ANSWER KEY

Algebra I

NEXT GENERATION

Course Workbook

with Regents Questions

2024-25

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Regents Exam Notation

A code next to each Regents Question answer number indicates from which Common Core (CC) or Next Generation (NG) Regents exam or sampler the question came. For example, CC AUG '18 [25] means the question appeared on the August 2018 exam as question 25.

Practice Problems

Chapter 1 Equations and Inequalities

1.1 Properties of Real Numbers

1. (1)	2. (3)
3. $-\frac{2}{3}$	4. $\frac{3}{2}$
5. $-(a-b)$, or $-a+b$	6. $-ab$
7. (3)	8. (1)
9. associative property of multiplication	10. distributive property
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. $5(x - 2) = 2(10 + x)$ $5x - 10 = 20 + 2x$ $3x - 10 = 20$ $3x = 30$ $x = 10$

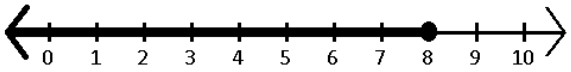
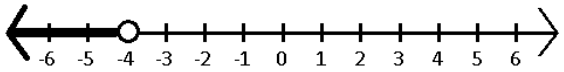
21. $2(x-4)=4(2x+1)$ $2x-8=8x+4$ $-8=6x+4$ $-12=6x$ $-2=x$	22. $3(x+1)-5x=12-(6x-7)$ $3x+3-5x=12-6x+7$ $3-2x=19-6x$ $3+4x=19$ $4x=16$ $x=4$
23. $-4(y-3)=5(2y-6)$ $-4y+12=10y-30$ $12=14y-30$ $42=14y$ $3=y$	24. $3(x-2)-2(x+1)=5(x-4)$ $3x-6-2x-2=5x-20$ $x-8=5x-20$ $-8=4x-20$ $12=4x$ $3=x$

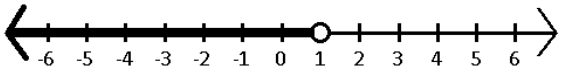
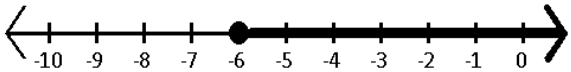
1.3 Solve Equations with Fractions

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. $\frac{ey}{n} + k \geq t$ $\frac{ey}{n} \geq t - k$ $ey \geq n(t - k)$ $ey \geq nt - nk$ *distribute* $y \leq \frac{nt - nk}{e}$ *reverse the symbol*
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. $0.10(3n) + 0.25(n + 4) + 0.05n = 4.60$ $0.3n + 0.25n + 1 + 0.05n = 4.60$ $0.6n + 1 = 4.60$ $0.6n = 3.60$ $n = 6 \quad 3(6) = 18 \quad 6 + 4 = 10$ 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. $6.50s + 9.00(150 - s) = 1180.00$ $6.5s + 1350 - 9s = 1180$ $-2.5s + 1350 = 1180$ $-2.5s = -170$ $s = 68 \quad 150 - 68 = 82$ 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. $0.75(200) + 1.25x \geq 250$	

