ANSWER KEY

Algebra I

NEXT GENERATION

Course Workbook

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9. $-(a-b)$, or $-a+b$	10. $-ab$
11. commutative property of multiplication	12. associative property of addition
13. $5x+25$	14. $4b-16$
15. $-2x+2$	16. $-3a+3b$
17. $-1-y$	18. $a+1$
19. $rs+rt=r(s+t)$	20. $2x+10=2(x+5)$
21. $(2\div 1)\neq(1\div 2)$ or any similar counterexample.	22. No. For example, when we subtract the whole number 5 from the whole number 2, the result is –3, which is *not* a whole number.
23. No. For example, when we divide the integer 1 by the integer 2, the result is $\frac{1}{2}$, which is *not* an integer.	24. If $\frac{a}{b}$ and $\frac{c}{d}$ are rational numbers and *a*, *b*, *c*, and *d* are *non-zero* integers, then $\frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\times\frac{d}{c}=\frac{ad}{bc}$. Since the set of integers is closed under multiplication, *ad* and *bc* are integers, so $\frac{ad}{bc}$ is rational.

1.2 Solve Linear Equations in One Variable

1. $x=3$ *[divide both sides by -4]*	2. $-4=x$ *[subtract 9 from both sides]*
3. $6x-5=-29$ $6x=-24$ *[add 5 to both sides]* $x=-4$ *[divide both sides by 6]*	4. $18=-10+7x$ $28=7x$ *[add 10 to both sides]* $4=x$ *[divide both sides by 7]*
5. $4n-n=-12$ $3n=-12$ *[combine like terms]* $n=-4$	6. $25=3x-10-8x$ $25=-5x-10$ *[combine like terms]* $35=-5x$ $-7=x$

7. $3(m-2)=18$ $3m-6=18$ *[distribute]* $3m=24$ $m=8$	8. $28=-4(x-1)$ $28=-4x+4$ *[distribute]* $24=-4x$ $-6=x$
9. $2(x-4)+7=3$ $2x-8+7=3$ $2x-1=3$ $2x=4$ $x=2$	10. $0.2(n-6)=2.8$ $0.2n-1.2=2.8$ $0.2n=4$ $n=20$
11. $-5=-(y+1)-y$ $-5=-y-1-y$ $-5=-2y-1$ $-4=-2y$ $2=y$	12. $15x-3(3x+4)=6$ $15x-9x-12=6$ $6x-12=6$ $6x=18$ $x=3$
13. $3x+8=5x$ $8=2x$ $4=x$	14. $3+2g=5g-9$ $3=3g-9$ $12=3g$ $4=g$
15. $8p+2=4p-10$ $4p+2=-10$ $4p=-12$ $p=-3$	16. $5p-1=2p+20$ $3p-1=20$ $3p=21$ $p=7$
17. $0.06y+200=0.03y+350$ $0.03y+200=350$ $0.03y=150$ $y=5000$	18. $5-2x=-4x-7$ $5+2x=-7$ $2x=-12$ $x=-6$
19. $5(2x-7)=15x-10$ $10x-35=15x-10$ $-35=5x-10$ $-25=5x$ $-5=x$	20. $5(x-2)=2(10+x)$ $5x-10=20+2x$ $3x-10=20$ $3x=30$ $x=10$
21. $2(x-4)=4(2x+1)$ $2x-8=8x+4$ $-8=6x+4$ $-12=6x$ $-2=x$	22. $3(x+1)-5x=12-(6x-7)$ $3x+3-5x=12-6x+7$ $3-2x=19-6x$ $3+4x=19$ $4x=16$ $x=4$
23. $-4(y-3)=5(2y-6)$ $-4y+12=10y-30$ $12=14y-30$ $42=14y$ $3=y$	24. $3(x-2)-2(x+1)=5(x-4)$ $3x-6-2x-2=5x-20$ $x-8=5x-20$ $-8=4x-20$ $12=4x$ $3=x$

1.3 Solve Equations with Fractions

1. $\frac{x}{16}+\frac{1}{4}=\frac{1}{2}$ $16\left(\frac{x}{16}\right)+16\left(\frac{1}{4}\right)=16\left(\frac{1}{2}\right)$ $x+4=8$ $x=4$	2. $\frac{x}{2}+\frac{x}{6}=2$ $6\left(\frac{x}{2}\right)+6\left(\frac{x}{6}\right)=6(2)$ $3x+x=12$ $4x=12$ $x=3$
3. $\frac{2x}{3}+\frac{x}{6}=5$ $6\left(\frac{2x}{3}\right)+6\left(\frac{x}{6}\right)=6(5)$ $4x+x=30$ $5x=30$ $x=6$	4. $\frac{3}{5}x+\frac{2}{5}=4$ $5\left(\frac{3}{5}x\right)+5\left(\frac{2}{5}\right)=5(4)$ $3x+2=20$ $3x=18$ $x=6$
5. $\frac{3}{4}x+2=\frac{5}{4}x-6$ $4\left(\frac{3}{4}x\right)+4(2)=4\left(\frac{5}{4}x\right)+4(-6)$ $3x+8=5x-24$ $8=2x-24$ $32=2x$ $16=x$	6. $\frac{2}{3}x+\frac{1}{2}=\frac{5}{6}$ $6\left(\frac{2}{3}x\right)+6\left(\frac{1}{2}\right)=6\left(\frac{5}{6}\right)$ $4x+3=5$ $4x=2$ $x=\frac{2}{4}=\frac{1}{2}$
7. $\frac{3}{4}x=\frac{1}{3}x+5$ $12\left(\frac{3}{4}x\right)=12\left(\frac{1}{3}x\right)+12(5)$ $9x=4x+60$ $5x=60$ $x=12$	8. $\frac{x}{3}+\frac{x+1}{2}=x$ $6\left(\frac{x}{3}\right)+6\left(\frac{x+1}{2}\right)=6(x)$ $2x+3(x+1)=6x$ $2x+3x+3=6x$ $5x+3=6x$ $3=x$
9. $\frac{2x}{5}+\frac{1}{3}=\frac{7x-2}{15}$ $15\left(\frac{2x}{5}\right)+15\left(\frac{1}{3}\right)=15\left(\frac{7x-2}{15}\right)$ $6x+5=7x-2$ $5=x-2$ $7=x$	10. $\frac{1}{7}+\frac{2x}{3}=\frac{15x-3}{21}$ $21\left(\frac{1}{7}\right)+21\left(\frac{2x}{3}\right)=21\left(\frac{15x-3}{21}\right)$ $3+14x=15x-3$ $3=x-3$ $6=x$
11. $\frac{3}{4}(x+3)=9$ $4\cdot\frac{3}{4}(x+3)=4(9)$ $3(x+3)=36$ $3x+9=36$ $3x=27$ $x=9$	12. $\frac{3}{5}(x+2)=x-4$ $5\cdot\frac{3}{5}(x+2)=5(x-4)$ $3(x+2)=5x-20$ $3x+6=5x-20$ $6=2x-20$ $26=2x$ $13=x$

13. $\frac{1}{2}(18-5x)=\frac{1}{3}(6-4x)$
$6\cdot\frac{1}{2}(18-5x)=6\cdot\frac{1}{3}(6-4x)$
$3(18-5x)=2(6-4x)$
$54-15x=12-8x$
$54=12+7x$
$42=7x$
$6=x$

14. $\frac{2}{3}\left(2x-\frac{1}{2}\right)=13$
$3\cdot\frac{2}{3}\left(2x-\frac{1}{2}\right)=3(13)$
$2\left(2x-\frac{1}{2}\right)=39$
$4x-1=39$
$4x=40$
$x=10$

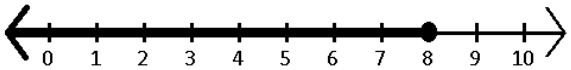
15. $\frac{m}{5}+\frac{3(m-1)}{2}=2(m-3)$
$\frac{m}{5}+\frac{3m-3}{2}=2m-6$
$10\left(\frac{m}{5}\right)+10\left(\frac{3m-3}{2}\right)=10(2m)-10(6)$
$2m+15m-15=20m-60$
$17m-15=20m-60$
$45=3m$
$15=m$

1.4 Solve Linear Inequalities in One Variable

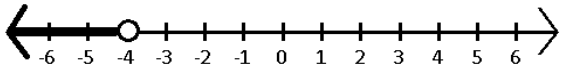
1. $x\leq 4$

2. $x>-4$

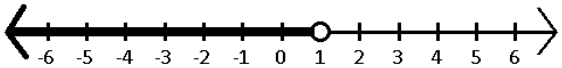
3. $2x-5\leq 11$
$2x\leq 16$
$x\leq 8$



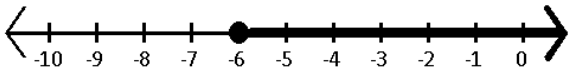
4. $-6y+1>25$
$-6y>24$
$y<-4$



5. $-4>2(r-3)$
$-4>2r-6$
$2>2r$
$1>r$
$r<1$



6. $-\frac{4}{3}(x-3)\leq 12$
$-\frac{4}{3}x+4\leq 12$
$-\frac{4}{3}x\leq 8$
$-4x\leq 24$
$x\geq -6$



7. $-6x-17\geq 8x+25$
$-17\geq 14x+25$
$-42\geq 14x$
$-3\geq x$
$x\leq -3$

8. $-5x+35<15$
$-5x<-20$
$x>4$

9. $2x - 5 < 3$ $2x < 8$ $x < 4$ Graph (1)	10. $3(2m - 1) \leq 4m + 7$ $6m - 3 \leq 4m + 7$ $2m - 3 \leq 7$ $2m \leq 10$ $m \leq 5$
11. $-4(2m - 6) + m > 3m + 4$ $-8m + 24 + m > 3m + 4$ $-7m + 24 > 3m + 4$ $24 > 10m + 4$ $20 > 10m$ $2 > m$ $m < 2$	12. $-5(p + 1) \geq -p + 11$ $-5p - 5 \geq -p + 11$ $-5 \geq 4p + 11$ $-16 \geq 4p$ $-4 \geq p$ $p \leq -4$

1.5 Solve Literal Equations and Inequalities

1. $2m + 2p = 16$ $2p = -2m + 16$ $p = -m + 8$	2. $bx - 2 = K$ $bx = K + 2$ $x = \frac{K + 2}{b}$
3. $c = 2m + d$ $c - d = 2m$ $\frac{c - d}{2} = m$	4. $bx - 3a = c$ $bx = 3a + c$ $x = \frac{3a + c}{b}$
5. $V = lwh$ $\frac{V}{lh} = w$	6. $A = \frac{bh}{2}$ $2A = bh$ $\frac{2A}{b} = h$
7. $abx - 5 = 0$ $abx = 5$ $x = \frac{5}{ab}$	8. $2y + 2w = x$ $2w = x - 2y$ $w = \frac{x - 2y}{2}$
9. $s = \frac{2x + t}{r}$ $sr = 2x + t$ $sr - t = 2x$ $\frac{sr - t}{2} = x$	10. $V = \frac{1}{3}Bh$ $3V = Bh$ $\frac{3V}{B} = h$

11. $v = \frac{1}{2}at^2$ $2v = at^2$ $\frac{2v}{t^2} = a$	12. $\frac{ey}{n} + k = t$ $\frac{ey}{n} = t - k$ $ey = n(t - k)$ $ey = nt - nk$ $y = \frac{nt - nk}{e}$
13. $3x - ax = b$ $x(3 - a) = b$ $x = \frac{b}{3 - a}$	14. $bc + ac = ab$ $c(b + a) = ab$ $c = \frac{ab}{b + a}$
15. $k = am + 3mx$ $k = m(a + 3x)$ $\frac{k}{a + 3x} = m$	16. $2ax = -bx + 1$ $2ax + bx = 1$ $x(2a + b) = 1$ $x = \frac{1}{2a + b}$
17. $ax + 3 = 7 - bx$ $ax + bx = 4$ $x(a + b) = 4$ $x = \frac{4}{a + b}$	18. $z + y = x + xy^2$ $z + y = x(1 + y^2)$ $\frac{z + y}{1 + y^2} = x$

Chapter 2 Verbal Problems

2.1 Translate Expressions

1. (3)	2. (4)
3. $7x - 5$	4. $2(x - 8)$
5. $33 - g$	6. $20 - 2d$
7. $4x + 10$	8. $\frac{n}{12}$
9. xd	10. $d - 2h$
11. $5(x + 4)$, or $5x + 20$	12. $3x - 4$
13. $3d - 1200$	14. $280 + 0.05n$
15. $y + y + 1 + y + 2 + y + 3$ $4y + 6$	16. $x + 3 + x + 5 + x + 7$ $3x + 15$
17. $x + x + 2 + x + 4$ $3x + 6$	18. $x(x + 1)$ $x^2 + x$
19. t = Tommy's age $t - 4$ = Donny's age $t - 4 + 7 = t + 3$ = Camille's age Sum is $3t - 1$	20. h = horse's lifespan $h + 70$ = stork's lifespan $4(h + 70) = 4h + 280$ = whale's lifespan Sum is $6h + 350$
21. a = number of cookies eaten by Alice $a + 4$ = number of cookies eaten by Carl $2(a + 4)$ cookies were eaten by Bob	22. x bags of chips $3x$ bags of pretzels $3x - 2$ bags of nachos $x + 3x + 3x - 2$ $7x - 2$

2.2 Translate Equations

1. $9h + 60 = 375$	2. $3(x + 4) = 5x - 2$
3. $\frac{1}{2}l - 4$	4. $x(2x - 3) = 43$
5. $2(3x + 2) = 22$	6. $0.30(n + 4) + 0.50n = 3.60$
7. $0.05n + 0.10(n + 6) = 1.35$	8. $0.10(72 - q) + 0.25q = 14.70$
9. $x(x + 1) = 20$	10. $x + x + 2 + x + 4 = -3$

2.3 Linear Model in Two Variables

1. the number of hours of tutoring	2. the number of miles driven
3. $c = 80x + 75$	4. $P(y) = 5y + 100$
5. $m = 20 - 0.50g$	6. $h(m) = 30{,}000 - 2{,}000m$
7. $c = 2(n - 1) + 5$	8. $w(h) = 30(h - 40) + 800$

2.4 Word Problems – Linear Equations

1. $3x + 5 = 17$ $3x = 12$ $x = 4$ 4 rides	2. $2.25 + 3.50(x - 1) = 44.25$ $2.25 + 3.50x - 3.50 = 44.25$ $3.50x - 1.25 = 44.25$ $3.50x = 45.50$ $x = 13$ 13 miles
3. $a + a + 5 = 19$ $2a + 5 = 19$ $2a = 14$ $a = 7$ $(7) + 5 = 12$, so Jamie is 12 years old.	4. $c + 2c = 561$ $3c = 561$ $c = 187$ $2(187) = 374$ There are 187 crickets and 374 grasshoppers.
5. $c + 3c = 20$ $4c = 20$ $c = 5$ $3(5) = 15$, so there were 15 robins.	6. $f + 2f + 4 = 16$ $3f + 4 = 16$ $3f = 12$ $f = 4$ $2(4) + 4 = 12$ There are 4 freshmen and 12 sophomores.
7. $2x + 3 = 15$ $2x = 12$ $x = 6$ He bought 6 pizzas last year.	8. $2(2x) + 2x = 45$ $4x + 2x = 45$ $6x = 45$ $x = 7.50$ Each CD costs $7.50.
9. $4m - 8 = 28$ $4m = 36$ $m = 9$ Minnie owns 9 video discs.	10. $b + (2b + 3) = 42$ $3b + 3 = 42$ $3b = 39$ $b = 13$ There are 13 black marbles, so there are $42 - 13 = 29$ red marbles.

11. $7x$ deer, $3x$ foxes $3x = 210$ $x = 70$ $7(70) = 490$ deer	12. $7x$ boys, $10x$ girls $7x + 10x = 357$ $17x = 357$ $x = 21$ $7(21) = 147$, so 147 boys
13. $n + (n + 1) + (n + 2) = 39$ $3n + 3 = 39$ $3n = 36$ $n = 12$ Integers are 12, 13, and 14	14. $3x = (x + 4) + 48$ $3x = x + 52$ $2x = 52$ $x = 26$ 26 years old
15. $0.10(3n) + 0.25(n + 4) + 0.05n = 4.60$ $0.3n + 0.25n + 1 + 0.05n = 4.60$ $0.6n + 1 = 4.60$ $0.6n = 3.60$ $n = 6$ $3(6) = 18$ $6 + 4 = 10$ 6 nickels, 18 dimes, 10 quarters	16. $4(m + 100) + 12m = 3056$ $4m + 400 + 12m = 3056$ $16m + 400 = 3056$ $16m = 2656$ $m = 166$ $166 + 100 = 266$ There were 266 balcony tickets sold.
17. $6.50s + 9.00(150 - s) = 1180.00$ $6.5s + 1350 - 9s = 1180$ $-2.5s + 1350 = 1180$ $-2.5s = -170$ $s = 68$ $150 - 68 = 82$ 68 small and 82 large	

2.5 Translate Inequalities

1. $3x - 8 > 15$	2. $h \geq 48$
3. $b + (b + 9) < 144$	4. $h + 3h \leq 120$
5. $x + 2x \geq 90$	6. $0.75a + 1.25b \leq 25$
7. $30 + 2w \leq 50$	8. $w(2w - 3) \leq 30$
9. $155 \leq h \leq 190$	10. $1500 \leq c < 1800$
11. $0.75(200) + 1.25x \geq 250$	

2.6 Word Problems – Inequalities

1. $2n - 5 > 23$ $2n > 28$ $n > 14$ Smallest integer is 15.	2. $5x < 55$ $x < 11$ Largest integer is 10
3. $n + 7n \leq 60$ $8n \leq 60$ $n \leq 7.5$ Largest two integers are 7 and 49.	4. $375 + 155w \geq 900$ $155w \geq 525$ $w \geq 3.387 \ldots$ He needs to work 4 weeks.
5. $5.95h \geq 215$ $h \geq 36.1344 \ldots$ He needs to work 37 hours.	6. $6n > 3n + 30$ $3n > 30$ $n > 10$ They need to make 11 toys.
7. $13.95 + 0.49x \leq 50.00$ $0.49x \leq 36.05$ $x \leq 73.5714 \ldots$ She can buy 73 songs.	8. $19.00 + 0.07x \leq 29.50$ $0.07x \leq 10.50$ $x \leq 150$ She can use 150 minutes.
9. Convert \$1.50 per 30 mins. to \$3/hr. $3(h - 1) + 5 \leq 12.50$ $3h - 3 + 5 \leq 12.50$ $3h + 2 \leq 12.50$ $3h \leq 10.50$ $h \leq 3.5$ She can park 3.5 hours.	10. $2n - (150 + 0.50n) \geq 500$ $2n - 150 - 0.50n \geq 500$ $1.5n - 150 \geq 500$ $1.5n \geq 650$ $n \geq 433\frac{1}{3}$ They must sell 434 programs.

2.7 Conversions

1. $20\ \cancel{in} \times \frac{2.54\ cm}{1\ \cancel{in}} = 50.8 \approx 51$ cm	2. $8900\ \cancel{ft} \times \frac{1\ mi}{5280\ \cancel{ft}} \approx 1.7$ mi
3. $1680\ \cancel{oz} \times \frac{1\ \cancel{lb}}{16\ \cancel{oz}} \times \frac{1\ bag}{5\ \cancel{lbs}} = 21$ bags	4. $0.75\ \cancel{tsp} \times \frac{1\ tbsp}{3\ \cancel{tsp}} \times 5 = 1.25$ tbsp
5. $2.625\ \cancel{in} \times \frac{2.54\ \cancel{cm}}{1\ \cancel{in}} \times \frac{10\ mm}{1\ \cancel{cm}}$ $= 2.625 \times 2.54 \times 10$ mm ≈ 67 mm	6. $6\ furlongs \times \frac{1\ mi}{8\ furlongs} \times \frac{1.61\ km}{1\ mile}$ $= \frac{6 \times 1.61\ km}{8} = 1.2075\ km \approx 1.21\ km$
7. $48\ \cancel{in} \times \frac{\$3.75}{1\ \cancel{yd}} \times \frac{1\ \cancel{yd}}{3\ \cancel{ft}} \times \frac{1\ \cancel{ft}}{12\ \cancel{in}} = \$5.00$	8. $60\ \cancel{ft} \times \frac{12\ \cancel{in}}{1\ \cancel{ft}} \times \frac{2.54\ \cancel{cm}}{1\ \cancel{in}} \times \frac{1\ m}{100\ \cancel{cm}}$ $= \frac{60 \times 12 \times 2.54\ m}{100} = 18.288\ m \approx 18.3\ m$

9. $\frac{150\ m}{1.5\ \cancel{min}} \times \frac{60\ \cancel{min}}{1\ hr} \times \frac{9000\ m}{1.5\ hr} = 6000\ m/hr$	10. $\frac{344\ m}{1\ \cancel{s}} \times \frac{60\ \cancel{s}}{1\ \cancel{min}} \times \frac{60\ \cancel{min}}{1\ hr}$ $= 1{,}238{,}400\ m/hr$
11. $\frac{43\ \cancel{mi}}{1\ \cancel{g}} \times \frac{1.61\ km}{1\ \cancel{mi}} \times \frac{1\ \cancel{g}}{3.79\ l} = \frac{43 \times 1.61\ km}{3.79\ l}$ $\approx 18.3\ km/l$	12. $\frac{\$1.50}{2\ \cancel{l}} \times \frac{3.79\ \cancel{l}}{1\ g} = \frac{\$1.50 \times 3.79}{2\ g} \approx \$2.84/g$ The 1-gallon bottle is the better buy.
13. $\frac{8000\ \cancel{mi}}{1\ \cancel{yr}} \times \frac{1760\ yds}{1\ \cancel{mi}} \times \frac{1\ \cancel{yr}}{365\ days} =$ $\frac{14{,}080{,}000\ yds}{365\ days} \approx 38{,}575\ yds/day$	14. $\frac{30\ \cancel{mi}}{1\ \cancel{hr}} \times \frac{5280\ ft}{1\ \cancel{mi}} \times \frac{1\ \cancel{hr}}{60\ \cancel{min}} \times \frac{1\ \cancel{min}}{60\ s} =$ $\frac{30 \times 5280\ ft}{60 \times 60\ s} = 44\ ft/s$
15. $\frac{100\ \cancel{yds}}{11\ \cancel{s}} \times \frac{3\ \cancel{ft}}{1\ \cancel{yd}} \times \frac{1\ mi}{5280\ \cancel{ft}} \times \frac{60\ \cancel{s}}{1\ \cancel{min}} \times \frac{60\ \cancel{min}}{1\ hr} = \frac{100 \times 3 \times 60 \times 60\ mi}{11 \times 5280\ hr} \approx 18.6\ mph$	

