}$ **b)** $\frac{1}{3}$, -3

13. **a)** $2x - 3y = -16$ **b)** $4x + 7y = 9$

14. **a)** $3x + 2y = 2$ **b)** $7x - 4y = 32$

15. **a)** $x + 2y = 9$ **b)** $2x - 3y = -18$

16. **a)** $2x - y = 8$ **b)** $3x + 2y = -1$

17. **a)** $C = 8.5n + 940$ **b)** \$940 **c)** \$26 440 **d)** 2800 books

18. **a)** -11 **b)** 10 **c)** $-\frac{5}{3}$ **d)** $\frac{2}{3}$ **e)** $-3a - 2$ **f)** $-\frac{a}{3} - \frac{2}{3}$ **g)** $-3x - 3h - 2$ **h)** $-3x - 3h - 4$

19. **a)** $f(x) = -\frac{2}{5}x + \frac{26}{5}$ **b)** $f(x) = \frac{11}{4}x - \frac{5}{4}$ **c)** $f(x) = \frac{7}{5}x + \frac{18}{5}$ **d)** $f(x) = -x + 6$ **e)** $f(x) = 2x$
f) $f(x) = -x + a + b$