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

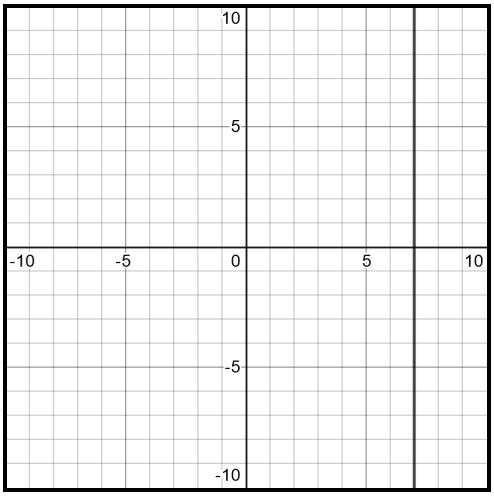
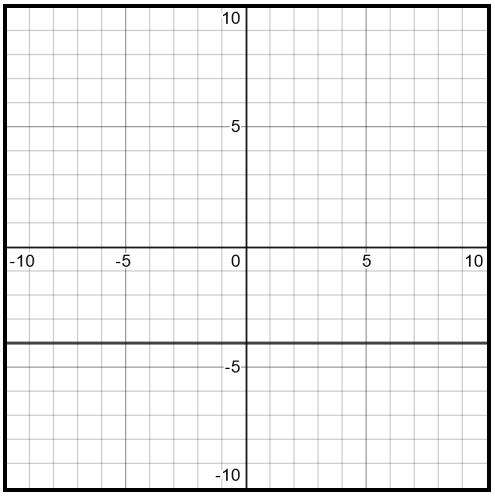
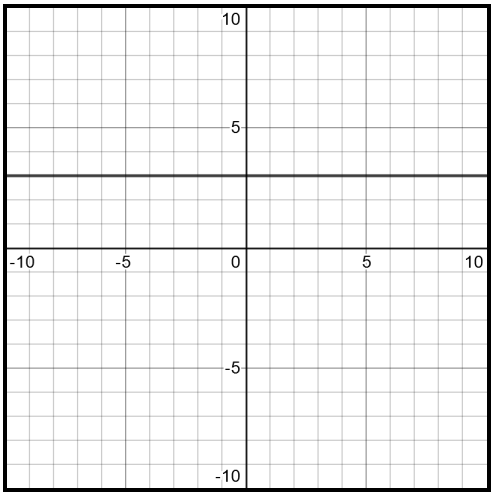
1. $20\ \cancel{in} \times \frac{2.54\ cm}{1\ \cancel{in}} = 50.8 \approx 51$ cm	2. $8900\ \cancel{ft} \times \frac{1\ mi}{5280\ \cancel{ft}} \approx 1.7$ mi
3. $1680\ \cancel{oz} \times \frac{1\ \cancel{lb}}{16\ \cancel{oz}} \times \frac{1\ bag}{5\ \cancel{lbs}} = 21$ bags	4. $0.75\ \cancel{tsp} \times \frac{1\ tbsp}{3\ \cancel{tsp}} \times 5 = 1.25$ 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. $\frac{\$1.50}{2\ \cancel{g}} \times \frac{3.79\ \cancel{l}}{1\ g} = \frac{\$1.50 \times 3.79}{2\ g} \approx \$2.84/g$ 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. $\frac{100\ \cancel{yds}}{11\ \cancel{s}} \times \frac{3\ \cancel{ft}}{1\ \cancel{yd}} \times \frac{1\ mi}{5280\ \cancel{ft}} \times \frac{60\ \cancel{s}}{1\ \cancel{min}} \times \frac{60\ \cancel{min}}{1\ hr} = \frac{100 \times 3 \times 60 \times 60\ mi}{11 \times 5280\ hr} \approx 18.6\ mph$	

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. $m = -\frac{2}{6} = -\frac{1}{3}$

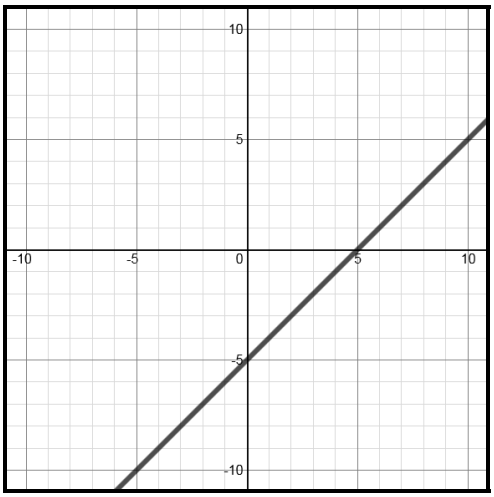
3. $m = \frac{4}{3}$	4. $m = -\frac{2}{3}$
5. $m = -\frac{3}{3} = -1$	6. $m = \frac{5}{5} = 1$
7. $m = \frac{13-3}{5-1} = \frac{10}{4} = \frac{5}{2}$	8. $m = \frac{8-(-6)}{1-3} = \frac{14}{-2} = -7$
9. $m = \frac{-3-5}{0-4} = \frac{-8}{-4} = 2$	10. $m = \frac{-2-(-2)}{2-(-4)} = \frac{0}{6} = 0$
11. $m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