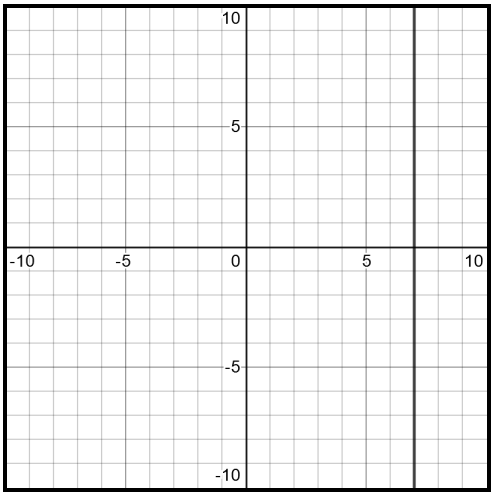
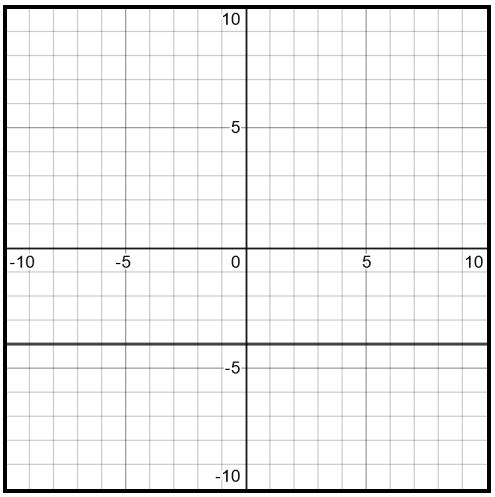
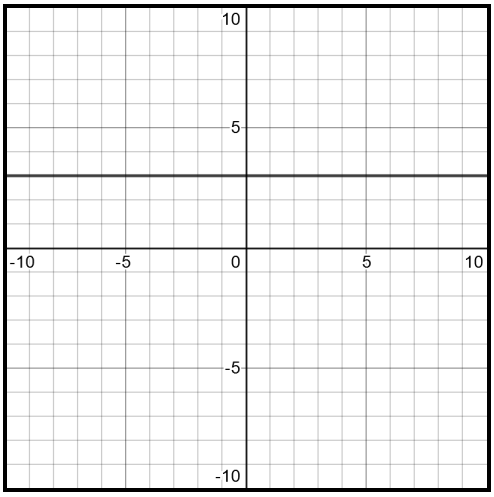
Chapter 3 Linear Graphs

3.1 Determine Whether a Point is on a Line

1. Yes. $7 \stackrel{?}{=} 3(3) - 2$ $7 \stackrel{?}{=} 9 - 2$ $7 = 7$ ✓	2. No. $9 \stackrel{?}{=} \frac{1}{2}(4) + 5$ $9 \stackrel{?}{=} 2 + 5$ $9 \neq 7$ ✗
3. Yes. $0 \stackrel{?}{=} 4(0)$ $0 = 0$ ✓	4. Yes. $2(-4) - 3(-2) \stackrel{?}{=} -2$ $-8 + 6 \stackrel{?}{=} -2$ $-2 = -2$ ✓
5. No. $4(-4) - (3) \stackrel{?}{=} -13$ $-16 - 3 \stackrel{?}{=} -13$ $-19 \neq -13$ ✗	6. Yes. $5(-2) - 2(-4) \stackrel{?}{=} -2$ $-10 + 8 \stackrel{?}{=} -2$ $-2 = -2$ ✓
7. No. $2(-5) - (-1) \stackrel{?}{=} -11$ $-10 + 1 \stackrel{?}{=} -11$ $-9 \neq -11$ ✗	8. Yes. $4(3) \stackrel{?}{=} 3(-2) + 18$ $12 \stackrel{?}{=} -6 + 18$ $12 = 12$ ✓
9. $2x + 6(-2) = 4$ $2x - 12 = 4$ $2x = 16$ $x = 8$	10. $4k + (3) = -9$ $4k = -12$ $k = -3$
11. $k - 2(-3) = -2$ $k + 6 = -2$ $k = -8$	12. $2(5) + k = 9$ $10 + k = 9$ $k = -1$

3.2 Lines Parallel to Axes

1. (1)	2. (2)
3. $x = 9$	4. $y = 1$
5. $x = 0$	6. $y = 0$

7. (5,0)	8. 
9. 	10. $y - 4 = -1$ $y = 3$ 

3.3 Find Intercepts

1.	x-intercept: 2	y-intercept: –4	2.	x-intercept: –2	y-intercept: –3
3.	x-intercept: $3(0) + 2x = 6$ $2x = 6$ $x = 3$	y-intercept: $3y + 2(0) = 6$ $3y = 6$ $y = 2$	4.	x-intercept: $3x - 4(0) = 12$ $3x = 12$ $x = 4$	y-intercept: $3(0) - 4y = 12$ $-4y = 12$ $y = -3$
5.	x-intercept: $(0) = -2x + 5$ $-5 = -2x$ $x = \frac{5}{2}$	y-intercept: $y = -2(0) + 5$ $y = 5$	6.	x-intercept: $9x - 6(0) + 5 = 0$ $9x + 5 = 0$ $9x = -5$ $x = -\frac{5}{9}$	y-intercept: $9(0) - 6y + 5 = 0$ $-6y + 5 = 0$ $-6y = -5$ $y = \frac{5}{6}$

3.4 Find Slope Given Two Points

1. $m = \frac{4}{8} = \frac{1}{2}$	2. $m = -\frac{2}{6} = -\frac{1}{3}$
3. $m = \frac{4}{3}$	4. $m = -\frac{2}{3}$
5. $m = -\frac{3}{3} = -1$	6. $m = \frac{5}{5} = 1$
7. $m = \frac{13-3}{5-1} = \frac{10}{4} = \frac{5}{2}$	8. $m = \frac{8-(-6)}{1-3} = \frac{14}{-2} = -7$
9. $m = \frac{-3-5}{0-4} = \frac{-8}{-4} = 2$	10. $m = \frac{-2-(-2)}{2-(-4)} = \frac{0}{6} = 0$
11. $m = \frac{3-5}{7-2} = -\frac{2}{5}$	12. $m = \frac{2-5}{-2-3} = \frac{-3}{-5} = \frac{3}{5}$

3.5 Find Slope Given an Equation

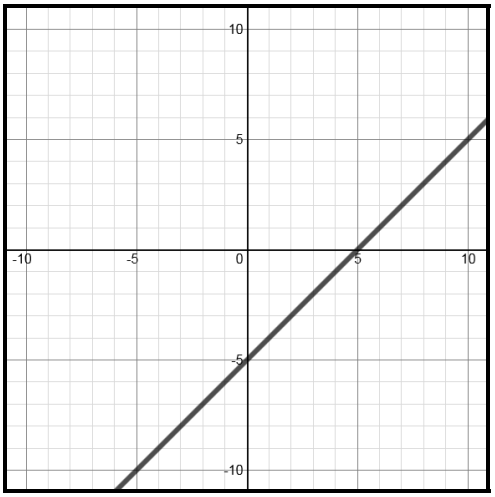
1. Slope is $\frac{2}{5}$	2. $y - 3x = 1$ $y = 3x + 1$ Slope is 3
3. $2y = 5x + 4$ $y = \frac{5}{2}x + 2$ Slope is $\frac{5}{2}$	4. $5y - 10x = -15$ $5y = 10x - 15$ $y = 2x - 3$ Slope is 2
5. $4x + 3y = 12$ $3y = -4x + 12$ $y = -\frac{4}{3}x + 4$ Slope is $-\frac{4}{3}$	6. $2y = x - 4$ $y = \frac{1}{2}x - 2$ Slope is $\frac{1}{2}$
7. $3x - 2y = 12$ $-2y = -3x + 12$ $y = \frac{3}{2}x - 6$ Slope is $\frac{3}{2}$	8. $3x - 4y - 16 = 0$ $3x - 4y = 16$ $-4y = -3x + 16$ $y = \frac{3}{4}x - 4$ Slope is $\frac{3}{4}$
9. $y = -2x + 2$	10. $y = \frac{1}{2}x$
11. (1) Same slope of –3	12. $2x - 3y = 9$ $-3y = -2x + 9$ $y = \frac{2}{3}x - 3$ Choice (1)

13. The first equation:
$2y + 2x = 6$
$2y = -2x + 6$
$y = -x + 3$

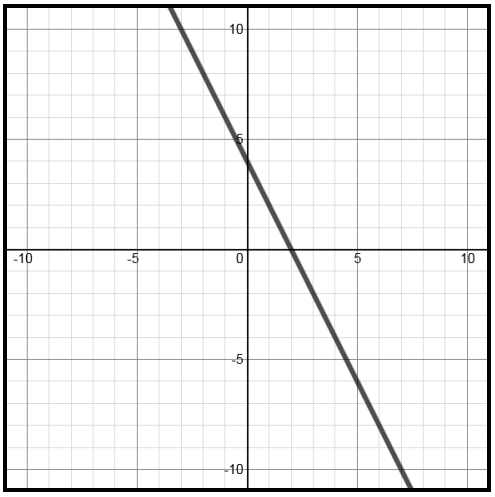
14. The first equation:
$4x + 6y = 5$
$6y = -4x + 5$
$y = -\frac{2}{3}x + \frac{5}{6}$
$-3y = 2x + 5$
$y = -\frac{2}{3}x - \frac{5}{3}$

3.6 Graph Linear Equations

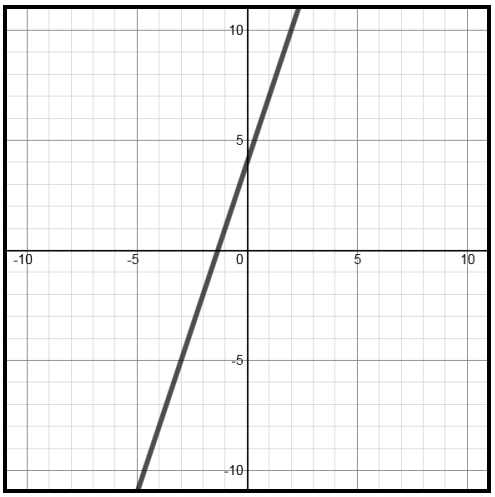
1.



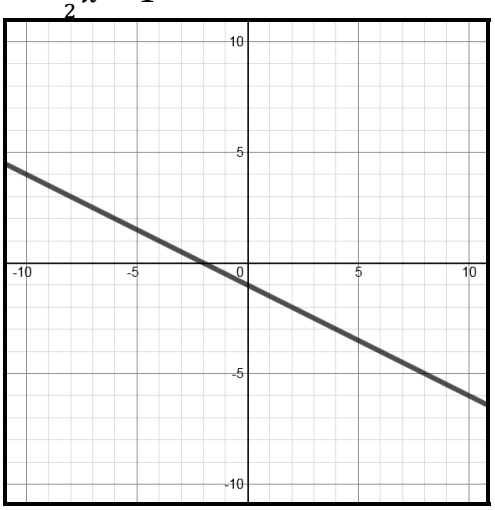
2.



3. $y - 3x = 4$
$y = 3x + 4$



4. $2y + 2x = x - 2$
$2y = -x - 2$
$y = -\frac{1}{2}x - 1$



5. (4) $2y = -4x - 10$
$y = -2x - 5$

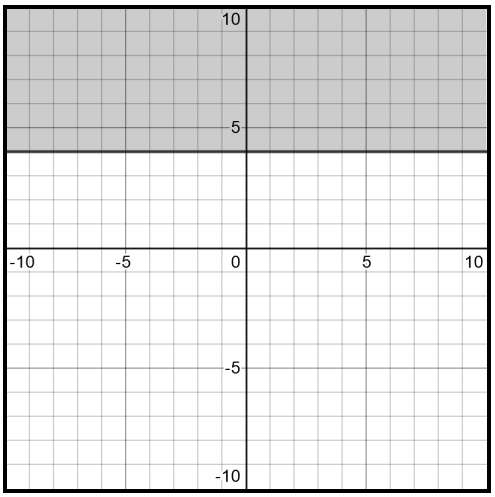
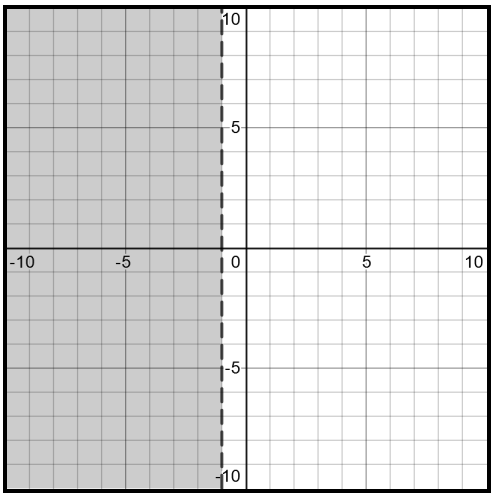
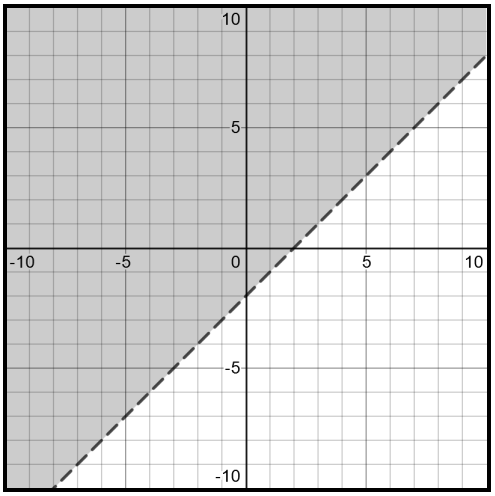
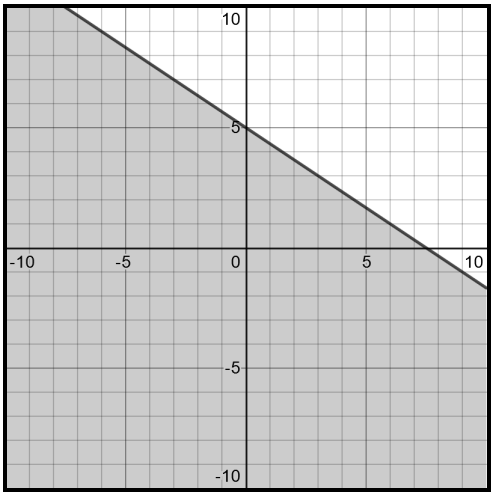
3.7 Write an Equation Given a Point and Slope

1. $y = mx + b$ $4 = 2(1) + b$ $4 = 2 + b$ $2 = b$ $\quad y = 2x + 2$	2. $y = mx + b$ $5 = 5(-6) + b$ $5 = -30 + b$ $35 = b$ $\quad y = 5x + 35$
3. $y = mx + b$ $2 = \frac{1}{3}(-3) + b$ $2 = -1 + b$ $3 = b$ $\quad y = \frac{1}{3}x + 3$	4. $y = mx + b$ $-3 = \frac{3}{4}(8) + b$ $-3 = 6 + b$ $-9 = b$ $\quad y = \frac{3}{4}x - 9$
5. $y = mx + b$ $4 = \frac{3}{4}(-8) + b$ $4 = -6 + b$ $10 = b$ $\quad y = \frac{3}{4}x + 10$	6. $y = mx + b$ $-7 = -\frac{4}{3}(3) + b$ $-7 = -4 + b$ $-3 = b$ $\quad y = -\frac{4}{3}x - 3$

3.8 Write an Equation Given Two Points

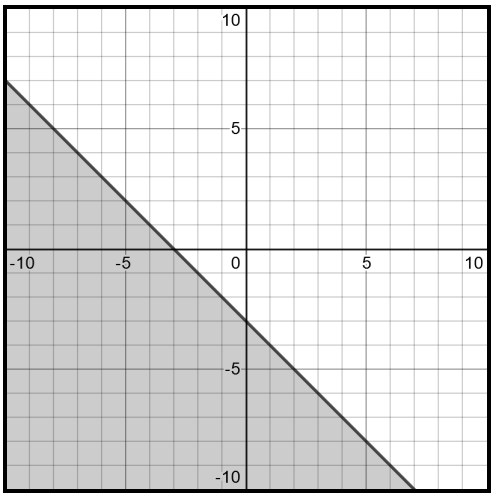
1. $m = \frac{6-2}{5-1} = \frac{4}{4} = 1$ $y = mx + b$ $2 = 1(1) + b$ $2 = 1 + b$ $1 = b$ $\quad y = x + 1$	2. $m = \frac{4-(-1)}{3-2} = \frac{5}{1} = 5$ $y = mx + b$ $-1 = 5(2) + b$ $-1 = 10 + b$ $-11 = b$ $\quad y = 5x - 11$
3. $m = \frac{-2-0}{3-(-3)} = \frac{-2}{6} = -\frac{1}{3}$ $y = mx + b$ $0 = -\frac{1}{3}(-3) + b$ $0 = 1 + b$ $-1 = b$ $\quad y = -\frac{1}{3}x - 1$	4. $m = \frac{4-4}{2-(-2)} = \frac{0}{4} = 0$ $y = mx + b$ $4 = 0(-2) + b$ $4 = b$ $\quad y = 4$
5. $m = \frac{5-3}{8-1} = \frac{2}{7}$ $y - 3 = \frac{2}{7}(x - 1)$	6. $m = \frac{0-4}{-5-5} = \frac{2}{5}$ a) $4 = \frac{2}{5}(5) + b$ $4 = 2 + b$ $2 = b$ $y = \frac{2}{5}x + 2$ b) $y - 4 = \frac{2}{5}(x - 5)$

3.9 Graph Inequalities

1. (1)	2. (2)
3. (3) $2y + 6 > 4x$ $2y > 4x - 6$ $y > 2x - 3$	
4. $y \leq x - 1$	5. $y \leq \frac{4}{3}x - 4$
6. $y < 3$	7. $y > \frac{3}{2}x + 2$
8. 	9. 
10. 	11. 

12. $x + y \leq -3$

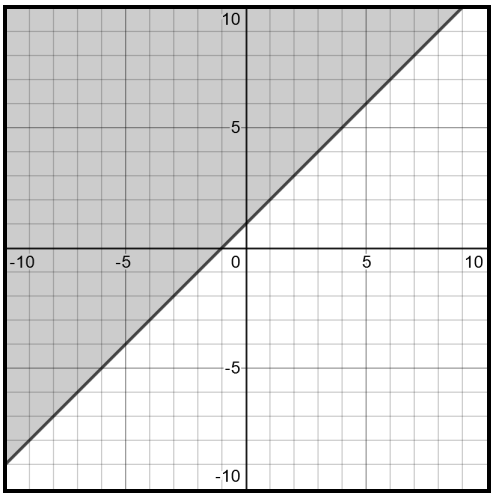
$y \leq -x - 3$



13. $x - y \leq -1$

$-y \leq -x - 1$

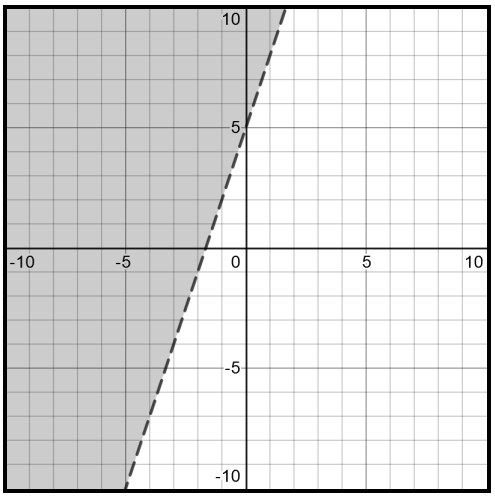
$y \geq x + 1$



14. $2y - 6x > 10$

$2y > 6x + 10$

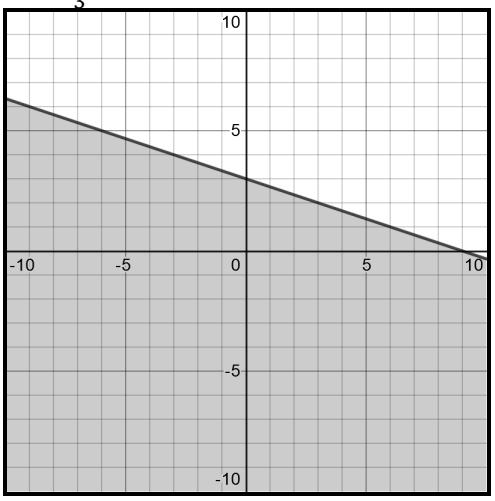
$y > 3x + 5$



15. $9 - x \geq 3y$

$3 - \frac{1}{3}x \geq y$

$y \leq -\frac{1}{3}x + 3$



4.1 Solve Linear Systems Algebraically

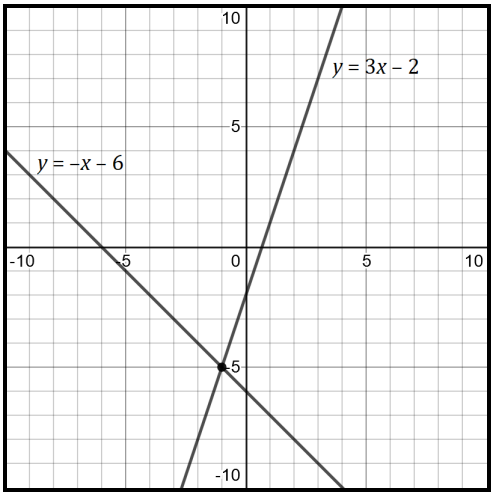
1. $3x - y = 8$ $x + y = 4$ $4x = 12$ $x = 3$ $(3) + y = 4$ $y = 1$	2. $2x - 3y = 19$ $3x + 3y = 21$ $5x = 40$ $x = 8$ $2(8) - 3y = 19$ $16 - 3y = 19$ $-3y = 3$ $y = -1$
3. $3x + 2y = 12$ $5x - 2y = 4$ $8x = 16$ $x = 2$ $3(2) + 2y = 12$ $6 + 2y = 12$ $2y = 6$ $y = 3$	4. $2x - 5y = 11$ $-2x + 3y = -9$ $-2y = 2$ $y = -1$ $2x - 5(-1) = 11$ $2x + 5 = 11$ $2x = 6$ $x = 3$
5. $2x - 4y = 12$ $-2x + y = -9$ $-3y = 3$ $y = -1$ $-2x + (-1) = -9$ $-2x = -8$ $x = 4$	6. $3x + y = 0$ $-x - y = -4$ $2x = -4$ $x = -2$ $3(-2) + y = 0$ $-6 + y = 0$ $y = 6$
7. $3x + 2y = 4 \rightarrow 3x + 2y = 4$ $-2x + 2y = 24 \times (-1) \; 2x - 2y = -24$ $5x = -20$ $x = -4$ $3(-4) + 2y = 4$ $-12 + 2y = 4$ $2y = 16$ $y = 8$	8. $2x + 3y = 6 \rightarrow 2x + 3y = 6$ $2x + y = -2 \times (-1) \; -2x - y = 2$ $2y = 8$ $y = 4$
9. $-3x + 4y = 11 \times 2 \; -6x + 8y = 22$ $6x - 5y = -16 \rightarrow 6x - 5y = -16$ $3y = 6$ $y = 2$ $-3x + 4(2) = 11$ $-3x + 8 = 11$ $-3x = 3$ $x = -1$	10. $2x + 3y = 7 \rightarrow 2x + 3y = 7$ $x + y = 3 \times (-3) \; -3x - 3y = -9$ $-x = -2$ $x = 2$ $2(2) + 3y = 7$ $4 + 3y = 7$ $3y = 3$ $y = 1$
11. $2x + y = 8 \times 3 \; 6x + 3y = 24$ $x - 3y = -3 \rightarrow x - 3y = -3$ $7x = 21$ $x = 3$ $2(3) + y = 8$ $6 + y = 8$ $y = 2$	12. $x + 2y = 9 \rightarrow x + 2y = 9$ $x - y = 3 \times 2 \; 2x - 2y = 6$ $3x = 15$ $x = 5$ $(5) - y = 3$ $-y = -2$ $y = 2$

13. $3x + 2y = 4 \quad \times 3 \quad 9x + 6y = 12$ $4x + 3y = 7 \quad \times (-2) \quad \underline{-8x - 6y = -14}$ $x \quad = -2$ $3(-2) + 2y = 4$ $-6 + 2y = 4$ $2y = 10$ $y = 5$	14. $3x + 4y = 9 \quad \times 3 \quad 9x + 12y = 27$ $5x + 6y = 21 \times (-2) \quad \underline{-10x - 12y = -42}$ $-x \quad = -15$ $x = 15$ $3(15) + 4y = 9$ $45 + 4y = 9$ $4y = -36$ $y = -9$
15. $4x - 10 = 5 - x$ $5x - 10 = 5$ $5x = 15$ $x = 3$ $y = 5 - 3$ $y = 2$	16. $x = (10 - 3x) - 2$ $4x = 8$ $x = 2$ $y = 10 - 3(2)$ $y = 4$
17. $3(9 - 2x) - 2x = 11$ $27 - 6x - 2x = 11$ $27 - 8x = 11$ $-8x = -16$ $x = 2$ $y = 9 - 2(2)$ $y = 5$	18. $x - 4y = -8$ $x = 4y - 8$ $7(4y - 8) + 3y = 68$ $28y - 56 + 3y = 68$ $31y - 56 = 68$ $31y = 124$ $y = 4$ $x - 4(4) = -8$ $x - 16 = -8$ $x = 8$
19. $2\left(\frac{1}{2}b - 6\right) + 3b = 12$ $b - 12 + 3b = 12$ $4b = 24$ $b = 6$ $a = \frac{1}{2}(6) - 6$ $a = -3$	20. $(4d - 6) + 3d = 8$ $7d - 6 = 8$ $7d = 14$ $d = 2$ $c = 4(2) - 6$ $c = 2$
21. $2x - y = 5$ $-y = -2x + 5$ $y = 2x - 5$ Choice (1)	

4.2 Solve Linear Systems Graphically

1. (3)	2. (3)
3. $(-2,3)$	

4.

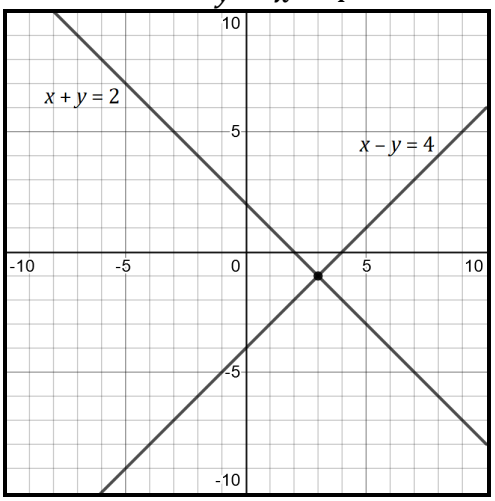


Solution: $(-1,-5)$

5. $x+y=2$ $\quad x-y=4$

$y=-x+2$ $\quad -y=-x+4$

$y=x-4$

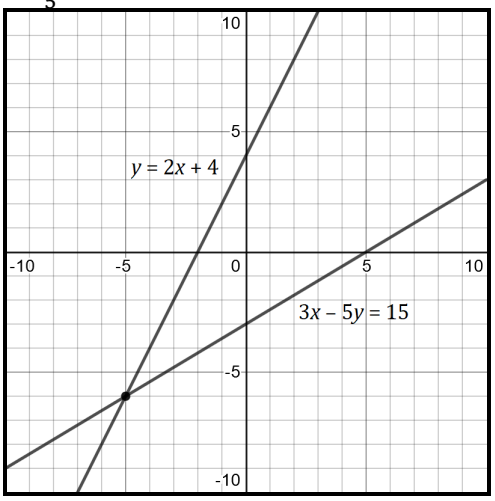


Solution: $(3,-1)$

6. $3x-5y=15$

$-5y=-3x+15$

$y=\frac{3}{5}x-3$

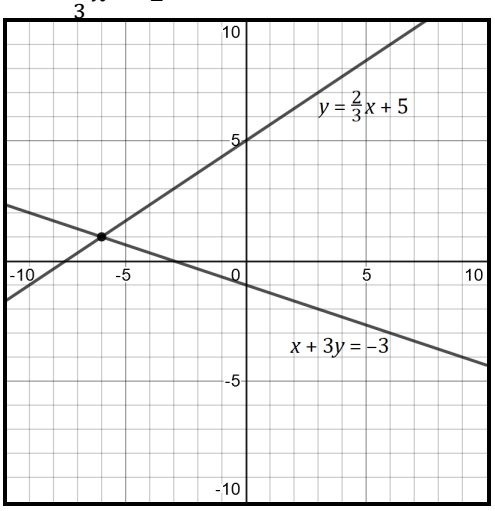


Solution: $(-5,-6)$

7. $x+3y=-3$

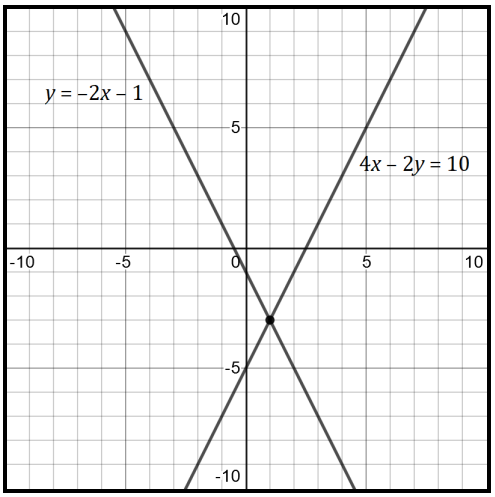
$3y=-x-3$

$y=-\frac{1}{3}x-1$



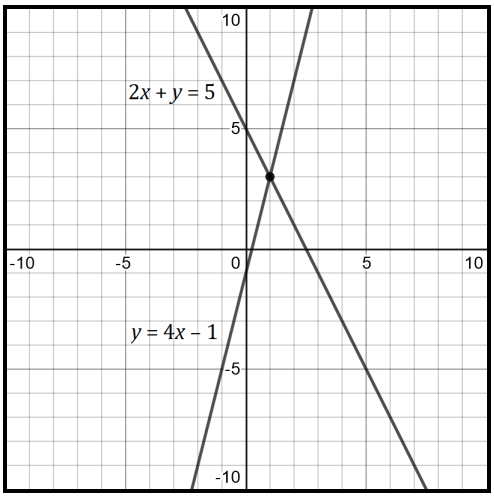
Solution: $(-6,1)$

8. $4x - 2y = 10$
$-2y = -4x + 10$
$y = 2x - 5$



Solution: $(1, -3)$

9. $2x + y = 5$
$y = -2x + 5$



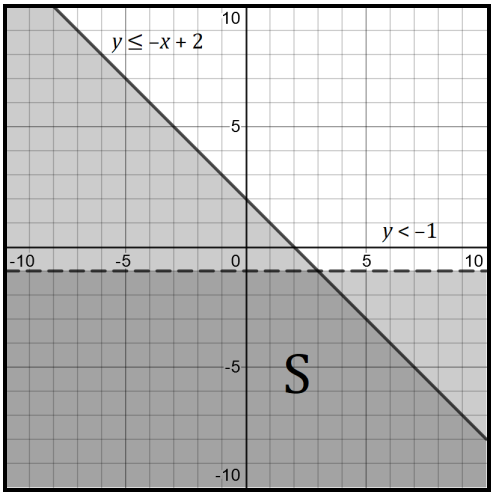
Solution: (1,3)

4.3 Solutions to Systems of Inequalities

1. (1) (1,1)	2. (4) (−9,0)
3. (4) (4,0)	4. (2) (2,0)
5. (4) (2,−2)	6. (2) (2,−1)

4.4 Solve Systems of Inequalities Graphically

1.



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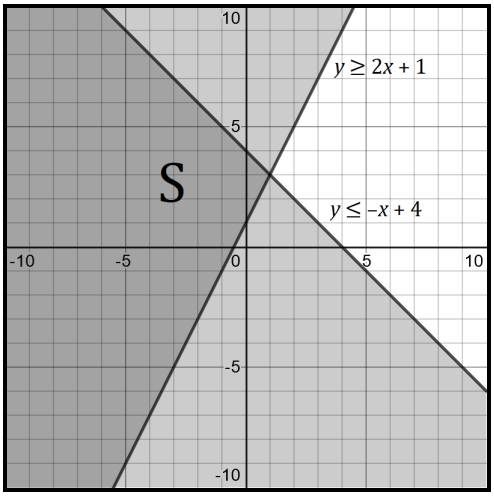

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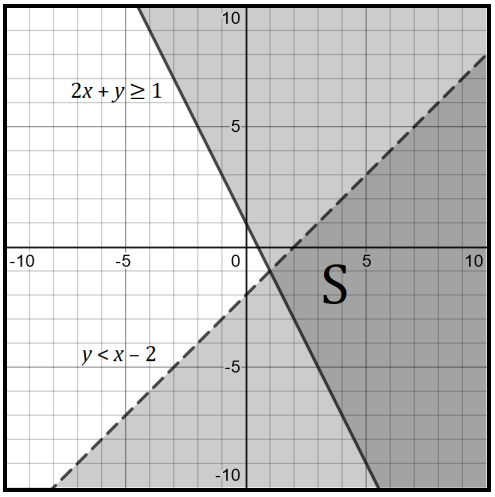
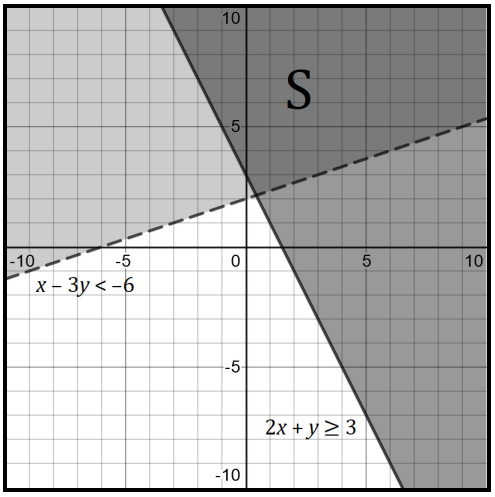
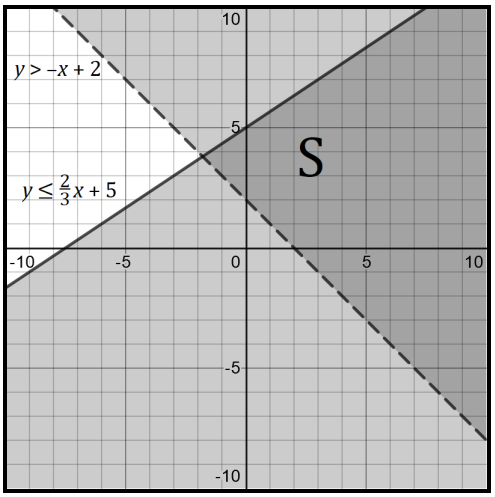


4.



5.



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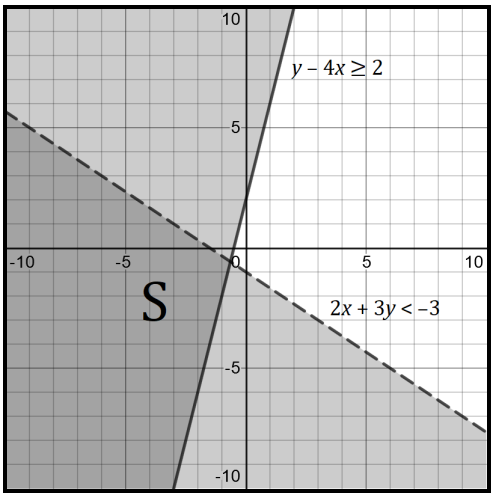
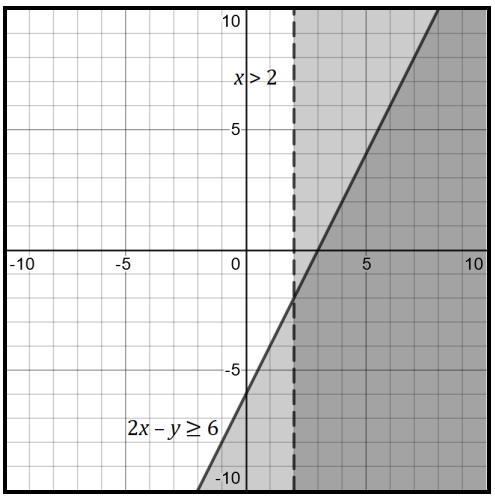
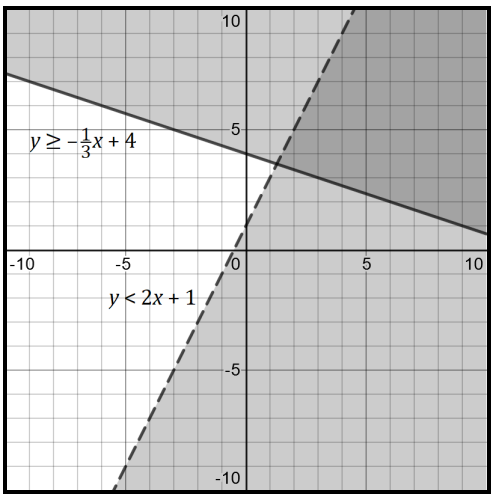


7.

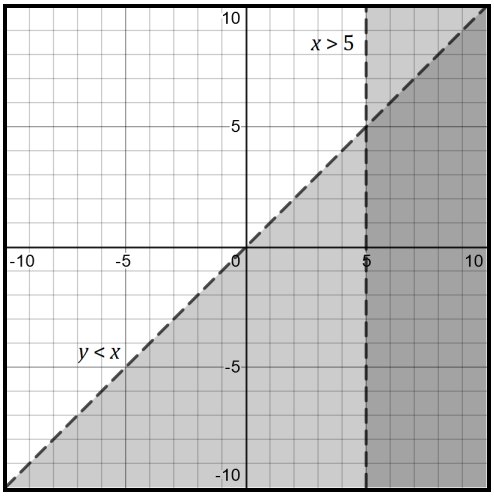
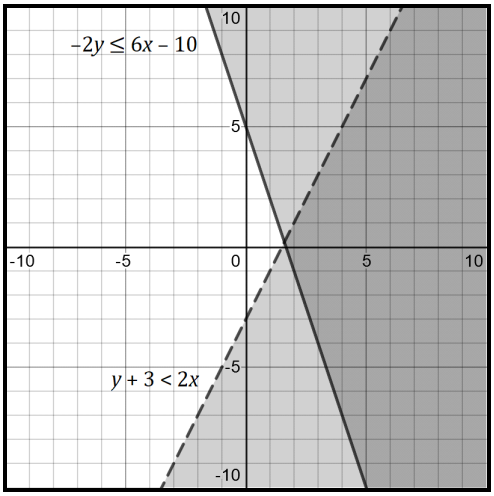
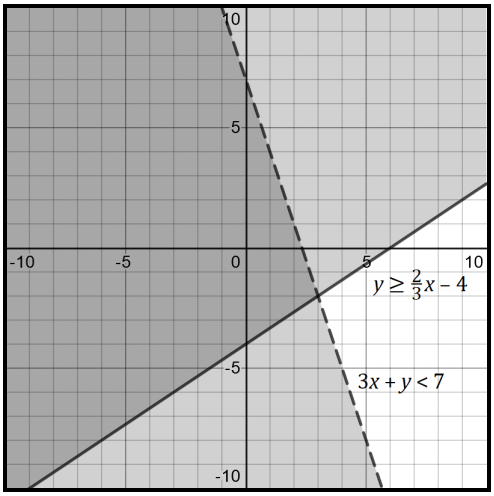
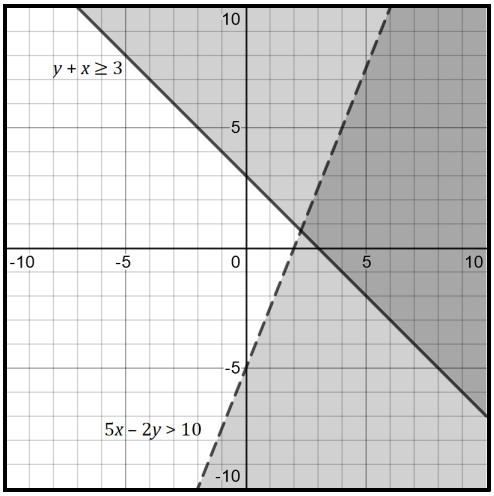


infinitely many solutions such as $(3, -3)$

8.



infinitely many solutions such as $(6, 6)$

9.  infinitely many solutions, such as (7,1)	10.  infinitely many solutions, such as (4,0)
11.  infinitely many solutions such as $(-1,-1)$	12.  infinitely many solutions such as (2,4)
13. Yes	14. No
15. (1) $(1,-4)$	16. (2) $(-2,2)$

4.5 Word Problems – Linear Systems

1. x and y are the two numbers. $x - y = 5$ $x + y = 59$ $\quad (32) + y = 59$ $2x = 64$ $\quad y = 27$ $x = 32$ The numbers are 32 and 27.	2. a = smaller number b = larger number $b + a = 47$ $b - a = 15$ $2b = 62$ $b = 31$ The larger number is 31.

3. p = cost of one bag of popcorn
c = cost of one cookie

$$\begin{array}{rll} p + 2c = 5 & \rightarrow & p + 2c = 5 \\ p + 4c = 6 & \times(-1) & \underline{-p - 4c = -6} \\ & & -2c = -1 \\ & & c = 0.50 \end{array}$$

One cookie costs \$0.50.

4. d = cost of a doughnut
c = cost of a cookie

$$\begin{array}{rl} 2d + 3c = 3.30 & \times 2 \\ 5d + 2c = 4.95 & \times(-3) \\ 4d + 6c = 6.60 & \\ \underline{-15d - 6c = -14.85} & \\ -11d = -8.25 & \\ d = 0.75 & \end{array}$$

$2(0.75) + 3c = 3.30$
$1.50 + 3c = 3.30$
$3c = 1.80$
$c = 0.60$
Doughnuts cost 75¢ and cookies cost 60¢.

5. p = cost of a pizza slice
c = cost of a cola

$$\begin{array}{rl} 3p + 2c = 6.00 & \times 3 \\ 2p + 3c = 5.25 & \times(-2) \\ 9p + 6c = 18.00 & \\ \underline{-4p - 6c = -10.50} & \\ 5p = 7.50 & \\ p = 1.50 & \end{array}$$

$3(1.50) + 2c = 6.00$
$4.50 + 2c = 6.00$
$2c = 1.50$
$c = 0.75$
Pizzas cost \$1.50 and colas cost \$0.75.

6. s = hourly rate for the sprayer
g = hourly rate for the generator

$$\begin{array}{rl} 6s + 6g = 90 & \times 2 \\ 4s + 8g = 100 & \times(-3) \\ 12s + 12g = 180 & \\ \underline{-12s - 24g = -300} & \\ -12g = -120 & \\ g = 10 & \end{array}$$

$6s + 6(10) = 90$
$6s + 60 = 90$
$6s = 30$
$s = 5$
Sprayer costs \$5/hr and generator \$10/hr.

7. f = number of fancy shirts bought
p = number of plain shirts bought

$$\begin{array}{rll} 28f + 15p = 131 & \rightarrow & \\ f + p = 7 & \times(-15) & \\ 28f + 15p = 131 & & \\ \underline{-15f - 15p = -105} & & \\ 13f = 26 & & \\ f = 2 & & \end{array}$$

$(2) + p = 7$
$p = 5$
She bought 2 fancy and 5 plain shirts.

8. n = cost of one notebook
p = cost of one pencil

$$\begin{array}{rl} 3n + 4p = 8.50 & \times(-2) \\ 5n + 8p = 14.50 & \rightarrow \\ -6n - 8p = -17.00 & \\ \underline{5n + 8p = 14.50} & \\ -n = -2.50 & \\ n = 2.50 & \end{array}$$

$3(2.50) + 4p = 8.50$
$7.50 + 4p = 8.50$
$4p = 1.00$
$p = 0.25$
\$2.50 per notebook and \$0.25 per pencil.

9. a = number of apples sold last week
o = number of oranges sold last week

$a + o = 108 \quad \times (-3)$

$5a + 3o = 452 \quad \rightarrow$

$$\begin{array}{r} -3a - 3o = -324 \\ 5a + 3o = 452 \\ \hline 2a \quad = 128 \end{array}$$

$a = 64$

$64 + o = 108$

$o = 44$

64 apples and 44 oranges

10. t = tens digit; u = units digit

$10u + t = 10t + u + 9$

$9u + t = 10t + 9$

$9u - 9t = 9$

$u - t = 1$ *[divide by 9]*

$u + t = 7$

$u - t = 1$

$2u = 8 \qquad (4) + t = 7$

$u = 4 \qquad t = 3$

The number is 34.