3.5 Find Slope Given an Equation

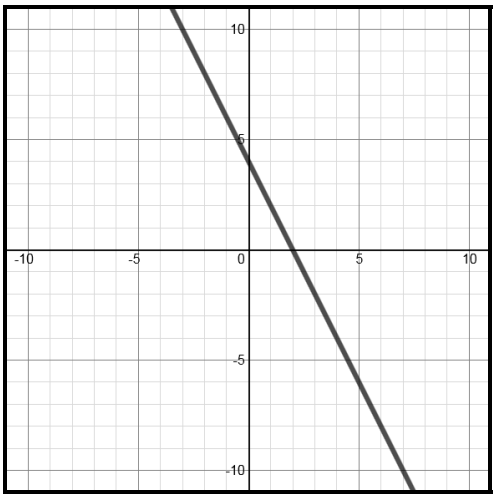
1. Slope is $\frac{2}{5}$	2. $y - 3x = 1$ $y = 3x + 1$ Slope is 3
3. $2y = 5x + 4$ $y = \frac{5}{2}x + 2$ Slope is $\frac{5}{2}$	4. $5y - 10x = -15$ $5y = 10x - 15$ $y = 2x - 3$ Slope is 2
5. $4x + 3y = 12$ $3y = -4x + 12$ $y = -\frac{4}{3}x + 4$ Slope is $-\frac{4}{3}$	6. $2y = x - 4$ $y = \frac{1}{2}x - 2$ 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: $4x + 6y = 5$ $\quad -3y = 2x + 5$ $6y = -4x + 5$ $\quad y = -\frac{2}{3}x - \frac{5}{3}$ $y = -\frac{2}{3}x + \frac{5}{6}$

3.6 Graph Linear Equations

1.

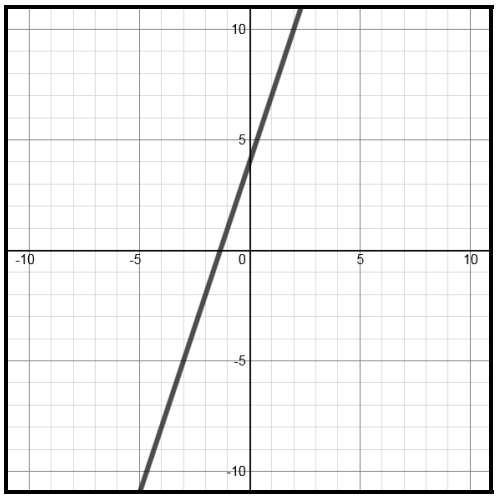


2.



3. $y - 3x = 4$

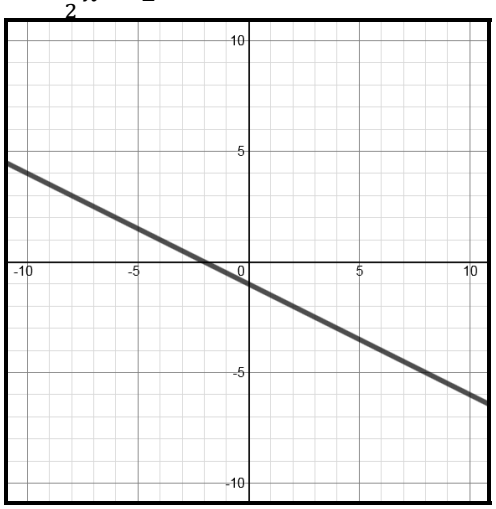
$y = 3x + 4$



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. $y = mx + b$ $-7 = -\frac{4}{3}(3) + b$ $-7 = -4 + b$ $-3 = b$ $\quad y = -\frac{4}{3}x - 3$