4.6 Word Problems – Systems of Inequalities

1. d = number of dog-walking hours
c = number of car wash hours

$d + c \leq 20$

$7.50d + 6.00c \geq 92.00$

2. s = number of bags of soil
p = number of plants

$4s + 10p \leq 100$

$p \geq 5$

3. s = number of boxes of small books
l = number of boxes of large books

$15s + 8l \geq 350$

$s + l \geq 35$

4. a)

$t \leq 3$

$d \leq 55t$

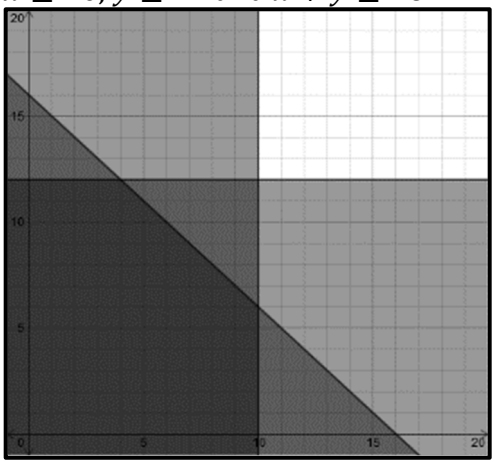
Therefore,

$d \leq 55(3)$

$d \leq 165$

b) Yes

5. $x \leq 10$, $y \leq 12$ and $x + y \leq 16$



Chapter 5 Polynomials

5.1 Polynomial Expressions

1. a) 3 b) 4 c) 3 d) –1	2. a) $x^2 - 2x + 3$ b) 2 c) 1 d) 3
3. $-5x^3 - 3x^2 - 8x + 15$	

5.2 Add and Subtract Polynomials

1. $8x^2 - 1$	2. $4x^2 + x - 1$
3. $7x^3 + 9x^2 - 3x - 8$	4. $-8x^2 - x + 5$
5. $2x^2 + 8x + 3$	6. $5n^2 - 9n + 3$
7. $(3x^2 + 2xy + 7) - (6x^2 - 4xy + 3) =$ $3x^2 + 2xy + 7 - 6x^2 + 4xy - 3 =$ $-3x^2 + 6xy + 4$	8. $(a^2 + a - 1) - (3a^2 - 2a + 5) =$ $a^2 + a - 1 - 3a^2 + 2a - 5 =$ $-2a^2 + 3a - 6$
9. $(x^2 - 3x - 2) - (2x^2 - x + 6) =$ $x^2 - 3x - 2 - 2x^2 + x - 6 =$ $-x^2 - 2x - 8$	10. $(x^2 + 1) - (3x^2 + 4x - 1) =$ $x^2 + 1 - 3x^2 - 4x + 1 =$ $-2x^2 - 4x + 2$
11. $(9x^2 - 2x + 3) - (4x^2 + 7x - 5) =$ $9x^2 - 2x + 3 - 4x^2 - 7x + 5 =$ $5x^2 - 9x + 8$	12. $(9x^2 + 3x - 4) - (5x^2 - 7x - 6) =$ $9x^2 + 3x - 4 - 5x^2 + 7x + 6 =$ $4x^2 + 10x + 2$
13. $(6x^2 + 3x - 2) - (2x^2 - 5x + 8) =$ $6x^2 + 3x - 2 - 2x^2 + 5x - 8 =$ $4x^2 + 8x - 10$	14. $(-3x^2 + 6x + 7) - (6x^2 - 13x + 12) =$ $-3x^2 + 6x + 7 - 6x^2 + 13x - 12 =$ $-9x^2 + 19x - 5$
15. $(x^3 + 3x^2 - 2x) - (x^2 + 3x - 4) =$ $x^3 + 3x^2 - 2x - x^2 - 3x + 4 =$ $x^3 + 2x^2 - 5x + 4$	16. $(5x - 4) - (5x + 4) =$ $5x - 4 - 5x - 4 =$ -8

5.3 Multiply Polynomials

1. $7x - 7x^4$	2. $6r^3 - 15r$
3. $-15x^3y^3 - 3x^3y^2$	4. $4x^3 + 12x^2 + 8x$
5. $(3w - 7)(w) =$ $3w^2 - 7w$	6. $(c + 8)(c - 5) =$ $c^2 - 5c + 8c - 40 =$ $c^2 + 3c - 40$

7. $(3x+2)(x-7) =$ $3x^2 - 21x + 2x - 14 =$ $3x^2 - 19x - 14$	8. $(x-7)(2x+3) =$ $2x^2 + 3x - 14x - 21 =$ $2x^2 - 11x - 21$
9. $a^2 + 2ab + b^2$	10. $(x-6)(x-6) =$ $x^2 - 6x - 6x + 36 =$ $x^2 - 12x + 36$
11. x | x: x^2, 3: $3x$ $-y$: $-xy$, $-3y$ -1: $-x$, -3	12. (3) $ax + by$
13. $(x-1)(2x^2+x-2) =$ $2x^3 + x^2 - 2x - 2x^2 - x + 2 =$ $2x^3 - x^2 - 3x + 2$	14. $(x^2+2)(x^2-2x+1) =$ $x^4 - 2x^3 + x^2 + 2x^2 - 4x + 2 =$ $x^4 - 2x^3 + 3x^2 - 4x + 2$

5.4 Divide a Polynomial by a Monomial

1. $\frac{2x+4}{2} = \frac{2x}{2} + \frac{4}{2} = x + 2$	2. $\frac{x^2+2x}{x} = \frac{x^2}{x} + \frac{2x}{x} = x + 2$
3. $\frac{14ab+28b}{14b} = \frac{14ab}{14b} + \frac{28b}{14b} = a + 2$	4. $\frac{6x^3+9x^2+3x}{3x} = \frac{6x^3}{3x} + \frac{9x^2}{3x} + \frac{3x}{3x}$ $= 2x^2 + 3x + 1$
5. $\frac{12x^3-6x^2+2x}{2x} = \frac{12x^3}{2x} - \frac{6x^2}{2x} + \frac{2x}{2x}$ $= 6x^2 - 3x + 1$	6. $\frac{16x^3-12x^2+4x}{4x} = \frac{16x^3}{4x} - \frac{12x^2}{4x} + \frac{4x}{4x}$ $= 4x^2 - 3x + 1$
7. $x^4 - 9x^2 + 1$	8. $4x^3 - x^2 + 2x - 3$
9. $3a^2b^2 - 6a$	10. $6xy^4 - 4x^5 + 1$

Chapter 6 Introduction to Functions

6.1 Recognize Functions

1. (2)	2. (2)
3. (1)	4. (2)
5. Yes, each *x* entry is mapped to a unique *y*	
6. (1)	7. (2)
8. (1)	
9. (1)	10. (3)

6.2 Function Graphs

1. x | $f(x)$ 0 | 0 1 | 3 2 | 4 3 | 7 4 | 2 5 | 0	2. a) $f(9) = 1$ b) $\left\{\frac{1}{2}, 3\right\}$

6.3 Evaluate Functions

1. $f(3) = -2(3)^2 - 3(3) - 6 =$ $-18 - 9 - 6 = -33$	2. $f(-3) = (-3)^2 - 2(-3) + 1 =$ $9 + 6 + 1 = 16$
3. $f(0) = (0 - 3)^2 = 9$	4. $f(2) = 0.5^2 = 0.25$
5. $f(3) - g(2) = [3(3) - 4] - [(2)^2] = 1$	6. $h(0) = 2(0) - 1 = -1$ $h(-2) = 2(-2) - 1 = -5$ $h(0) \cdot h(-2) = (-1)(-5) = 5$
7. $-10 = -4x + 2$ $-12 = -4x$ $3 = x$	8. $12 = k(2)^2$ $12 = 4k$ $3 = k$
9. $g(4a) = 2(4a)^2 + 6(4a) - 3 =$ $32a^2 + 24a - 3$	10. $f(a + 2) = (a + 2)^2 + 2(a + 2) - 1 =$ $a^2 + 4a + 4 + 2a + 4 - 1 =$ $a^2 + 6a + 7$
11. $P(125) = 0.0089(125)^2 + 1.1149(125) + 78.4491 \approx 356.9$	

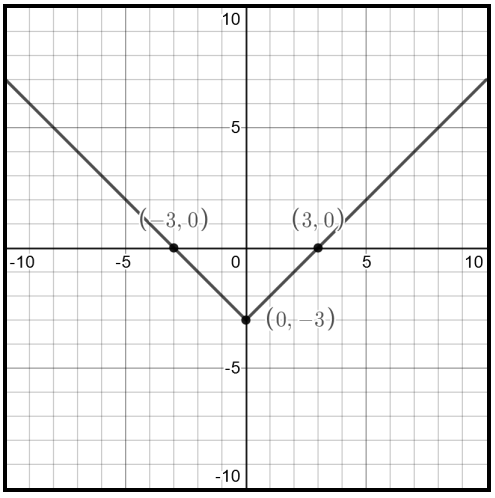
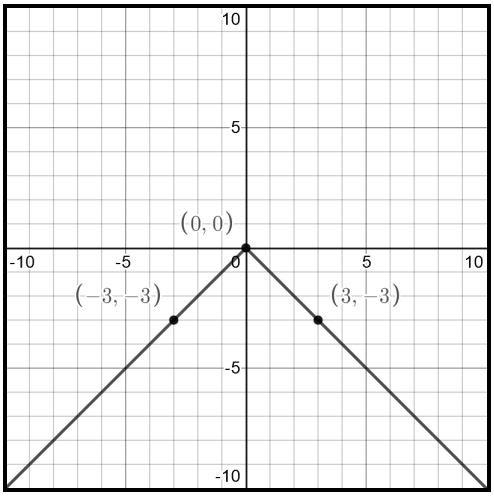
6.4 Features of Function Graphs

1. a) $0 < x < 2$ and $4 < x < 8$ b) $2 < x < 4$ c) $8 < x < 10$	2. a) $(-3,5)$ b) $(1,-3)$
3. a) positive at $x < -2$ and $0 < x < 2.5$; negative at $-2 < x < 0$ and $x > 2.5$ b) increasing at $-1 < x < 1$; decreasing at $x < -1$ and $x > 1$ c) relative maximum at $(1,2)$; relative minimum at $(-1,-2)$	

6.5 Domain and Range

1. $\{2, 3, 22, 51\}$	2. $\{x \mid x \neq 0\}$
3. domain: $1 < x \leq 4$ range: $1 < f(x) \leq 7$	4. domain: $-5 \leq x \leq 8$ Range: $-3 \leq y \leq 2$
5. $4 \leq x \leq 13$	6. $0 \leq y \leq 100$
7. $0 \leq x \leq 12$	8. $30 \leq y \leq 80$
9. the set of counting (natural) numbers	10. $f(5) = 25$ and $f(10) = 40$, so the range is $25 \leq f(x) < 40$
11. a) $f(x) \geq 0$ b) $0 \leq f(x) \leq 9$	12. a) $f(n) = 5n$ b) whole numbers $n \leq 20$ c) $\{0, 5, 10, 15, \ldots 100\}$

6.6 Absolute Value Functions

1. (4)	2. (1)
3. 	4. 

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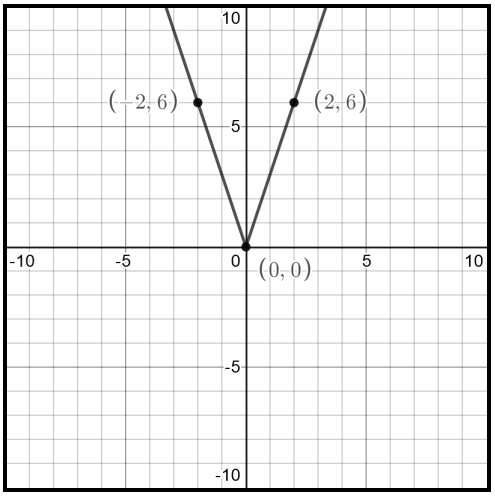

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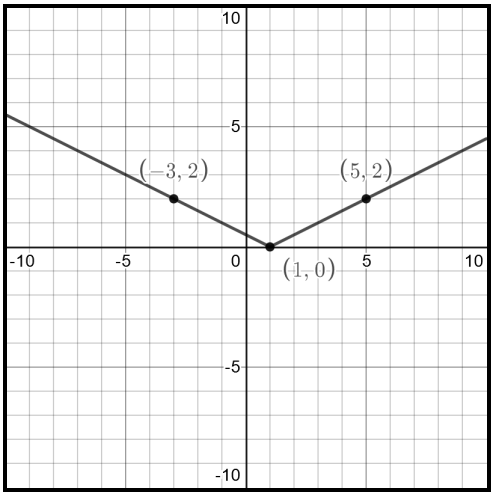
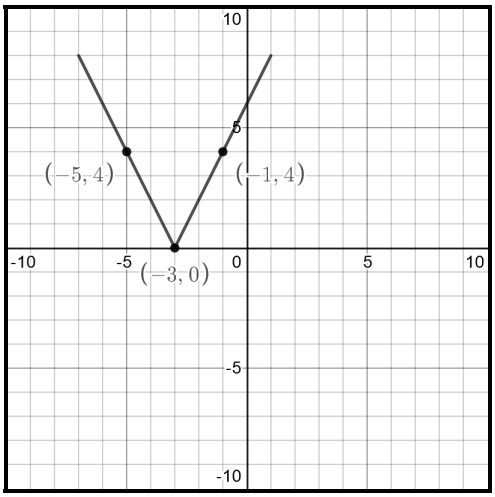


7.



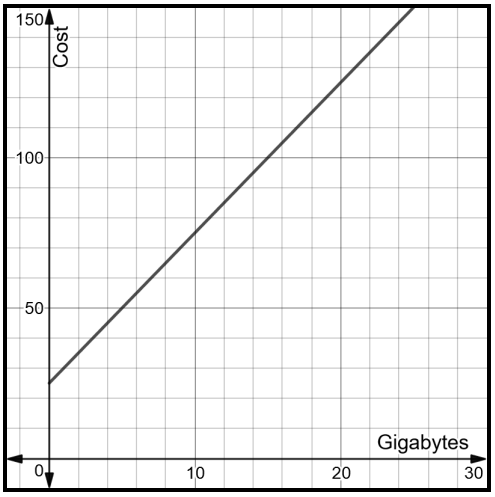
Chapter 7 Functions as Models

7.1 Write a Function from a Table

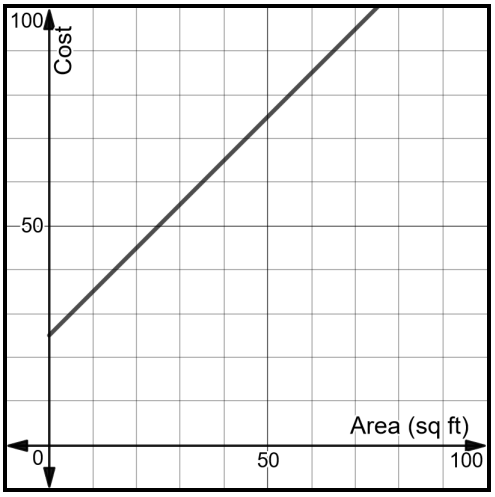
1. $f(x) = 4x + 9$	2. $f(x) = \frac{5}{3}x + 10$
3. $f(x) = 3(x - 1) + 7$ $f(x) = 3x + 4$	4. $f(x) = \frac{1}{2}(x - 1) - 5$ $f(x) = \frac{1}{2}x - 5\frac{1}{2}$
5. $f(x) = -2(x - 2) + 9$ $f(x) = -2x + 13$	6. $f(x) = 5(x - 11)$ $f(x) = 5x - 55$

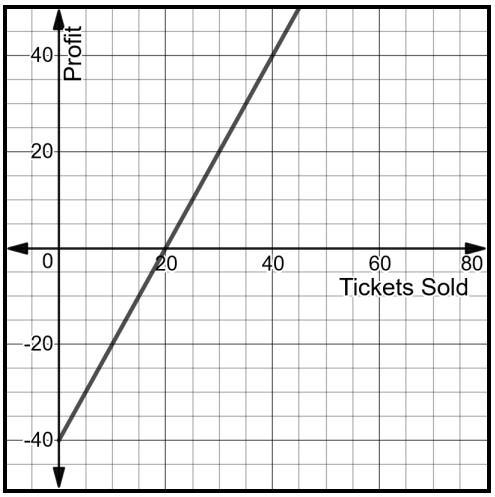
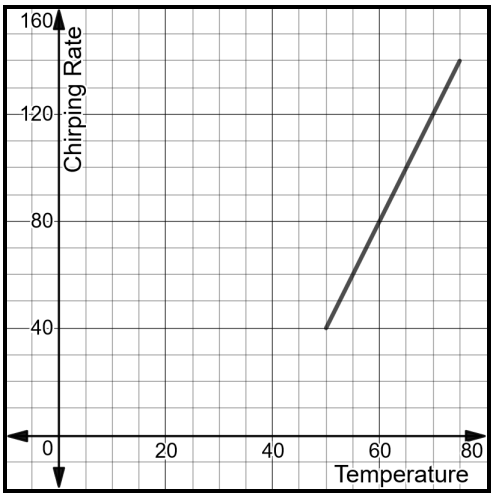
7.2 Graph Linear Functions

1. $c(g) = 5g + 25$



2. $c(x) = x + 25$



3. $y = 2x - 40$  	4. Line through points (59,76) and (65,100) has a slope of $\frac{24}{6} = 4$ and y-intercept $b = y - mx = 100 - 4(65) = -160$. $c(t) = 4t - 160$ 

7.3 Rate of Change for Linear Functions

1. negative	2. positive
3. negative	4. negative
5. positive; $m = \frac{348 - 232}{6 - 4} = \frac{116}{2} = 58$ mph	6. negative; as the distance travelled increases, the gas in the tank decreases.

7.4 Average Rate of Change

1. a) $m = \frac{9 - 1}{3 - 1} = \frac{8}{2} = 4$ b) $m = \frac{4 - 1}{2 - (-1)} = \frac{3}{3} = 1$	2. (1) $\frac{5.06 - 3.91}{1999 - 1987} = \frac{1.15}{12} \approx 0.096$ (2) $\frac{7.50 - 5.06}{2009 - 1999} = \frac{2.44}{10} \approx 0.244$ (2) has the higher average rate of change.
3. $f(5) = 5^2 + 2 = 27$ $f(15) = 15^2 + 2 = 227$ $m = \frac{227 - 27}{15 - 5} = \frac{200}{10} = 20$	4. $f(-3) = (-3)^2 + 10(-3) + 16 = -5$ $f(3) = 3^2 + 10(3) + 16 = 55$ $m = \frac{55 - (-5)}{3 - (-3)} = \frac{60}{6} = 10$

7.5 Functions of Time

1. (3)	2. (2)
3. 30 secs.	4. 7 minutes From 7:04 to 7:07 and 7:20 to 7:24
5. a) point B because it is the only point after which her distance from home decreases; b) 5 mins, from point D to point E	6. a) Spencer starts at (0,20) and McKenna starts at (0,0). b) McKenna speeds up, as the graph curves upward. The average rate of change increases. c) At about 3.2 hours. They traveled about 41 miles.

7.

Characteristic of Graph	Interpretation in Terms of the Race
y-intercepts	At 11 A.M. Runner *A* is 10 miles from the finish line and Runner *B* is 7 miles from the finish line.
Slopes	Runner A is decreasing the distance to the finish line at 8 mph and Runner B is running at 3.5 mph.
Point of intersection	The two runners meet after about 2/3 hour at about $4\frac{2}{3}$ miles from the finish line.
x-intercepts	Runner A finishes at 12:15 and Runner B finishes at 1:00.

7.6 Systems of Functions

1. a) \$50 b) 5 months; \$125 c) slope $= \frac{125-75}{5-0} = \frac{50}{5} = \$10$	2. Tasha: $A(x) = 60 + 5x$ Tyson: $B(x) = 135 - 10x$ $60 + 5x = 135 - 10x$ $15x = 75$ $x = 5$ 5 weeks
3. a) $R(x) = 25x$ b) $C(x) = 20x + 50{,}000$ c) $25x = 20x + 50{,}000$ $5x = 50{,}000$ $x = 10{,}000$ 10,000 widgets	4. a) $f(h) = 36h + 50$ b) $g(h) = 39h + 35$ c) $36h + 50 = 39h + 35$ $50 = 3h + 35$ $15 = 3h$ $5 = h$ 5 hours

7.7 Combine Functions

1. $h(x) = (x^2 + x + 1) + (x - 5) =$ $x^2 + 2x - 4$	2. $h(x) = (2x + 1)(x - 2) = 2x^2 - 3x - 2$
3. a) $R(c) = 20c + 500$ b) $E(c) = 6c$ c) $P(c) = R(c) - E(c) = (20c + 500) - (6c) = 14c + 500$	

Chapter 8 Exponential Functions

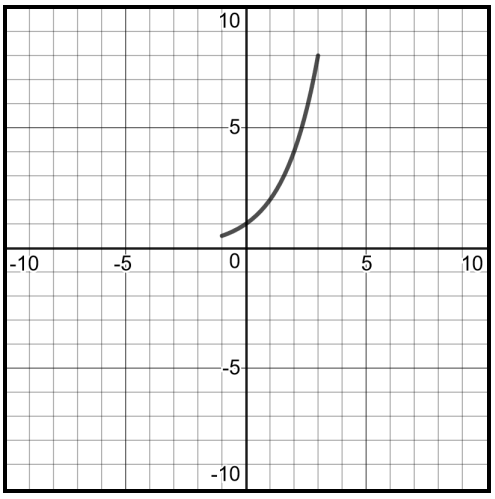
8.1 Exponential Growth and Decay

1. $x(1.1)^{20}$	2. $x(0.98)^{n}$
3. $2500(1.03)^{4}$	4. $10{,}000(1.2)^{t}$
5. $1500(1.05)^{6} \approx 2010.14$	6. $1000(1.03)^{5} \approx 1159.27$
7. $2000(1.035)^{4} \approx 2295$	8. $30{,}000(0.95)^{4} \approx 24{,}435.19$
9. $25{,}000(0.8)^{3} = 12{,}800$	10. $3810(1.035)^{5} \approx 4{,}525$
11. $20{,}000(0.88)^{3} = 13{,}629.44$	12. $11{,}900(0.87)^{3} \approx 7{,}800$
13. $1.39(1.005)^{12} \approx 1.48$	14. $256(0.25)^{3} = 4$

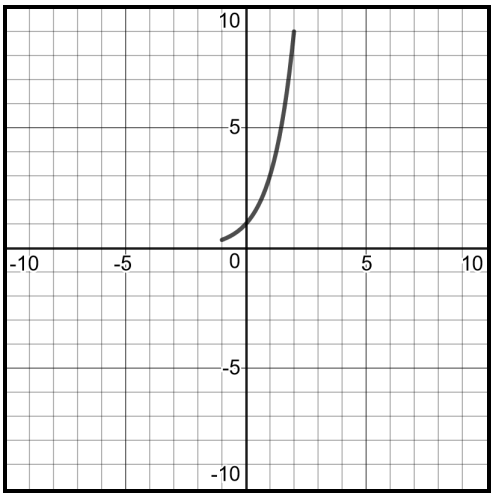
8.2 Graphs of Exponential Functions

1. (4)

2.



3.



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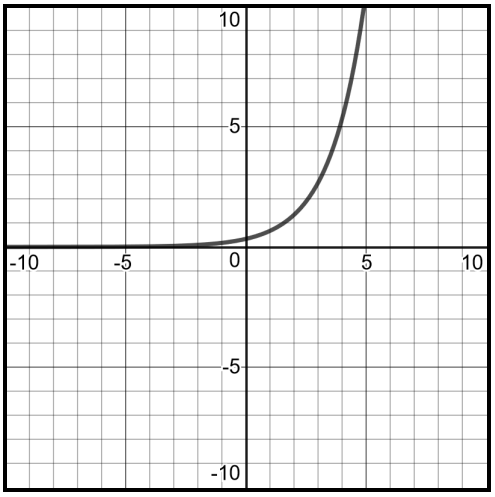
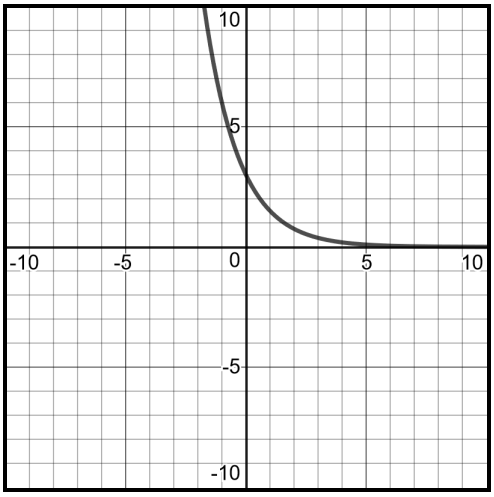


5.



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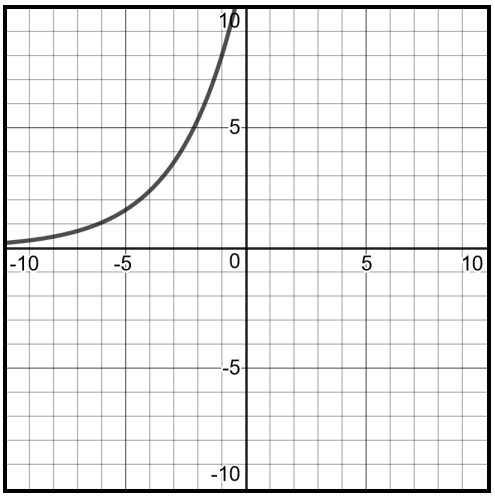

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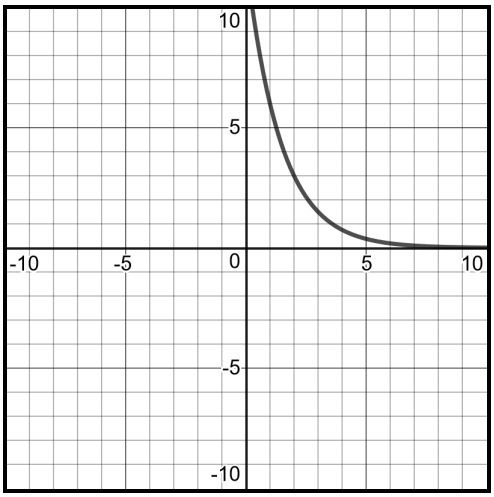

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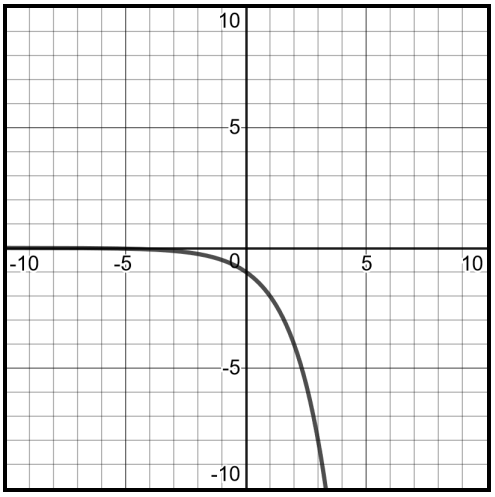
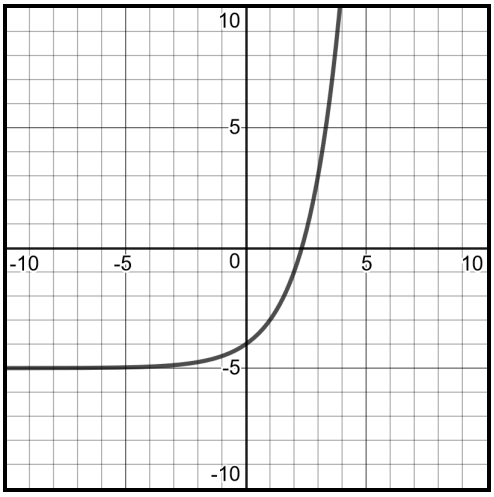


9.



It is shifted (translated) down by 5 units.

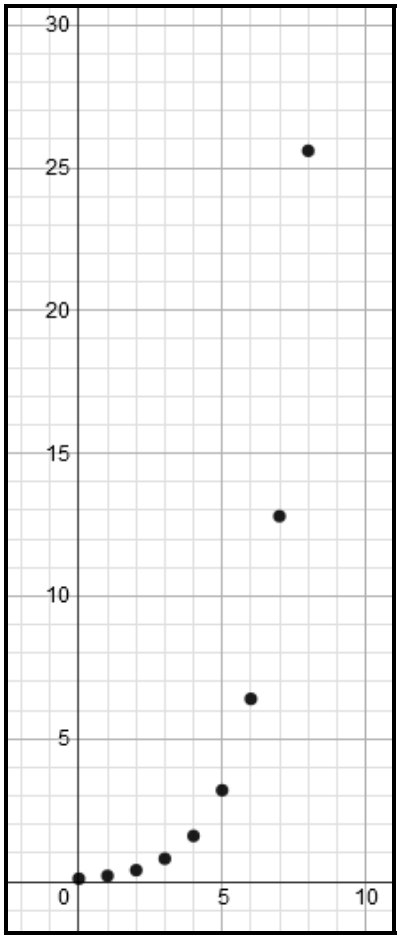
10. $y = 0.1(4)^x$

11. $y = \left(\frac{1}{4}\right)^x$

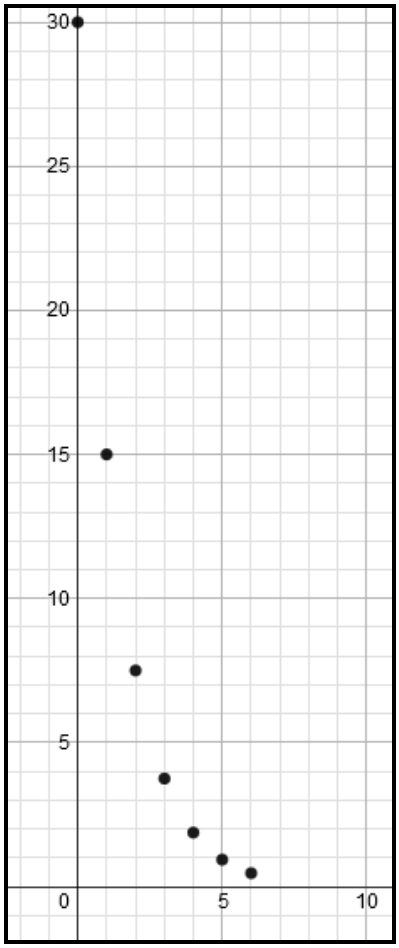
12. $y = 0.488(1.116)^x$

13. $y = 733.646(0.786)^x$
For $x = 12$, $y \approx 41$

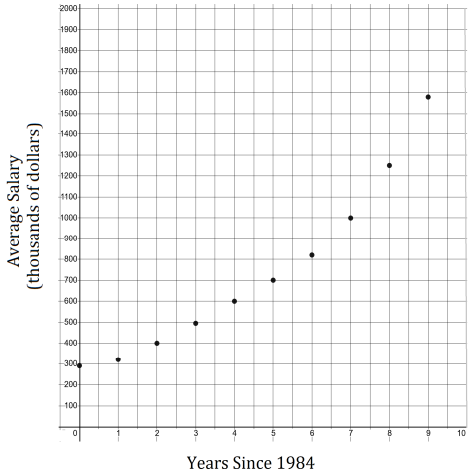
14. a) $t(n) = 0.1(2)^n$
b)



15. a) $h(n) = 30\left(\frac{1}{2}\right)^n$
b)



16.
a)



b) $y = 276.67(1.21)^x$
c) $y = 276.67(1.21)^{21} \approx 15{,}151$, or \$15,151,000

8.3 Rewrite Exponential Expressions

1. $5^{2x} = (5^2)^x = 25^x$	2. $10(1.1)^{5x} = 10(1.1^5)^x$ $= 10(1.61051)^x$
3. $2^{3x+2} = (2^3)^x \cdot (2^2) = 4(8)^x$	4. $4(3)^{x+1} = 4(3)^x \cdot (3^1) = 12(3)^x$

8.4 Compare Linear and Exponential Functions

1. a) linear b) exponential c) exponential d) neither	
2. $f(n) = 3n$	3. $f(n) = 3^n$

Chapter 9 Sequences

9.1 Arithmetic Sequences

1. 3	2. –4
3. $a_n = a_1 + (n-1)d$ $a_n = 15 + (n-1)\cdot 5$ $a_n = 15 + 5n - 5$ $a_n = 5n + 10$	4. $a_n = a_1 + (n-1)d$ $a_n = 10 + (n-1)\cdot 2$ $a_n = 10 + 2n - 2$ $a_n = 2n + 8$
5. $a_n = a_1 + (n-1)d$ $a_8 = 21 + (8-1)\cdot 9$ $a_8 = 84$	6. $a_n = a_1 + (n-1)d$ $a_{27} = 5 + (27-1)\cdot 3$ $a_{27} = 83$
7. Find *d* by calculating the slope using (6,10) and (21,55) as two points: $d = \frac{55-10}{21-6} = \frac{45}{15} = 3$ Solve for a_1: $a_6 = a_1 + (6-1)d$ $10 = a_1 + 5\cdot 3$ $-5 = a_1$ Write the rule: $a_n = a_1 + (n-1)d$ $a_n = -5 + (n-1)\cdot 3$ $a_n = -5 + 3n - 3$ $a_n = -8 + 3n$	8. Find *d* by calculating the slope using (4, −23) and (22,49) as two points: $d = \frac{49-(-23)}{22-4} = \frac{72}{18} = 4$ Solve for a_1: $a_4 = a_1 + (4-1)d$ $-23 = a_1 + 3\cdot 4$ $-35 = a_1$ Write the rule: $a_n = a_1 + (n-1)d$ $a_n = -35 + (n-1)\cdot 4$ $a_n = -35 + 4n - 4$ $a_n = -39 + 4n$

9.2 Geometric Sequences

1. $\frac{1}{2}$	2. -2
3. -4	4. $a_n = a_1 r^{n-1}$ $a_n = 4(2.5)^{n-1}$
5. $a_n = a_1 r^{n-1}$ $a_n = (-1)(-2)^{n-1} = -(-2)^{n-1}$	6. $a_n = a_1 r^{n-1}$ $a_{15} = 5(-2)^{15-1} = 5(-2)^{14} = 81{,}920$
7. $a_n = a_1 r^{n-1}$ $a_7 = 6\left(-\frac{1}{2}\right)^{7-1} = 6\left(-\frac{1}{2}\right)^{6}$ $= 6\left(\frac{1}{64}\right) = 0.09375$	8. $a_{10} = a_1 r^9 = 512$ $a_{15} = a_1 r^{14} = 16384$ $\frac{a_1 r^{14}}{a_1 r^9} = \frac{16384}{512}$, so $r^5 = 32$, or $r = 2$. Using $a_{10} = a_1(2)^9 = 512$, so $a_1 = 1$. $a_{30} = 1(2)^{29} = 536{,}870{,}912$

Chapter 10 Irrational Numbers

10.1 Simplifying Radicals

1. $\sqrt{12} = \sqrt{\boxed{2\cdot 2}\cdot 3} = 2\sqrt{3}$	2. $\sqrt{50} = \sqrt{2\cdot\boxed{5\cdot 5}} = 5\sqrt{2}$
3. $\sqrt{32} = \sqrt{\boxed{2\cdot 2}\cdot\boxed{2\cdot 2}\cdot 2} = 2\cdot 2\sqrt{2} = 4\sqrt{2}$	4. $4\sqrt{75} = 4\sqrt{3\cdot\boxed{5\cdot 5}} = 4\cdot 5\sqrt{3} = 20\sqrt{3}$
5. $5\sqrt{20} = 5\sqrt{\boxed{2\cdot 2}\cdot 5} = 5\cdot 2\sqrt{5} = 10\sqrt{5}$	6. $3\sqrt{45} = 3\sqrt{\boxed{3\cdot 3}\cdot 5} = 3\cdot 3\sqrt{5} = 9\sqrt{5}$
7. $5\sqrt{72} = 5\sqrt{\boxed{2\cdot 2}\cdot 2\cdot\boxed{3\cdot 3}}$ $= 5\cdot 2\cdot 3\sqrt{2} = 30\sqrt{2}$	8. $2\sqrt{128} = 2\sqrt{\boxed{2\cdot 2}\cdot\boxed{2\cdot 2}\cdot\boxed{2\cdot 2}\cdot 2}$ $= 2\cdot 2\cdot 2\cdot 2\sqrt{2} = 16\sqrt{2}$
9. $-3\sqrt{48} = -3\sqrt{16\cdot 3} = -3\cdot 4\sqrt{3} = -12\sqrt{3}$	10. $-\sqrt{98} = -\sqrt{49\cdot 2} = -7\sqrt{2}$
11. $2\sqrt{108} = 2\sqrt{36\cdot 3} = 2\cdot 6\sqrt{3} = 12\sqrt{3}$	12. $3\sqrt{250} = 3\sqrt{25\cdot 10} = 3\cdot 5\sqrt{10} = 15\sqrt{10}$
13. $\frac{\sqrt{32}}{4} = \frac{4\sqrt{2}}{4} = \sqrt{2}$	14. $\frac{7\sqrt{18}}{3} = \frac{7\cdot 3\sqrt{2}}{3} = 7\sqrt{2}$

10.2 Operations with Radicals

1. $\sqrt{75} + \sqrt{3} = 5\sqrt{3} + \sqrt{3} = 6\sqrt{3}$	2. $\sqrt{27} + \sqrt{12} = 3\sqrt{3} + 2\sqrt{3} = 5\sqrt{3}$
3. $\sqrt{50} + \sqrt{32} = 5\sqrt{2} + 4\sqrt{2} = 9\sqrt{2}$	4. $\sqrt{27} + \sqrt{108} = 3\sqrt{3} + 6\sqrt{3} = 9\sqrt{3}$
5. $\sqrt{28} + \sqrt{63} = 2\sqrt{7} + 3\sqrt{7} = 5\sqrt{7}$	6. $\sqrt{150} + \sqrt{24} = 5\sqrt{6} + 2\sqrt{6} = 7\sqrt{6}$
7. $3\sqrt{2} + \sqrt{8} = 3\sqrt{2} + 2\sqrt{2} = 5\sqrt{2}$	8. $\sqrt{72} - 3\sqrt{2} = 6\sqrt{2} - 3\sqrt{2} = 3\sqrt{2}$
9. $5\sqrt{7} + 3\sqrt{28} = 5\sqrt{7} + 6\sqrt{7} = 11\sqrt{7}$	10. $2\sqrt{50} - \sqrt{2} = 10\sqrt{2} - \sqrt{2} = 9\sqrt{2}$
11. $6\sqrt{50} + 6\sqrt{2} = 30\sqrt{2} + 6\sqrt{2} = 36\sqrt{2}$	12. $\sqrt{25} - 2\sqrt{3} + \sqrt{27} + 2\sqrt{9} =$ $5 - 2\sqrt{3} + 3\sqrt{3} + 6 = 11 + \sqrt{3}$
13. $\sqrt{6}\cdot\sqrt{15} = \sqrt{90} = 3\sqrt{10}$	14. $4\sqrt{2}\cdot 2\sqrt{6} = 8\sqrt{12} = 16\sqrt{3}$
15. $\sqrt{90}\cdot\sqrt{40} - \sqrt{8}\cdot\sqrt{18} = \sqrt{3600} - \sqrt{144} =$ $60 - 12 = 48$	16. $3\sqrt{20}(2\sqrt{5} - 7) = 6\sqrt{100} - 21\sqrt{20} =$ $60 - 42\sqrt{5}$
17. $3\sqrt{7}(\sqrt{14} + 4\sqrt{56}) = 3\sqrt{7}(\sqrt{14} + 8\sqrt{14}) =$ $3\sqrt{98} + 24\sqrt{98} = 27\sqrt{98} = 27\sqrt{49\cdot 2} =$ $189\sqrt{2}$	18. $(3 + \sqrt{5})(3 - \sqrt{5})$ $= 9 - 3\sqrt{5} + 3\sqrt{5} - 5 = 9 - 5 = 4$

19. $y\sqrt{3}-\left(4\sqrt{2}+3y\sqrt{3}\right)$ $=y\sqrt{3}-4\sqrt{2}-3y\sqrt{3}=-2y\sqrt{3}-4\sqrt{2}$	20. $3\sqrt{8}=6\sqrt{2}$ $P=2\left(6\sqrt{2}+2\right)+2\left(2\sqrt{2}+1\right)$ $=12\sqrt{2}+4+4\sqrt{2}+2=6+16\sqrt{2}$ $A=\left(6\sqrt{2}+2\right)\left(2\sqrt{2}+1\right)$ $=24+6\sqrt{2}+4\sqrt{2}+2=26+10\sqrt{2}$
21. $\frac{\sqrt{65}}{\sqrt{5}}=\sqrt{13}$	22. $\frac{20\sqrt{100}}{4\sqrt{2}}=5\sqrt{50}=25\sqrt{2}$
23. $\frac{\sqrt{84}}{2\sqrt{3}}=\frac{1}{2}\sqrt{28}=\frac{1}{2}\cdot 2\sqrt{7}=\sqrt{7}$	24. $\frac{6\sqrt{20}}{3\sqrt{5}}=2\sqrt{4}=2\cdot 2=4$
25. $\frac{3\sqrt{75}+\sqrt{27}}{3}=\frac{15\sqrt{3}+3\sqrt{3}}{3}=\frac{18\sqrt{3}}{3}=6\sqrt{3}$	26. $\frac{16\sqrt{21}}{2\sqrt{7}}-5\sqrt{12}=8\sqrt{3}-10\sqrt{3}=-2\sqrt{3}$
27. $\frac{\sqrt{48}-5\sqrt{27}+2\sqrt{75}}{\sqrt{3}}=\sqrt{16}-5\sqrt{9}+2\sqrt{25}$ $=4-15+10=-1$	28. $\frac{\sqrt{27}+\sqrt{75}}{\sqrt{12}}=\frac{3\sqrt{3}+5\sqrt{3}}{2\sqrt{3}}=\frac{8\sqrt{3}}{2\sqrt{3}}=4$

10.3 Rationalizing Denominators

1. $\frac{1}{\sqrt{7}}\cdot\left(\frac{\sqrt{7}}{\sqrt{7}}\right)=\frac{\sqrt{7}}{7}$	2. $\frac{6}{\sqrt{2}}\cdot\left(\frac{\sqrt{2}}{\sqrt{2}}\right)=\frac{6\sqrt{2}}{2}=3\sqrt{2}$
3. $\frac{5}{\sqrt{10}}\cdot\left(\frac{\sqrt{10}}{\sqrt{10}}\right)=\frac{5\sqrt{10}}{10}=\frac{\sqrt{10}}{2}$	4. $\frac{6}{\sqrt{21}}\cdot\left(\frac{\sqrt{21}}{\sqrt{21}}\right)=\frac{6\sqrt{21}}{21}=\frac{2\sqrt{21}}{7}$
5. $\frac{8}{3\sqrt{6}}\cdot\left(\frac{\sqrt{6}}{\sqrt{6}}\right)=\frac{8\sqrt{6}}{3(6)}=\frac{8\sqrt{6}}{18}=\frac{4\sqrt{6}}{9}$	6. $\frac{10\sqrt{2}}{\sqrt{5}}\cdot\left(\frac{\sqrt{5}}{\sqrt{5}}\right)=\frac{10\sqrt{10}}{5}=2\sqrt{10}$
7. $\frac{2}{\sqrt{3}}\times\frac{\sqrt{2}}{5}=\frac{2\sqrt{2}}{5\sqrt{3}}$ $\frac{2\sqrt{2}}{5\sqrt{3}}\cdot\left(\frac{\sqrt{3}}{\sqrt{3}}\right)=\frac{2\sqrt{2}\sqrt{3}}{5(3)}=\frac{2\sqrt{6}}{15}$	8. $\sqrt{\frac{16}{3}}=\frac{\sqrt{16}}{\sqrt{3}}=\frac{4}{\sqrt{3}}$ $\frac{4}{\sqrt{3}}\cdot\left(\frac{\sqrt{3}}{\sqrt{3}}\right)=\frac{4\sqrt{3}}{3}$
9. Rationalize denominators of both fractions. $\frac{1}{\sqrt{3}}\cdot\left(\frac{\sqrt{3}}{\sqrt{3}}\right)=\frac{\sqrt{3}}{3}\quad\frac{1}{\sqrt{2}}\cdot\left(\frac{\sqrt{2}}{\sqrt{2}}\right)=\frac{\sqrt{2}}{2}$ LCD is 6. $\frac{\sqrt{3}}{3}\cdot\left(\frac{2}{2}\right)+\frac{\sqrt{2}}{2}\cdot\left(\frac{3}{3}\right)=\frac{2\sqrt{3}}{6}+\frac{3\sqrt{2}}{6}=$ $\frac{2\sqrt{3}+3\sqrt{2}}{6}$	10. Rationalize denominators of both fractions. $\frac{1}{\sqrt{2}}\cdot\left(\frac{\sqrt{2}}{\sqrt{2}}\right)=\frac{\sqrt{2}}{2}\quad\frac{3}{\sqrt{5}}\cdot\left(\frac{\sqrt{5}}{\sqrt{5}}\right)=\frac{3\sqrt{5}}{5}$ LCD is 10. $\frac{\sqrt{2}}{2}\cdot\left(\frac{5}{5}\right)+\frac{3\sqrt{5}}{5}\cdot\left(\frac{2}{2}\right)=\frac{5\sqrt{2}}{10}+\frac{6\sqrt{5}}{10}=$ $\frac{5\sqrt{2}+6\sqrt{5}}{10}$

11. Rationalize denominators of both fractions.

$\frac{3}{\sqrt{5}} \cdot \left(\frac{\sqrt{5}}{\sqrt{5}}\right) = \frac{3\sqrt{5}}{5}$

$\frac{4}{\sqrt{6}} \cdot \left(\frac{\sqrt{6}}{\sqrt{6}}\right) = \frac{3\sqrt{6}}{6} = \frac{2\sqrt{6}}{3}$

LCD is 15.

$\frac{3\sqrt{5}}{5} \cdot \left(\frac{3}{3}\right) + \frac{2\sqrt{6}}{3} \cdot \left(\frac{5}{5}\right) = \frac{9\sqrt{5}}{15} + \frac{10\sqrt{6}}{15} = \frac{9\sqrt{5} + 10\sqrt{6}}{15}$

12. $\frac{3-\sqrt{8}}{\sqrt{3}} \cdot \left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{3}(3-\sqrt{8})}{3} = \frac{3\sqrt{3}-\sqrt{24}}{3}$

$= \frac{3\sqrt{3}-2\sqrt{6}}{3} = \sqrt{3} - \frac{2}{3}\sqrt{6}$

13. $\sqrt{\frac{4}{3}} - \sqrt{\frac{3}{4}} = \frac{\sqrt{4}}{\sqrt{3}} - \frac{\sqrt{3}}{\sqrt{4}} = \frac{2}{\sqrt{3}} - \frac{\sqrt{3}}{2} = \frac{2}{\sqrt{3}} \cdot \left(\frac{\sqrt{3}}{\sqrt{3}}\right) - \frac{\sqrt{3}}{2} = \frac{2\sqrt{3}}{3} - \frac{\sqrt{3}}{2}$

$\frac{2\sqrt{3}}{3} \cdot \left(\frac{2}{2}\right) - \frac{\sqrt{3}}{2} \cdot \left(\frac{3}{3}\right) = \frac{4\sqrt{3}}{6} - \frac{3\sqrt{3}}{6} = \frac{\sqrt{3}}{6}$

10.4 Closure

1. (2) $\sqrt{8}$

$-\sqrt{16} = -4,\ \sqrt{64} = 8,\ \sqrt{\frac{1}{64}} = \frac{1}{8}$

2. Irrational. 3 is not a perfect square.

3. Irrational.
π is irrational, and the quotient of an irrational number and a non-zero rational number is irrational.

4. Irrational.
$\sqrt{29}$ is irrational since 29 is not a perfect square. The numerator is the difference of a non-zero rational and irrational, so the numerator is irrational. The fraction is the quotient of an irrational and a non-zero rational, so it is irrational.

5. *x* could be 0, $\sqrt{3}$, $\sqrt{12}$, $\frac{1}{\sqrt{3}}$, etc.

6. $\pi \approx 3.141593$ and $\frac{22}{7} \approx 3.142857$

$\pi - 3.14 \approx 0.001593$

$\frac{22}{7} - \pi \approx 0.001264$

So, $\frac{22}{7}$ is a closer approximation.