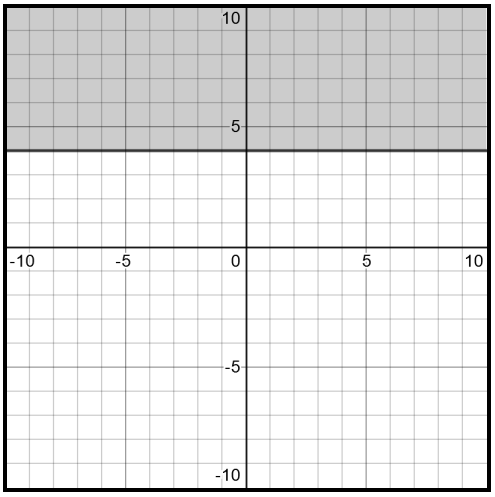
3.8 Write an Equation Given Two Points

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) $y - 4 = \frac{2}{5}(x - 5)$

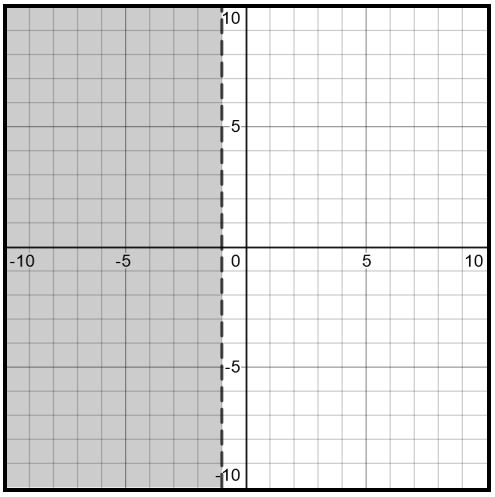
3.9 Graph Inequalities

1. (1)	2. (2)
3. (3) $\quad 2y + 6 > 4x$ $2y > 4x - 6$ $y > 2x - 3$	
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.



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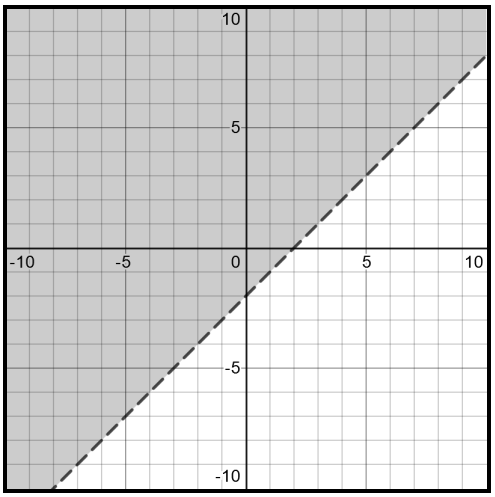

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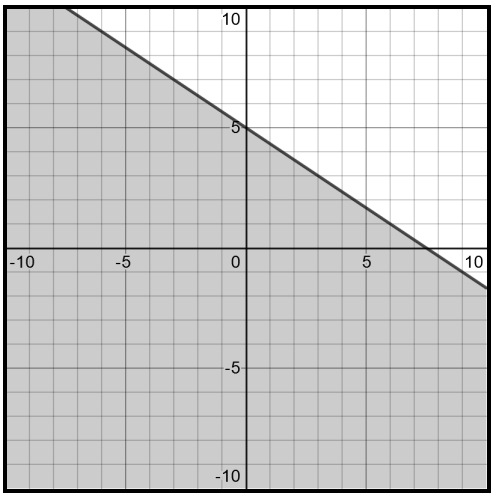
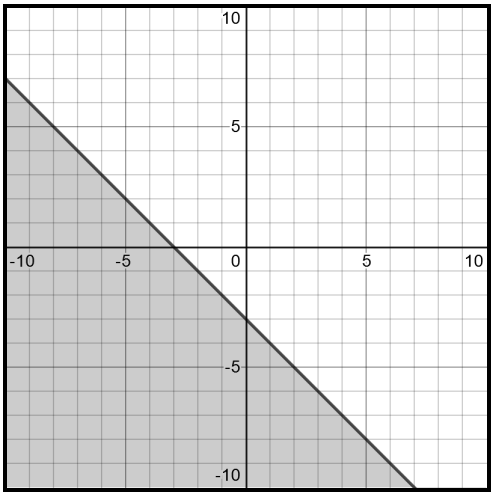
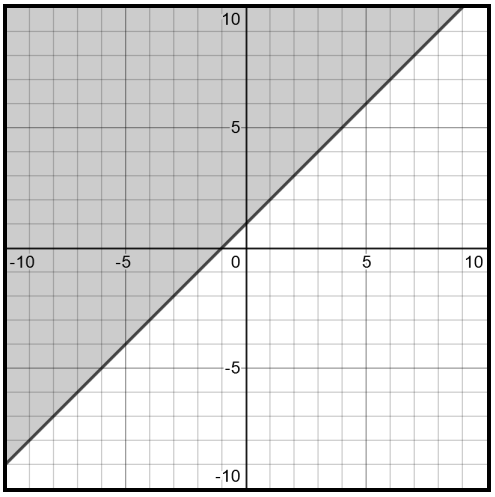