Chapter 11 Factoring

11.1 Factor Out the Greatest Common Factor

1. $4x^2 - 6x$ $= 2 \cdot 2 \cdot x \cdot x - 2 \cdot 3 \cdot x = 2x(2x - 3)$	2. $5a^2 - 10a$ $= 5 \cdot a \cdot a - 2 \cdot 5 \cdot a = 5a(a - 2)$
3. $7x(2x^2 + 1)$	4. $x(x^2 + x - 1)$
5. $6xy(2x^2 + 3y)$	6. $2y(y^2 - 2y + 1)$
7. $3x(x^2 - 2x + 2)$	8. $-2(x + y)$
9. $3mn(m + 4n)$	10. $2x^2y^2(3xz - 2)$

11.2 Factor a Trinomial

1. $(x + 7)(x + 2)$	2. $(x - 9)(x - 2)$
3. $(x - 9)(x + 3)$	4. $(a - 15)(a + 14)$
5. $(x + 8)(x - 3)$	6. $(x + 5)(x - 3)$
7. $(x - 12)(x + 2)$	8. $(x - 3)(x - 2)$
9. yes, it is prime	10. $(x + 2)(x + 5) = x^2 + 7x + 10$, so $b = 7$
11. $(-3x^2 + x - 2) + (4x^2 + 3x - 10) = x^2 + 4x - 12 = (x + 6)(x - 2)$	

11.3 Factor the Difference of Perfect Squares

1. $(x + 6)(x - 6)$	2. $(2x + 3)(2x - 3)$
3. $(3 + x)(3 - x)$	4. $(a + 1)(a - 1)$
5. $(7x + y)(7x - y)$	6. $(2a + 3b)(2a - 3b)$
7. $(xy + 4)(xy - 4)$	8. $(x^5 + 10)(x^5 - 10)$
9. $(10n + 1)(10n - 1)$	10. $(11 + x)(11 - x)$
11. $(3a + 8b)(3a - 8b)$	12. 10

11.4 Factor Completely

1. $2y^2 + 12y - 54 =$ $2(y^2 + 6y - 27) =$ $2(y + 9)(y - 3)$	2. $3x^2 + 15x - 42 =$ $3(x^2 + 5x - 14) =$ $3(x + 7)(x - 2)$
3. $3x^2 - 27 =$ $3(x^2 - 9) =$ $3(x + 3)(x - 3)$	4. $2x^2 - 50 =$ $2(x^2 - 25) =$ $2(x + 5)(x - 5)$
5. $2a^2 - 10a - 28 =$ $2(a^2 - 5a - 14) =$ $2(a - 7)(a + 2)$	6. $x^3 + 8x^2 + 7x =$ $x(x^2 + 8x + 7) =$ $x(x + 7)(x + 1)$
7. $2x^8 + 16x^7 + 32x^6 =$ $2x^6(x^2 + 8x + 16) =$ $2x^6(x + 4)(x + 4)$	8. $3ax^2 - 27a =$ $3a(x^2 - 9) =$ $3a(x + 3)(x - 3)$
9. $5x^2y^3 - 180y =$ $5y(x^2y^2 - 36) =$ $5y(xy + 6)(xy - 6)$	10. $2x^5 - 32x =$ $2x(x^4 - 16) =$ $2x(x^2 + 4)(x^2 - 4) =$ $2x(x^2 + 4)(x + 2)(x - 2)$
11. $2x^2 + 10x - 12 =$ $2(x^2 + 5x - 6) =$ $2(x + 6)(x - 1)$	12. $a^3 - 4a =$ $a(a^2 - 4) =$ $a(a + 2)(a - 2)$
13. $3x^3 - 33x^2 + 90x =$ $3x(x^2 - 11x + 30) =$ $3x(x - 6)(x - 5)$	14. $36x^2 - 100y^6 =$ $4(9x^2 - 25y^6) =$ $4(3x + 5y^3)(3x - 5y^3)$
15. $4x^3y^3 - 36xy =$ $4xy(x^2y^2 - 9) =$ $4xy(xy + 3)(xy - 3)$	16. $-x^3 - x^2 + 6x =$ $-x(x^2 + x - 6) =$ $-x(x + 3)(x - 2)$

Chapter 12 Quadratic Functions

12.1 Solve Simple Quadratic Equations

1. $x = \pm\sqrt{81} = \pm 9$ $\{-9,9\}$	2. $y = \pm\sqrt{20} = \pm 2\sqrt{5}$ $\{-2\sqrt{5}, 2\sqrt{5}\}$
3. $3x^2 = 75$ $x^2 = 25$ $x = \pm\sqrt{25} = \pm 5$ $\{-5,5\}$	4. $4x^2 - 36 = 0$ $4x^2 = 36$ $x^2 = 9$ $x = \pm\sqrt{9} = \pm 3$ $\{-3,3\}$
5. $2x^2 = 12$ $x^2 = 6$ $x = \pm\sqrt{6}$ $\{-\sqrt{6}, \sqrt{6}\}$	6. $9x^2 = 4$ $x^2 = \frac{4}{9}$ $x = \pm\sqrt{\frac{4}{9}} = \pm\frac{2}{3}$ $\left\{-\frac{2}{3}, \frac{2}{3}\right\}$
7. $5x^2 - 5 = 0$ $5x^2 = 5$ $x^2 = 1$ $x = \pm\sqrt{1} = \pm 1$ $\{-1,1\}$	8. $3m^2 = 0$ $m^2 = 0$ $m = 0$ $\{0\}$
9. $h^2 = 2s$ $h = \pm\sqrt{2s}$	10. $a^2 = c^2 - b^2$ $a = \sqrt{c^2 - b^2}$

12.2 Solve Quadratic Equations by Factoring

1. $x^2 - 5x = 0$ $x(x - 5) = 0$ $x = 0$ or $x - 5 = 0$ $\{0,5\}$	2. $x^2 + 3x - 18 = 0$ $(x + 6)(x - 3) = 0$ $x + 6 = 0$ or $x - 3 = 0$ $\{-6,3\}$
3. $4x^2 - 36 = 0$ $4(x^2 - 9) = 0$ $4(x + 3)(x - 3) = 0$ $x + 3 = 0$ or $x - 3 = 0$ $\{-3,3\}$	4. $x^2 - 4x - 32 = 0$ $(x + 4)(x - 8) = 0$ $x + 4 = 0$ or $x - 8 = 0$ $\{-4,8\}$
5. $x^2 - 5x = 6$ $x^2 - 5x - 6 = 0$ $(x + 1)(x - 6) = 0$ $x + 1 = 0$ or $x - 6 = 0$ $\{-1,6\}$	6. $x^2 - 3 = 2x$ $x^2 - 2x - 3 = 0$ $(x + 1)(x - 3) = 0$ $x + 1 = 0$ or $x - 3 = 0$ $\{-1,3\}$

7. $x^2 - x = 6$ $x^2 - x - 6 = 0$ $(x + 2)(x - 3) = 0$ $x + 2 = 0$ or $x - 3 = 0$ $\{-2,3\}$	8. $x^2 = 30 - 13x$ $x^2 + 13x - 30 = 0$ $(x + 15)(x - 2) = 0$ $x + 15 = 0$ or $x - 2 = 0$ $\{-15,2\}$
9. $x^2 - 4x = x + 24$ $x^2 - 5x - 24 = 0$ $(x + 3)(x - 8) = 0$ $x + 3 = 0$ or $x - 8 = 0$ $\{-3,8\}$	10. $2x^2 + 10x = 12$ $2x^2 + 10x - 12 = 0$ $2(x^2 + 5x - 6) = 0$ $2(x + 6)(x - 1) = 0$ $x + 6 = 0$ or $x - 1 = 0$ $\{-6,1\}$
11. $x(x + 2) = 3$ $x^2 + 2x = 3$ $x^2 + 2x - 3 = 0$ $(x + 3)(x - 1) = 0$ $x + 3 = 0$ or $x - 1 = 0$ $\{-3,1\}$	12. $(x + 2)(x + 3) = 12$ $x^2 + 5x + 6 = 12$ $x^2 + 5x - 6 = 0$ $(x + 6)(x - 1) = 0$ $x + 6 = 0$ or $x - 1 = 0$ $\{-6,1\}$

12.3 Find Quadratic Equations from Given Roots

1. $x = 10$ or $x = -2$ $x - 10 = 0$ or $x + 2 = 0$ $(x - 10)(x + 2) = 0$ $x^2 - 8x - 20 = 0$	2. $x = 0$ or $x = 3$ $x = 0$ or $x - 3 = 0$ $x(x - 3) = 0$ $x^2 - 3x = 0$
3. $x = -12$ or $x = 2$ $x + 12 = 0$ or $x - 2 = 0$ $(x + 12)(x - 2) = 0$ $x^2 + 10x - 24 = 0$	4. $x = -3$ or $x = 5$ $x + 3 = 0$ or $x - 5 = 0$ $(x + 3)(x - 5) = 0$ $x^2 - 2x - 15 = 0$
5. $x = -5$ or $x = 2$ $x + 5 = 0$ or $x - 2 = 0$ $(x + 5)(x - 2) = 0$ $x^2 + 3x - 10 = 0$	6. $x = 1$ or $x = 3$ $x - 1 = 0$ or $x - 3 = 0$ $(x - 1)(x - 3) = 0$ $x^2 - 4x + 3 = 0$
7. $\Downarrow$ multiply both sides by 2 $x - \frac{3}{2} = 0$ or $x - 2 = 0$ $2x - 3 = 0$ or $x - 2 = 0$ $(2x - 3)(x - 2) = 0$ $2x^2 - 7x + 6 = 0$	8. $(x - 1)^2 = 0$ $(x - 1)(x - 1) = 0$ $x^2 - 2x + 1 = 0$
9. $(x - 4)(x + 4) = 0$ $x^2 - 16 = 0$	10. $x = 0$ or $x = 1$ or $x = -1$ $x(x - 1)(x + 1) = 0$ $x(x^2 - 1) = 0$ $x^3 - x = 0$

12.4 Equations with the Square of a Binomial

1. $x+5=\pm\sqrt{16}=\pm4$ $x=-5\pm4$ $\{-9,-1\}$	2. $x-4=\pm\sqrt{10}$ $x=4\pm\sqrt{10}$ $\{4-\sqrt{10},4+\sqrt{10}\}$
3. $(b-1)^2=8$ $b-1=\pm\sqrt{8}=\pm2\sqrt{2}$ $b=1\pm2\sqrt{2}$ $\{1-2\sqrt{2},1+2\sqrt{2}\}$	4. $-(m+1)^2=-30$ $(m+1)^2=30$ $m+1=\pm\sqrt{30}$ $m=-1\pm\sqrt{30}$ $\{-1-\sqrt{30},-1+\sqrt{30}\}$
5. $(x-2)^2=0$ $x-2=0$ $x=2$ $\{2\}$	6. $2(x+5)^2-50=0$ $2(x+5)^2=50$ $(x+5)^2=25$ $x+5=\pm\sqrt{25}=\pm5$ $x=-5\pm5$ $\{-10,0\}$

12.5 Complete the Square

1. $x^2-8x+16=0$ This is a perfect square trinomial. $(x-4)^2=0$ $x-4=0$ Solution: $\{4\}$	2. $\left(\frac{b}{2}\right)^2=\left(\frac{10}{2}\right)^2=25$ $x^2+10x-11=0$ $x^2+10x=11$ $x^2+10x+25=11+25$ $(x+5)^2=36$ $x+5=\pm\sqrt{36}=\pm6$ $x=-5\pm6$ Solution: $\{-11,1\}$ *[Factoring would give us the same result: $x^2+10x-11=(x+11)(x-1)$]*
3. $\left(\frac{b}{2}\right)^2=\left(\frac{4}{2}\right)^2=4$ $x^2+4x+2=0$ $x^2+4x=-2$ $x^2+4x+4=-2+4$ $(x+2)^2=2$ $x+2=\pm\sqrt{2}$ $x=-2\pm\sqrt{2}$ Solution: $\{-2-\sqrt{2},-2+\sqrt{2}\}$	4. $\left(\frac{b}{2}\right)^2=\left(\frac{-4}{2}\right)^2=4$ $x^2-4x-8=0$ $x^2-4x=8$ $x^2-4x+4=8+4$ $(x-2)^2=12$ $x-2=\pm\sqrt{12}=\pm2\sqrt{3}$ $x=2\pm2\sqrt{3}$ Solution: $\{2-2\sqrt{3},2+2\sqrt{3}\}$

5. Divide both sides by 2 to get
$x^2 - 6x + 2 = 0$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{-6}{2}\right)^2 = 9$$

$x^2 - 6x = -2$
$x^2 - 6x + 9 = -2 + 9$ ←
$(x-3)^2 = 7$
$x - 3 = \pm\sqrt{7}$
Solution: $\{3 - \sqrt{7}, 3 + \sqrt{7}\}$

6. $$\left(\frac{b}{2}\right)^2 = \left(\frac{-2}{2}\right)^2 = 1$$

$x^2 - 2x + 3 = 0$
$x^2 - 2x = -3$
$x^2 - 2x + 1 = -3 + 1$ ←
$(x-1)^2 = -2$
$x - 1 = \pm\sqrt{-2}$
No real solutions, since the square root of a negative number is not a real number.

7. $w(w + 10) = 880$
$w^2 + 10w = 880$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{10}{2}\right)^2 = 25$$

$w^2 + 10w + 25 = 880 + 25$
$(w+5)^2 = 905$
$w + 5 = \pm\sqrt{905}$
$w = -5 \pm \sqrt{905} \approx -5 \pm 30.1$
$w \approx 25.1$ (reject negative w)
width ≈ 25.1 ft. and length ≈ 35.1 ft.

12.6 Quadratic Formula and the Discriminant

1. (2) 2

2. $b^2 - 4ac = 4^2 - 4(1)(7) = -12$,
so the answer is (a) not real

3. $b^2 - 4ac = 3^2 - 4(9)(-4) = 153$, so
(4) real, irrational, and unequal

4. $b^2 - 4ac = (-9)^2 - 4(2)(4) = 49$, so
(2) real, rational, and unequal

5. $6x^2 - 2x - 3 = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{2 \pm \sqrt{(-2)^2-4(6)(-3)}}{2(6)}$$

$$= \frac{2 \pm \sqrt{76}}{12} = \frac{2 \pm 2\sqrt{19}}{12} = \frac{1 \pm \sqrt{19}}{6}$$

Solution: $\left\{\frac{1-\sqrt{19}}{6}, \frac{1+\sqrt{19}}{6}\right\}$

6. $2x^2 + 7x - 3 = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-7 \pm \sqrt{7^2-4(2)(-3)}}{2(2)}$$

$$= \frac{-7 \pm \sqrt{73}}{4}$$

Solution: $\left\{\frac{-7-\sqrt{73}}{4}, \frac{-7+\sqrt{73}}{4}\right\}$

7. $x^2 + 7x + 8 = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-7 \pm \sqrt{7^2-4(1)(8)}}{2(1)}$$

$$= \frac{-7 \pm \sqrt{17}}{2}$$

Solution: $\left\{\frac{-7-\sqrt{17}}{2}, \frac{-7+\sqrt{17}}{2}\right\}$

8. $2x^2 - 8x + 3 = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{8 \pm \sqrt{(-8)^2-4(2)(3)}}{2(2)}$$

$$= \frac{8 \pm \sqrt{40}}{4} = \frac{8 \pm 2\sqrt{10}}{4} = 2 \pm \frac{\sqrt{10}}{2}$$

Solution: $\left\{2 - \frac{\sqrt{10}}{2}, 2 + \frac{\sqrt{10}}{2}\right\}$

12.7 Word Problems – Quadratic Equations

1. $x^2 - 2x = 48$ $x^2 - 2x - 48 = 0$ $(x - 8)(x + 6) = 0$ $x - 8 = 0$ or $x + 6 = 0$ $x = 8$ (reject $x = -6$) The number is 8.	2. $x^2 + (x + 8)^2 = 104$ $x^2 + x^2 + 16x + 64 = 104$ $2x^2 + 16x - 40 = 0$ $x^2 + 8x - 20 = 0$ *[divide by 2]* $(x + 10)(x - 2) = 0$ $x = 2$ (reject $x = -10$) Numbers are 2 and 10.
3. $x^2 - 36 = 5x$ $x^2 - 5x - 36 = 0$ $(x - 9)(x + 4) = 0$ $x - 9 = 0$ or $x + 4 = 0$ $x = 9$ (reject $x = -4$) Positive solution is 9.	4. $x^2 = 5x + 24$ $x^2 - 5x - 24 = 0$ $(x - 8)(x + 3)$ $x - 8 = 0$ or $x + 3 = 0$ $x = 8$ (reject $x = -3$) The positive number is 8.
5. $w(w + 5) = 500$ $w^2 + 5w - 500 = 0$ $(w - 20)(w + 25) = 0$ $w = 20$ (reject $w = -25$) Width is 20 and length is 25.	6. $(t + 7)(t - 3) = 24$ $t^2 + 4t - 21 = 24$ $t^2 + 4t - 45 = 0$ $(t - 5)(t + 9) = 0$ $t = 5$ (reject $t = -9$) Tamara is 5 years old.
7. $x(x + 2) = 63$ $x^2 + 2x - 63 = 0$ $(x + 9)(x - 7) = 0$ $x = -9$ (reject $x = 7$) Numbers are –9 and –7.	8. $x(x + 2) = (x + 4) + 8$ $x^2 + 2x = x + 12$ $x^2 + x - 12 = 0$ $(x - 3)(x + 4) = 0$ $x = 3$ (reject $x = -4$) Numbers are 3, 5, and 7.
9. $(x + 1)(x + 10) = 90$ $x^2 + 11x + 10 = 90$ $x^2 + 11x - 80 = 0$ $(x - 5)(x + 16) = 0$ $x = 5$ (reject $x = -16$) Numbers are 5 and 6.	10. $x(x + 4) = 2(x + 2) + 20$ $x^2 + 4x = 2x + 4 + 20$ $x^2 + 2x - 24 = 0$ $(x - 4)(x + 6) = 0$ $x = 4$ (reject $x = -6$) Ages are 4, 6, and 8
11. $x^2 + (x + 1)^2 = 6^2$ $x^2 + x^2 + 2x + 1 = 36$ $2x^2 + 2x - 35 = 0$ $x = \frac{-2 \pm \sqrt{284}}{4}$ $x \approx 3.71$ (reject $x \approx -4.71$) 3.71 and 4.71	12. $-16x^2 + 32x = 0$ $-16x(x - 2) = 0$ $-16x = 0$ or $x - 2 = 0$ $x = 2$ (reject $x = 0$) 2 seconds.
13. a) $w(0) = 120$ gallons b) $t = \frac{8 \pm \sqrt{2462}}{-10} \approx \{\cancel{-5.8}, 4.2\}$ 4.2 mins.	14. a) $(x + 40)(x + 60)$ b) $2400, 60x, x^2, 40x$ c) Both equal $x^2 + 100x + 2400$

Chapter 13 Parabolas

13.1 Find Roots Given a Parabolic Graph

1. (c)	2. (a)
3. 2 and 4	4. 1 and 5
5. –2 and 3	6. –4 and 2
7. –1 and 4	8. –1 and 5
9. –6 and 3	10. 0 (only)

13.2 Find Vertex and Axis Graphically

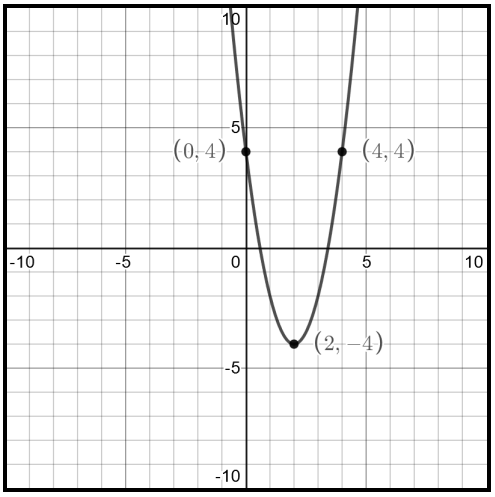
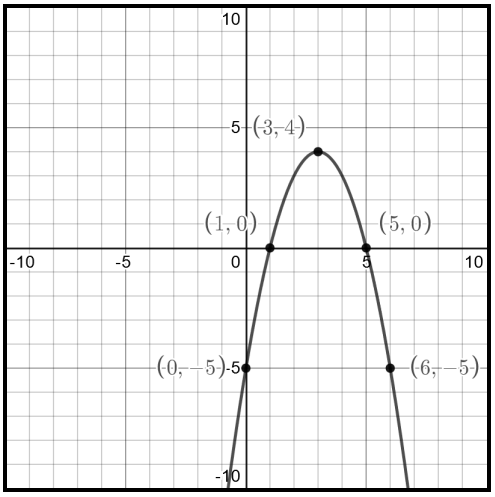
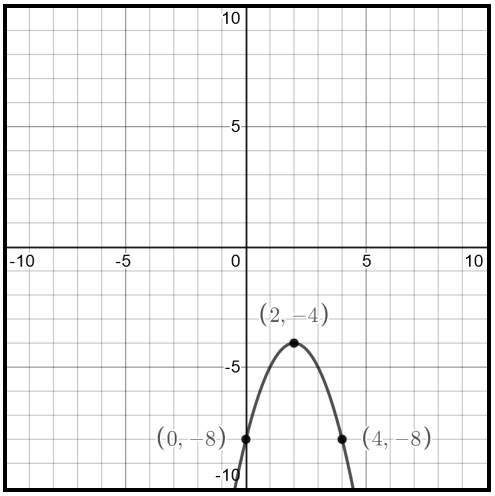
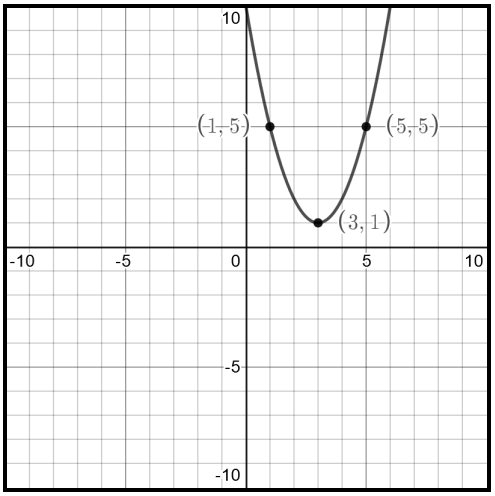
1. Vertex is $(3,-1)$ Axis of symmetry is $x = 3$.	2. Vertex is $(1,-5)$ Axis of symmetry is $x = 1$.
3. Vertex is $(-1,7)$ Axis of symmetry is $x = -1$.	4. Vertex is $(-2,-3)$ Axis of symmetry is $x = -2$.
5. Vertex is (3,23) Axis of symmetry is $x = 3$.	6. Vertex is (3,8) Axis of symmetry is $x = 3$.
7. Vertex is (0,0) Axis of symmetry is $x = 0$.	8. (3) (3,0) and (1,0)

13.3 Finding Vertex and Axis Algebraically

1. $x = \frac{-b}{2a} = \frac{-4}{-2} = 2$ $y = -(2)^2 + 4(2) - 8 = -4$ Vertex is $(2,-4)$ Axis of symmetry is $x = 2$	2. $x = \frac{-b}{2a} = \frac{6}{2} = 3$ $y = (3)^2 - 6(3) + 10 = 1$ Vertex is (3,1) Axis of symmetry is $x = 3$
3. $x = \frac{-b}{2a} = \frac{-6}{6} = -1$ $y = 3(-1)^2 + 6(-1) - 1 = -4$ Vertex is $(-1,-4)$	4. $x = \frac{-b}{2a} = \frac{-8}{4} = -2$ $y = 2(-2)^2 + 8(-2) + 9 = 1$ Vertex (minimum) is $(-2,1)$
5. $x = \frac{-b}{2a} = \frac{-2}{2} = -1$ $y = (-1)^2 + 2(-1) = -1$ Vertex is $(-1,-1)$ Axis of symmetry is $x = -1$	6. $x = \frac{-b}{2a} = \frac{0}{6} = 0$ $y = 3(0)^2 + 1 = 1$ Vertex is (0,1) Axis of symmetry is $x = 0$

7. $x = \frac{-b}{2a} = \frac{8}{-4} = -2$ $y = -2(-2)^2 - 8(-2) + 3 = 11$ $x = -2$ and $(-2,11)$	8. $x = \frac{-b}{2a} = \frac{2}{-2} = -1$ $y = -(-1)^2 - 2(-1) + 1 = 2$ $x = -1$ and $(-1,2)$
9. $x = \frac{-b}{2a} = \frac{8}{0.5} = 16$ $y = 0.25(16)^2 - 8(16) + 800 = 736$ Vertex is (16,736). So, producing 16 units will result in the minimum cost of \$736.	10. $w = \frac{-b}{2a} = \frac{-160}{-8} = 20$ workers

13.4 Graph Parabolas

1. 	2. 
3. 	4. 