12. $x + y \leq -3$
$y \leq -x - 3$



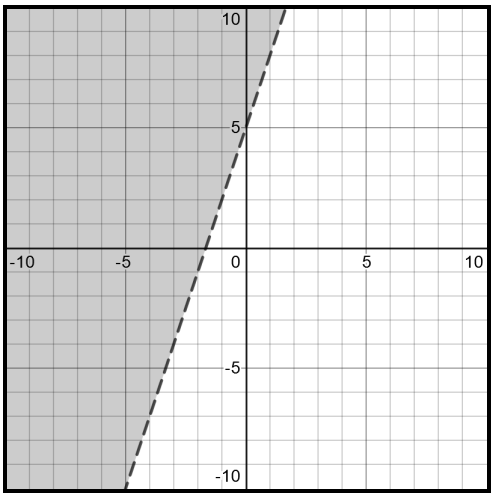
13. $x - y \leq -1$
$-y \leq -x - 1$
$y \geq x + 1$



14. $2y - 6x > 10$

$2y > 6x + 10$

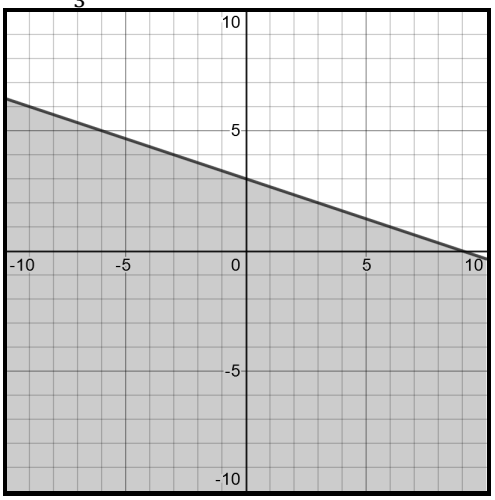
$y > 3x + 5$



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. $3x + 2y = 4$
$-2x + 2y = 24 \quad \times(-1)$
$3x + 2y = 4$
$2x - 2y = -24$
$5x = -20$
$x = -4$
$3(-4) + 2y = 4$
$-12 + 2y = 4$
$2y = 16$
$y = 8$

8. $2x + 3y = 6$
$2x + y = -2 \quad \times(-1)$
$2x + 3y = 6$
$-2x - y = 2$
$2y = 8$
$y = 4$

9. $-3x + 4y = 11 \quad \times 2$
$6x - 5y = -16$
$-6x + 8y = 22$
$6x - 5y = -16$
$3y = 6$
$y = 2$
$-3x + 4(2) = 11$
$-3x + 8 = 11$
$-3x = 3$
$x = -1$

10. $2x + 3y = 7$
$x + y = 3 \quad \times(-3)$
$2x + 3y = 7$
$-3x - 3y = -9$
$-x = -2$
$x = 2$
$2(2) + 3y = 7$
$4 + 3y = 7$
$3y = 3$
$y = 1$