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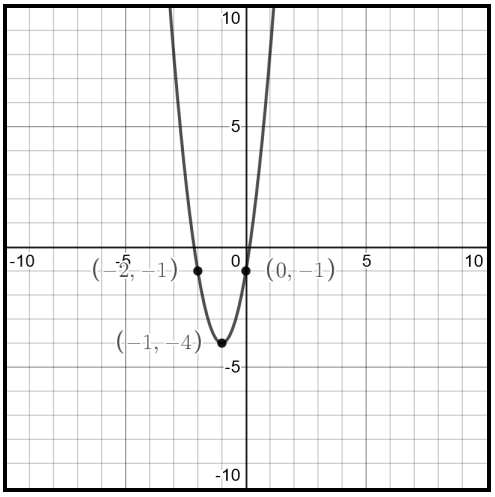

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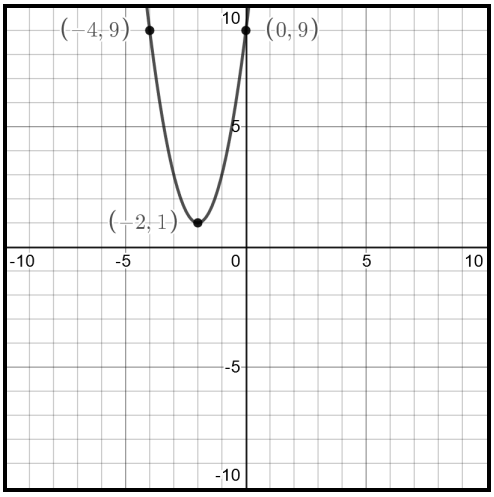

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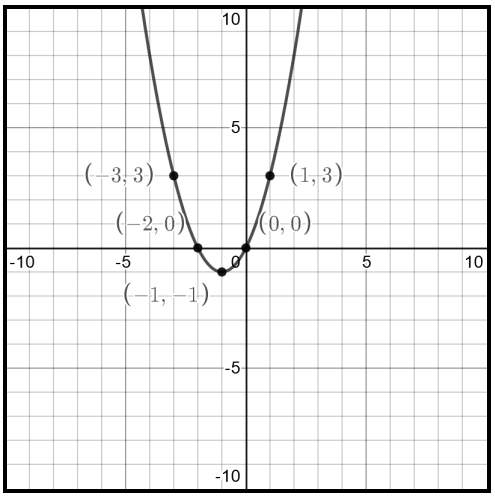

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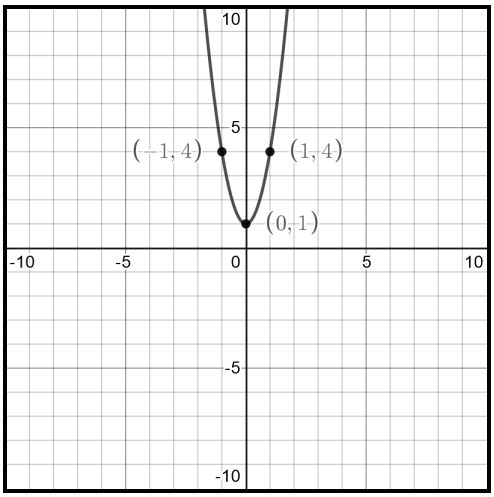

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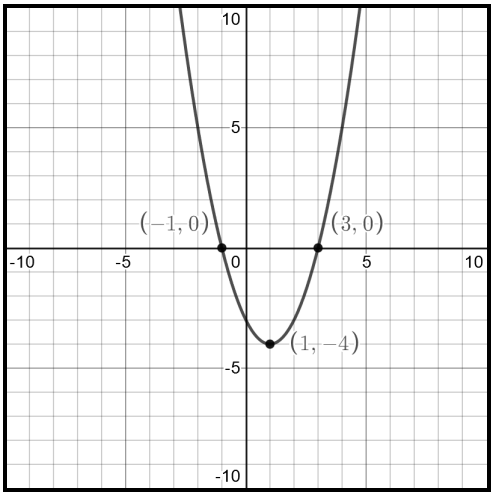
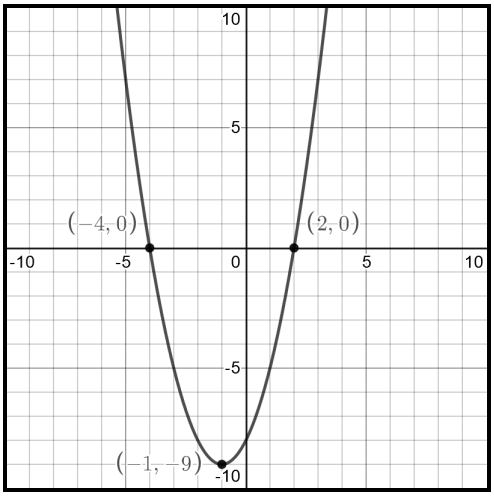


Roots are –1 and 3.

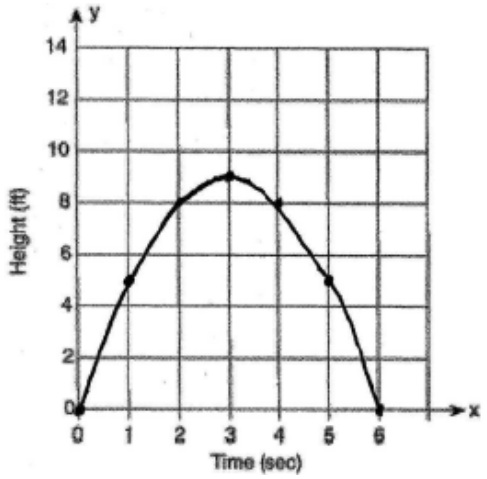
10.



Roots are –4 and 2.

11.

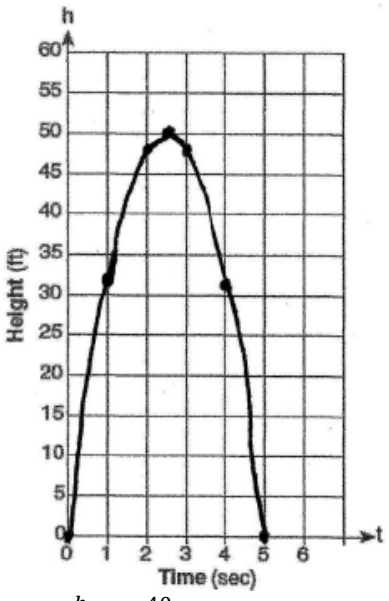
a)



$x = \frac{-b}{2a} = \frac{-6}{-2} = 3$ seconds

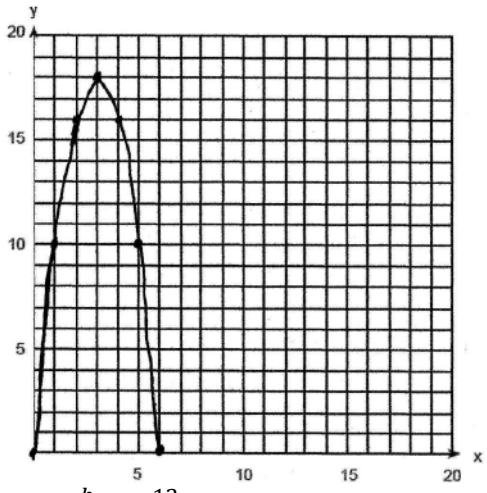
12.

a)



$t = \frac{-b}{2a} = \frac{-40}{-16} = 2.5$ seconds

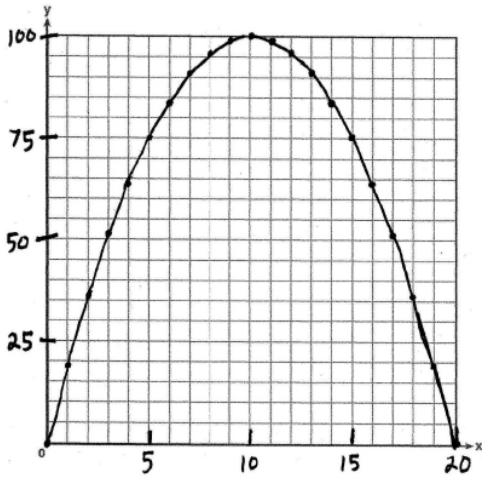
13. a)



b) $x = \frac{-b}{2a} = \frac{-12}{-4} = 3$

$y = -2(3)^2 + 12(3) = 18$ feet

14. a)



b) $x = \frac{-b}{2a} = \frac{-20}{-2} = 10$

$y = -(10)^2 + 20(10) = 100$ feet

13.5 Vertex Form

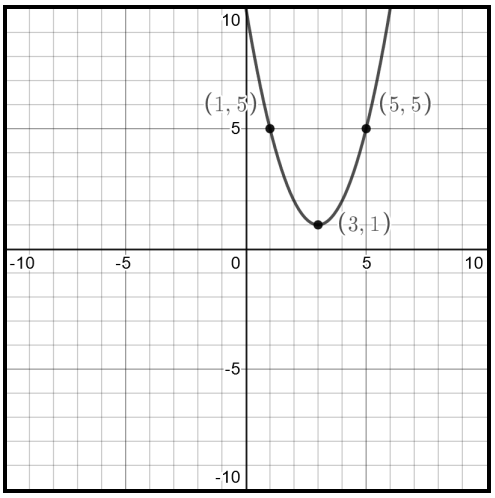
1. $\left(\frac{b}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = 9$

$y = x^2 + 6x + 10$
$y - 10 = x^2 + 6x$
$y - 10 + 9 = x^2 + 6x + 9$
$y - 1 = (x + 3)^2$
$y = (x + 3)^2 + 1$
vertex: $(-3,1)$

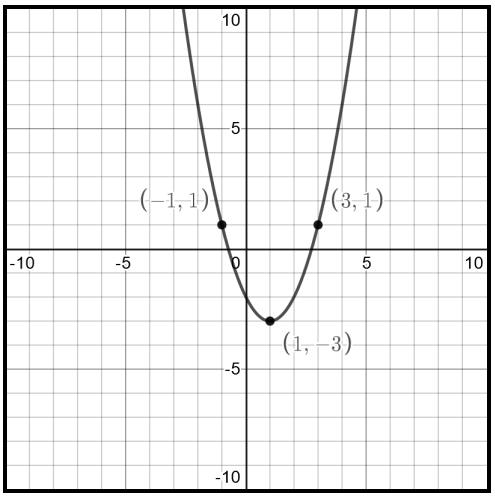
2. $\left(\frac{b}{2}\right)^2 = \left(\frac{10}{2}\right)^2 = 25$

$y = x^2 + 10x + 21$
$y - 21 = x^2 + 10x$
$y - 21 + 25 = x^2 + 10x + 25$
$y + 4 = (x + 5)^2$
$y = (x + 5)^2 - 4$
vertex: $(-5, -4)$

3.



4.

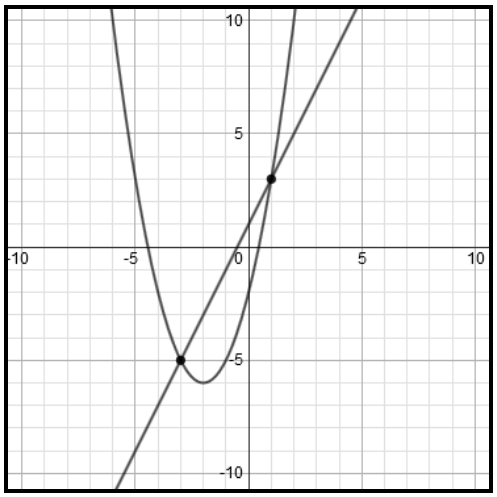
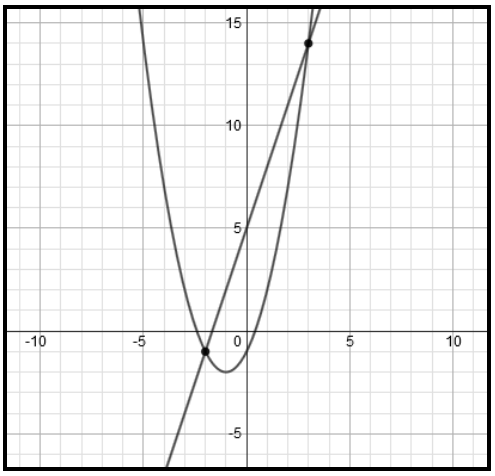
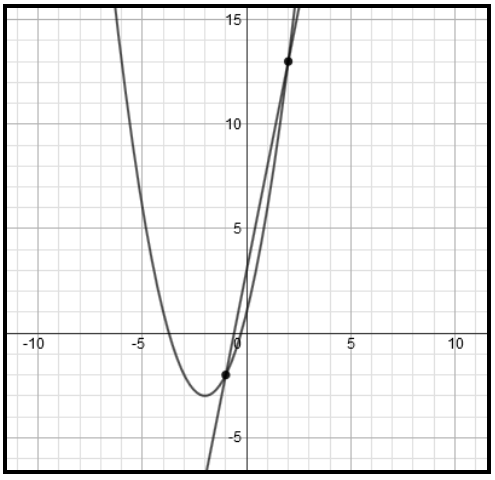
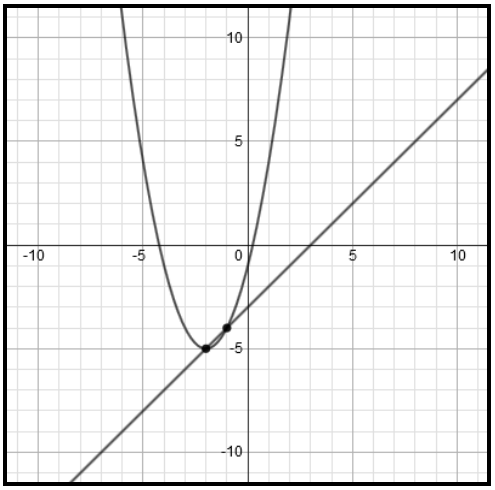


Chapter 14 Quadratic-Linear Systems

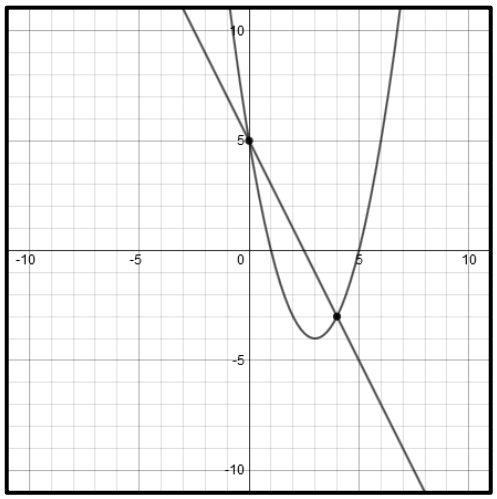
14.1 Solve Quadratic-Linear Systems Algebraically

1. $x^2 - 5 = -4x$ $x^2 + 4x - 5 = 0$ $(x + 5)(x - 1) = 0$ $x = \{-5,1\}$ When $x = -5$, $y = -4(-5) = 20$ When $x = 1$, $y = -4(1) = -4$ Solutions: $(-5,20)$ and $(1,-4)$	2. $x^2 + 4x + 1 = 5x + 3$ $x^2 - x - 2 = 0$ $(x + 1)(x - 2) = 0$ $x = \{-1,2\}$ When $x = -1$, $y = 5(-1) + 3 = -2$ When $x = 2$. $y = 5(2) + 3 = 13$ Solutions are $(-1,-2)$ and $(2,13)$
3. $x^2 + 2x - 1 = 3x + 5$ $x^2 - x - 6 = 0$ $(x + 2)(x - 3) = 0$ $x = \{-2,3\}$ When $x = -2$, $y = 3(-2) + 5 = -1$ When $x = 3$, $y = 3(3) + 5 = 14$ Solutions: $(-2,-1)$ and $(3,14)$	4. $x^2 + 4x - 2 = 2x + 1$ $x^2 + 2x - 3 = 0$ $(x + 3)(x - 1) = 0$ $x = \{-3,1\}$ When $x = -3$, $y = 2(-3) + 1 = -5$ When $x = 1$, $y = 2(1) + 1 = 3$ Solutions: $(-3,-5)$ and $(1,3)$
5. $y + 3x = 1 \rightarrow y = -3x + 1$ $x^2 + 7x + 22 = -3x + 1$ $x^2 + 10x + 21 = 0$ $(x + 7)(x + 3) = 0$ $x = \{-7,-3\}$ When $x = -7$, $y = -3(-7) + 1 = 22$ When $x = -3$, $y = -3(-3) + 1 = 10$ Solutions: $(-7,22)$ and $(-3,10)$	6. $y + 3x = 6 \rightarrow y = -3x + 6$ $x^2 = y + 2x + 6 \rightarrow y = x^2 - 2x - 6$ $x^2 - 2x - 6 = -3x + 6$ $x^2 + x - 12 = 0$ $(x + 4)(x - 3) = 0$ $x = \{-4,3\}$ When $x = -4$, $y = -3(-4) + 6 = 18$ When $x = 3$, $y = -3(3) + 6 = -3$ Solutions: $(-4,18)$ and $(3,-3)$
7. $x^2 + 2x - 8 = 2x + 1$ $x^2 = 9$ $x = \pm 3$ $y = 2(-3) + 1 = -5$ $y = 2(3) + 1 = 7$ $(-3,-5)$ and $(3,7)$	8. $x^2 - 6x + 9 = -9x + 19$ $x^2 + 3x - 10 = 0$ $(x + 5)(x - 2) = 0$ $\{-5,2\}$ $y = -9(-5) + 19 = 64$ $y = -9(2) + 19 = 1$ $(-5,64)$ and $(2,1)$
9. $x^2 + 5x - 17 = x - 5$ $x^2 + 4x - 12 = 0$ $(x + 6)(x - 2) = 0$ $\{-6,2\}$ $y = (-6) - 5 = -11$ $y = (2) - 5 = -3$ $(-6,-11)$ and $(2,-3)$	10. $x^2 - x - 6 = 3x - 6$ $x^2 - 4x = 0$ $x(x - 4) = 0$ $\{0,4\}$ $y = 3(0) - 6 = -6$ $y = 3(4) - 6 = 6$ $(0,-6)$ and $(4,6)$

14.2 Solve Quadratic-Linear Systems Graphically

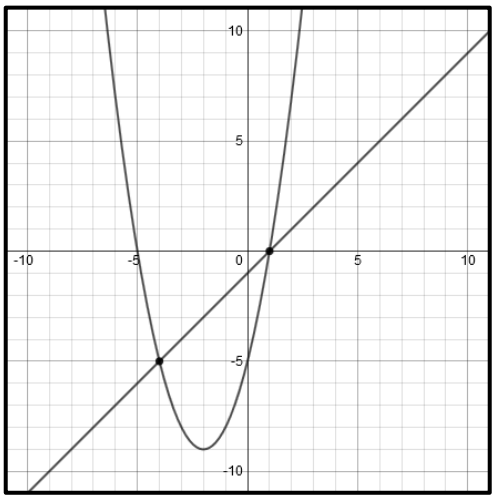
1. (2) $(-3, 5)$	2. (1) $(8, 9)$
3.  Solutions: (1,3) and $(-3, -5)$	4.  Solutions: (3,14) and $(-2, -1)$
5.  Solutions: (2,13) and $(-1, -2)$	6.  Solutions: $(-1, -4)$ and $(-2, -5)$

7.



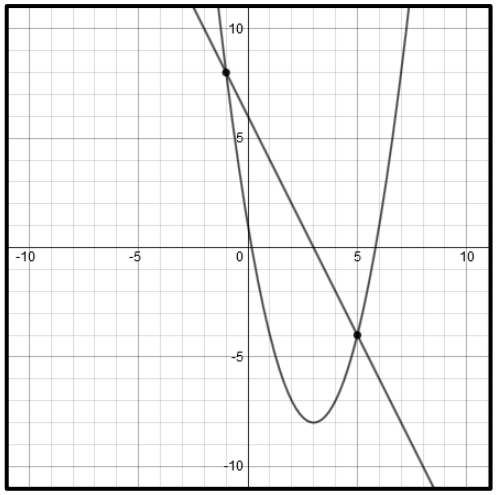
Solutions: $(0,5)$ and $(4,-3)$

8.



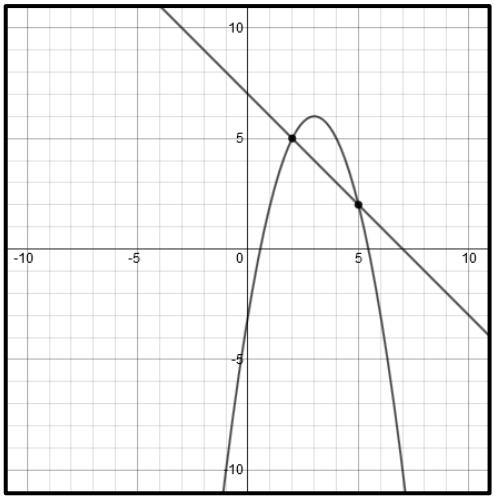
Solutions: $(-4,-5)$ and $(1,0)$

9.



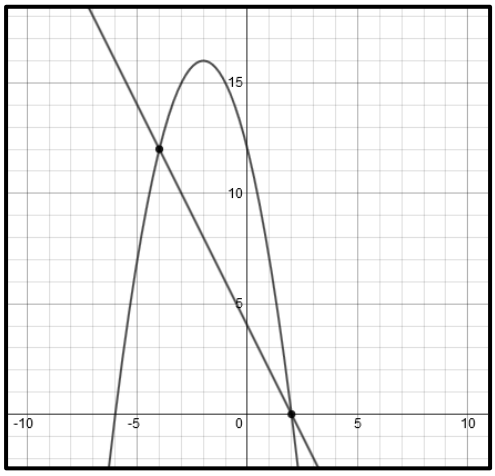
Solutions: $(-1,8)$ and $(5,-4)$

10.



Solutions: $(2,5)$ and $(5,2)$

11.



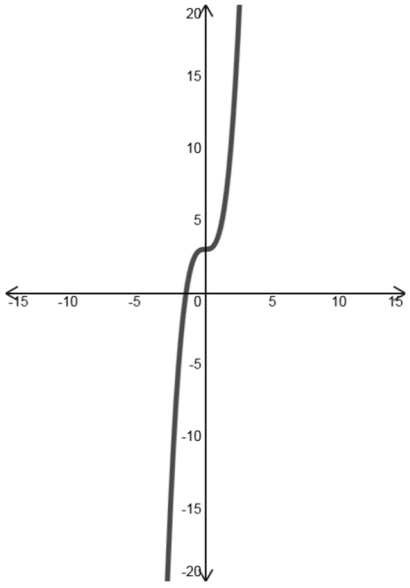
Solutions: $(-4,12)$ and $(2,0)$

Chapter 15 Cubic and Radical Functions

15.1 Cubic Functions

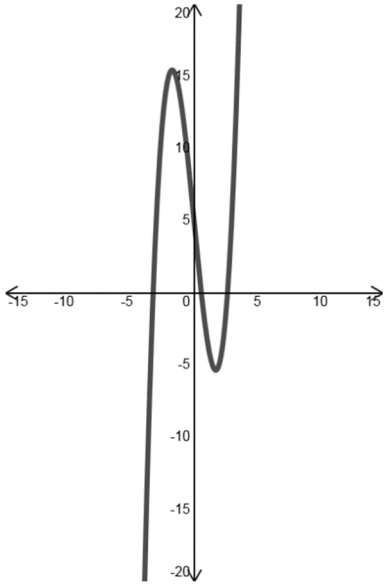
1. The function has one real root.

x	y
-2	-5
-1	2
0	3
1	4
2	11



2. The function has three real roots.

x	y
-3	5
-2	15
-1	13
0	5
1	-3
2	-5
3	5



15.2 Square Root Functions

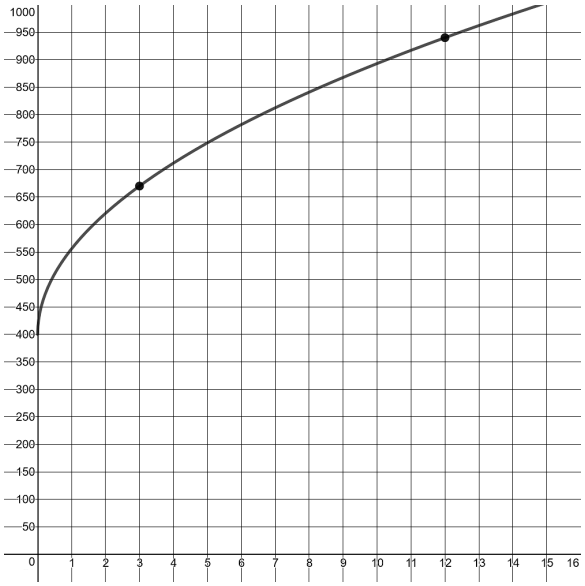
1. (2)

2.

a)

x	y
0	400
3	670
6	781.8
9	867.7
12	940
15	1003.7

b)



c) 670

d) 12

Chapter 16 Transformations of Functions

16.1 Translations

1. (4)	2. (2)
3. (3)	4. $y = \|x\| - 1$
5. $y = \|x + 4\|$	

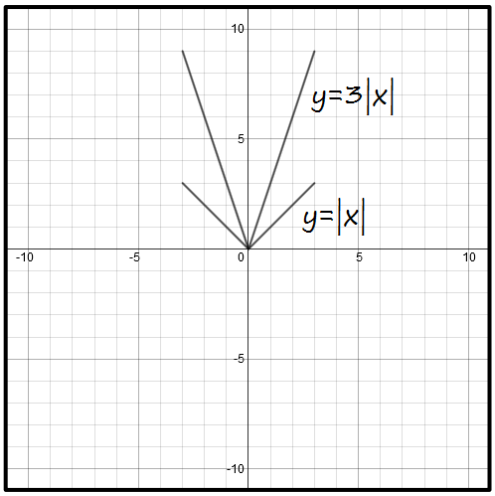
16.2 Reflections

1. (1)	2. (4)
3. (1)	4. $y = -(x - 1)^2$
5. $y = \sqrt{-x + 3}$	6. $y = (-x - 1)^3 - 2$

16.3 Stretches

1. (4)	2. (3)
3. (2)	4. $y = \frac{1}{2}x^2$; wider

5.

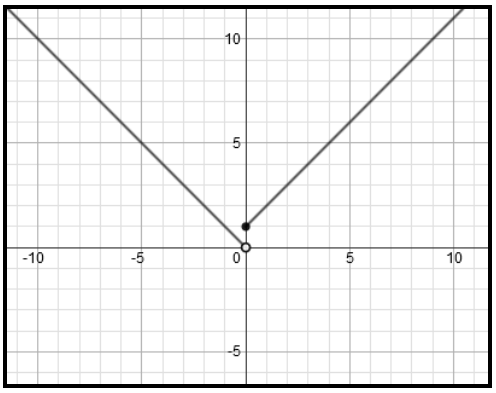


becomes narrower (vertically stretches)

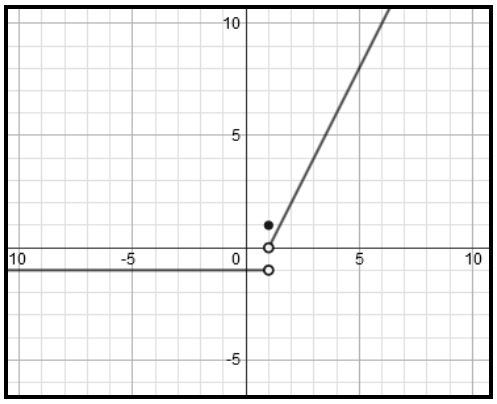
Chapter 17 Discontinuous Functions

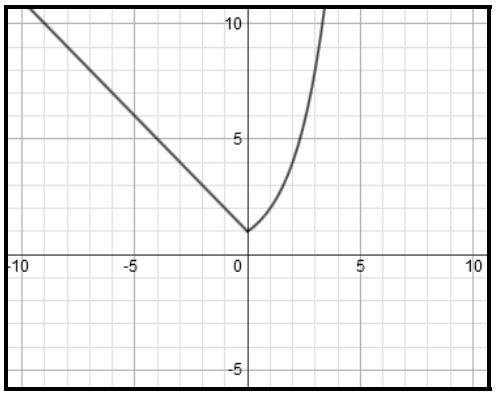
17.1 Piecewise Functions

1. $f(-3) = 3, f(0) = 1, f(2) = 3$

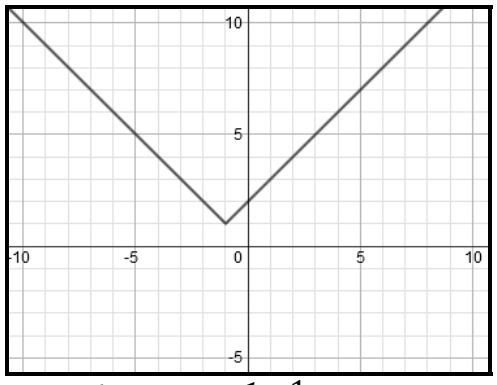
2. 

Not a continuous function.

3. 

4. 

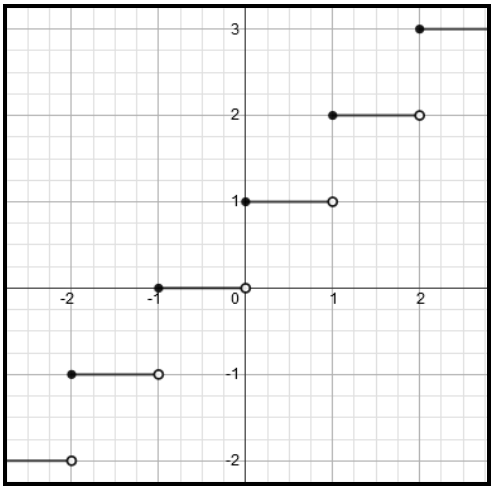
This is a continuous function.

5. 

$$f(x) = \begin{cases} -x & x \leq -1 \\ x + 2 & x > -1 \end{cases}$$

6. $$c(t) = \begin{cases} 4t & 0 < t \leq 2 \\ 2(t-2) + 8 & 2 < t \leq 6 \\ 16 & 6 < t \leq 8 \end{cases}$$

17.2 Step Functions

1. $f(6.25) = 3\lceil 6.25 \rceil + 5 = 3(7) + 5 = 26$	2. 

Chapter 18 Univariate Data

18.1 Types of Data

1. (3)

2. a) quantitative
   b) qualitative
   c) qualitative
   d) quantitative

3. (4)

3. bivariate: the two variables represent the sales quarter (Q1, Q2, Q3, or Q4) and the region (East, West, North, and South); the data values are the sales figures.

18.2 Frequency Tables

1.

Result (x)	**Frequency** (f)	**Relative Frequency** (rf)
1	5	0.25
2	3	0.15
3	1	0.05
4	5	0.25
5	4	0.20
6	2	0.10

2.

Result (x)	**Frequency** (f)	**Cumulative Frequency** (cf)
1	5	5
2	3	8
3	1	9
4	5	14
5	4	18
6	2	20

3.

Bases (x)	**Frequency** (f)	**Relative Frequency** (rf)	**Cumulative Frequency** (cf)
1	25,006	0.633	25,006
2	7,863	0.199	32,869
3	671	0.017	33,540
4	5,944	0.151	39,484

4. $\sum f = 973$

Category	Nobel Prizes	Relative Frequency
Physics	219	0.23
Chemistry	186	0.19
Medicine	224	0.23
Literature	118	0.12
Peace	137	0.14
Economics	89	0.09

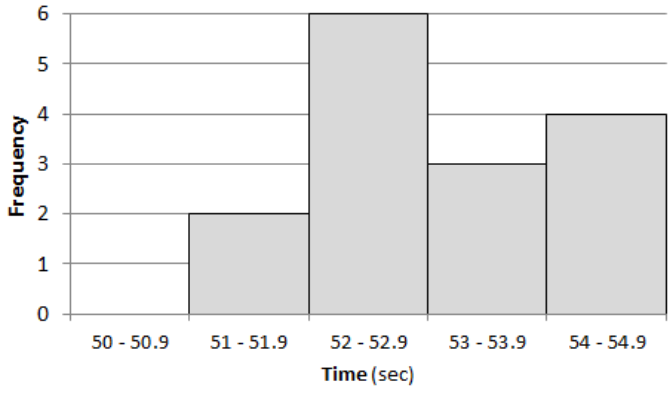
5. 25 – 18 = 7

6.

Test Score	Frequency
41 – 55	8
56 – 70	12
71 – 85	26
86 – 100	14

Test Score	Cumulative Frequency
41 – 55	8
41 – 70	20
41 – 85	46
41 – 100	60

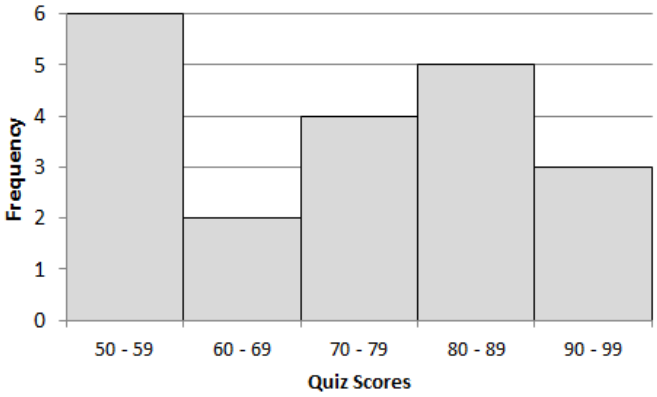
18.3 Histograms

1. Add the frequencies: 2 + 4 + 5 + 4 + 1 = 16
2. Add the frequencies: 7 + 10 + 3 + 5 = 25
3. 20 (the height of the last bar)
4. 3; 0; 20
5. 

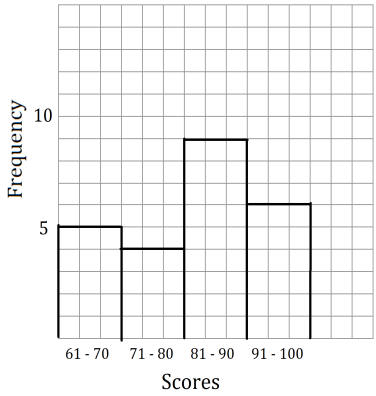
6.

Mathematics Quiz Scores

Interval	Tally	Frequency
50–59	𝍸 I	6
60–69	II	2
70–79	IIII	4
80–89	𝍸	5
90–99	III	3

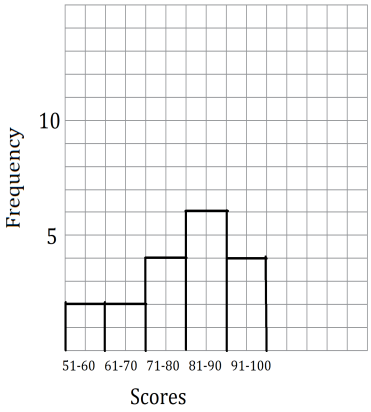


7.



8.

Interval	Tally	Frequency
51–60	II	2
61–70	II	2
71–80	IIII	4
81–90	𝍸 I	6
91–100	IIII	4



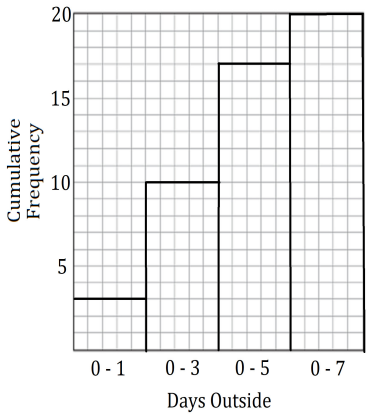
9.

Number of Days Outside

Interval	Tally	Frequency
0–1	𝍸	3
2–3	𝍸 ||	7
4–5	𝍸 ||	7
6–7	|||	3

Number of Days Outside

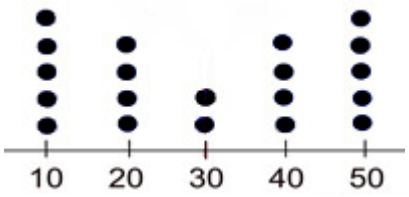
Interval	Cumulative Frequency
0–1	3
0–3	10
0–5	17
0–7	20



18.4 Central Tendency

1. mode	2. median
3. (1)	4. They are all divided by two as well.
5. The mean increased by five and the range remained the same.	6. mean ≈ 11.4, median = 12, mode = 7, they all increase by 5
7. City A (22)	8. mean = 79, median = 79, mode = 78
9. (2) mode = median = 6	10. (1) mean = 17, median = 18, mode = 22
11. (3) mean ≈ 85.6, median = 88, mode = 92	12. an outlier such as a very low score could greatly affect the range without affecting the median
13. mean = 22, median = 20, mode = 20	14. 131 – 150. There are 44 total scores, so the median would be the average of the 22nd and 23rd highest scores.
15. mean = 225000, median = 175000, the median because the mean is higher than all but one of the values (an outlier)	16. 71-80. Out of 31 students, the 16th lowest value is the median, which is within the 41-80 interval, or 71-80 interval on the related frequency table

18.5 Distribution

1. $\frac{18}{40} = 45\%$	2. mean $= 5.625$ median $= 5$ mode $= 10$
3. skewed to the right	4. skewed to the left
5. symmetrical, but with outliers at 9.45	6. below is just one possible example: 

18.6 Standard Deviation

1. The population is all the bolts in the shipment. The sample is the 100 selected bolts.	2. The population is all the mall shoppers. The sample is every sixth person within the 3-hour period.
3. (2)	4. (1)
5. The first set, as shown by the smaller SD.	6. McCrane; a larger SD means more variability
5. mean = 66, SD ≈ 30.4	6. mean ≈ 60.7, SD ≈ 15.1
7. SD ≈ 16.8	8. SD ≈ 0.88
7. mean = 9.46; standard deviation = 3.85	8. mean $= \frac{440}{10} = 44$ $(51-44)^2 = 49, (48-44)^2 = 16$, etc. $\frac{49+16+9+4+1+1+9+16+16+25}{10-1} = \frac{146}{9} = 16.\overline{2}$ SD $= \sqrt{16.\overline{2}} \approx 4.0$
9. mean = \$610, SD ≈ 14.7	10. SD ≈ 8.1

18.7 Percentiles and Quartiles

1. 25% of 40 = 10 students

2. $\frac{95{,}000}{125{,}000} = 76\%$, so the 76th percentile.

3. $\frac{22}{30} = 73\frac{1}{3}\%$, so the 73rd percentile.

4. $p = \frac{b}{n} = \frac{5}{10} = 0.5$, so 70 is the 50th percentile.

5. second quartile = median = $\frac{35+45}{2} = 40$

6. 5, 6, (7), 8, 12, (14), 17, 17, (18), 19, 19

   $Q_1 = 7$, $Q_2 = 14$, $Q_3 = 18$

7. 3, 6, 7, | 7, 8, 9, | 9, 9, 10, | 12, 13, 15

   $Q_1 = 7$, $Q_2 = 9$, $Q_3 = 11$

8. 21, 28, | 28, 32, (33), 41, 45, | 50, 53

   $Q_1 = 28$, $Q_2 = 33$, $Q_3 = 47.5$, IQR = 19.5

9. 71, 71, (72), 74, 74, | 75, 78, (79), 79, 83

   $Q_3 = 79$ and $Q_1 = 72$, so IQR = 7

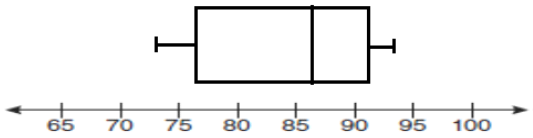
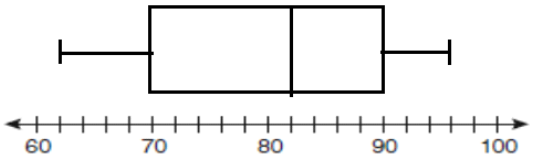
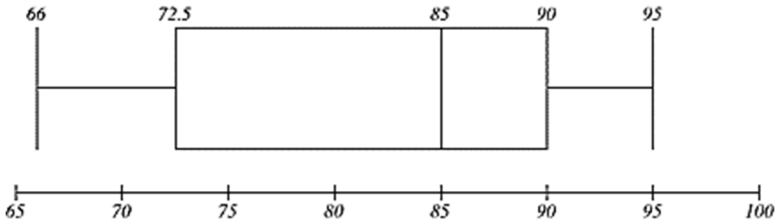
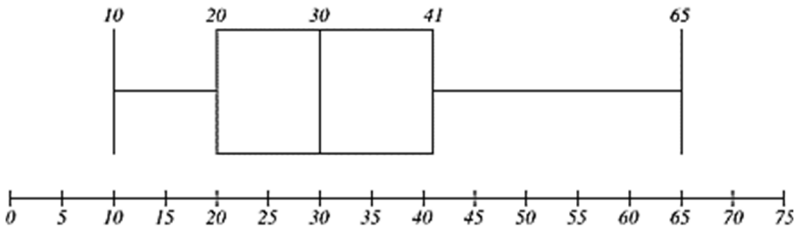
10. $Q_1 = 70$, $Q_2 = 80$, $Q_3 = 90$

11. The corresponding frequency table would show:

Minutes Used	Frequency
31–40	2
41–50	3
51–60	5
61–70	9
71–80	11

    25% of 30 is 7.5, so the first quartile would be between the 7th and 8th smallest values out of 30. This falls within the 51–60 interval.

18.8 Box Plots

1. 81	2. 75
3. 10	4. 84
5. 30	6. 4
7. 75 – 15 = 60	8. 25%
9. (4) 75–88	
10. (a) = (2) right skewed; (b) = (3) no skew; (c) = (1) left skewed	
11. $Q_1 = 77$, $Q_2 = 87$, $Q_3 = 91$ 	12. $Q_1 = 70$, $Q_2 = 82$, $Q_3 = 90$ 
13. 	
14. 	

Chapter 19 Bivariate Data

19.1 Two-Way Frequency Tables

1.

$\frac{15}{113} \approx 13.3\%$ of the students are undecided.

$\frac{31}{60} \approx 51.7\%$ of the 9th graders are watching.

3. Given data in bold below.

	Coca-Cola	Sprite	Total
Table	16	**14**	30
Garbage	34	8	**42**
Total	**50**	22	**72**

2.

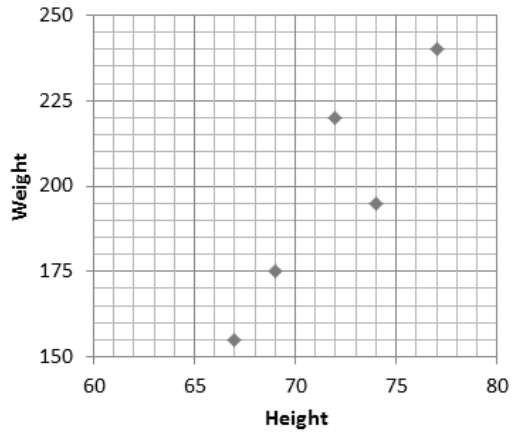
	Fiction	Nonfiction	Total
Hardcover	28	52	80
Paperback	94	36	130
Total	122	88	210

	Fiction	Nonfiction	Total
Hardcover	13.3%	24.8%	38.1%
Paperback	44.8%	17.1%	61.9%
Total	58.1%	41.9%	100%

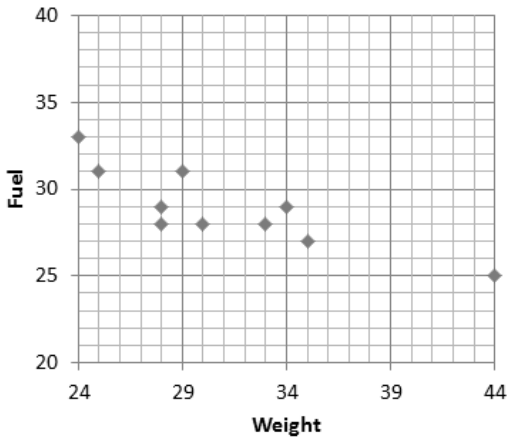
19.2 Scatter Plots

1. (2)

2.



3.



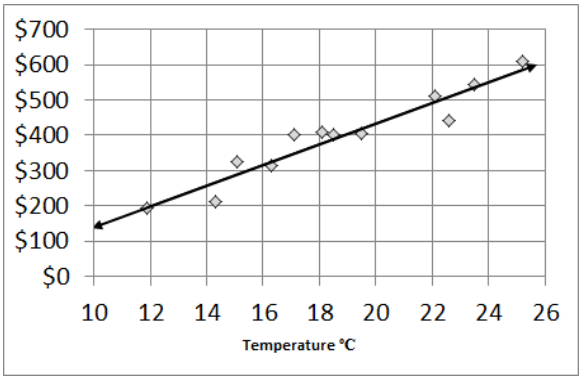
19.3 Correlation and Causality

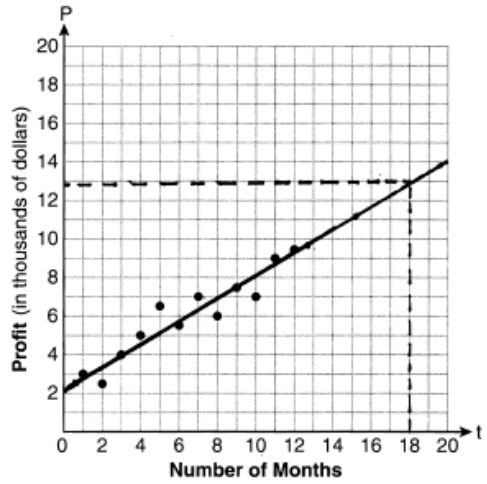
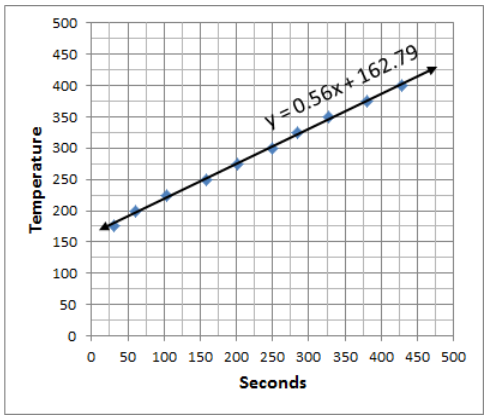
1. (3)	2. (2)
3. a) positive: children usually gain weight as they age and grow b) negative: as the volume of water increases, the remaining space decreases c) none: shoe size and hair length are unrelated d) positive: more people go to the beach when the temperature is higher	4. a) positive, causal b) positive, not causal; hot temperatures lead to higher sales and more fires c) negative, causal d) positive, not causal; the size and severity of the fire, which results in more firefighters being called e) negative, not causal; the degree of civilization and industrialization f) negative, not causal; higher temperatures may lead to less demand for snow shovels and may also lead to more ocean swimmers, resulting in more opportunity for shark attacks

19.4 Identify Correlation in Scatter Plots

1. (1)	
2. positive correlation	3. negative correlation
4. negative correlation	5. positive correlation
6. no correlation	7. positive correlation

19.5 Lines of Fit

1. Line A. Most of the points are closer to Line A than to Line B.	2. a) 80 wpm b) 9 wpm
3. 	
4. $y = 5x + 25$	5. $y = 0.2x + 7.5$

6. $y = 2x + 5.14$	7. (3) $y = 1{,}000x + 15{,}000$
8. The prediction for the 35-year-old is more likely to be accurate, since it is an interpolation rather than an extrapolation.	
9. (4) $y = \frac{3}{2}x + 1$	10. (2) 72
11. (3) 480	12. (3) \$42,500
13.  No, the line crosses near (18,13)	14.  $y = 0.56x + 162.79$
15. $y = -0.112x + 23.448$; -5°C	16. $y = -35.5x + 457.5$; 103

19.6 Correlation Coefficients

1. (1) 0.89	2. (4) 0.90
3. (2) There is a positive slope.	4. (3) There is a negative slope.
5. (4)	6. (2) -0.24 It is a weak correlation.
7. a. 0.90 b. –0.40 c. 0.99 d. –0.85 e. 0.50 f. 0	8. $r = 1$
9. $r \approx 0.371$	10. $r \approx -0.860$
11. $r \approx 0.986$	12. $r \approx -0.999$