11. $2x + y = 8 \quad \times 3$
$x - 3y = -3$
$6x + 3y = 24$
$x - 3y = -3$
$7x = 21$
$x = 3$
$2(3) + y = 8$
$6 + y = 8$
$y = 2$

12. $x + 2y = 9$
$x - y = 3 \quad \times 2$
$x + 2y = 9$
$2x - 2y = 6$
$3x = 15$
$x = 5$
$(5) - y = 3$
$-y = -2$
$y = 2$

13. $3x + 2y = 4 \quad \times 3 \qquad 9x + 6y = 12$
$4x + 3y = 7 \quad \times (-2) \qquad -8x - 6y = -14$
$x = -2$
$3(-2) + 2y = 4$
$-6 + 2y = 4$
$2y = 10$
$y = 5$

14. $3x + 4y = 9 \quad \times 3 \qquad 9x + 12y = 27$
$5x + 6y = 21 \times (-2) \qquad -10x - 12y = -42$
$-x = -15$
$x = 15$
$3(15) + 4y = 9$
$45 + 4y = 9$
$4y = -36$
$y = -9$

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. $2\left(\frac{1}{2}b - 6\right) + 3b = 12$
$b - 12 + 3b = 12$
$4b = 24$
$b = 6$
$a = \frac{1}{2}(6) - 6$
$a = -3$

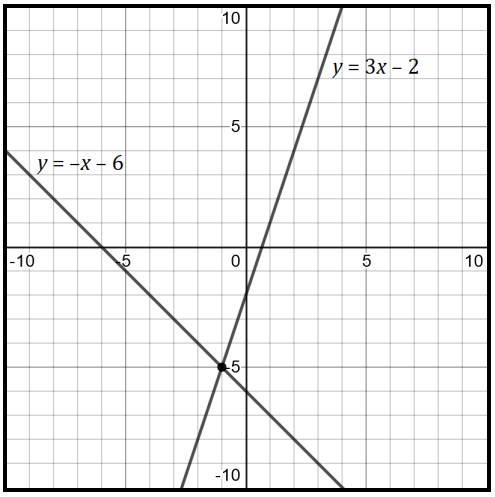
20. $(4d - 6) + 3d = 8$
$7d - 6 = 8$
$7d = 14$
$d = 2$
$c = 4(2) - 6$
$c = 2$

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.

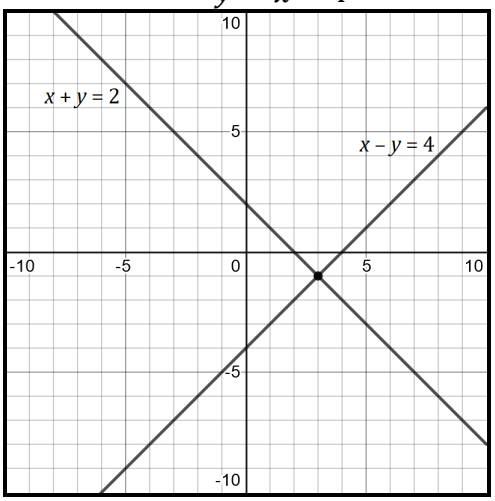


Solution: $(-1,-5)$

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

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

$y=x-4$

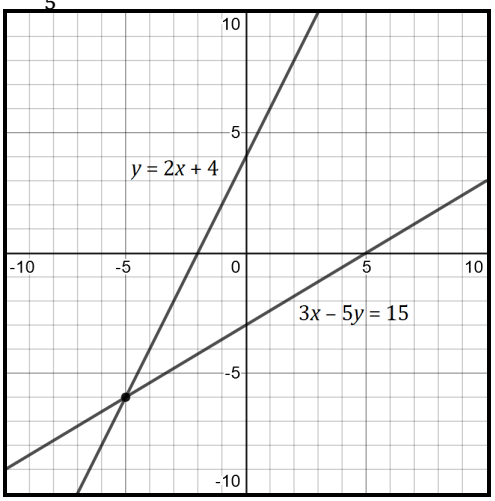


Solution: $(3,-1)$

6. $3x-5y=15$

$-5y=-3x+15$

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

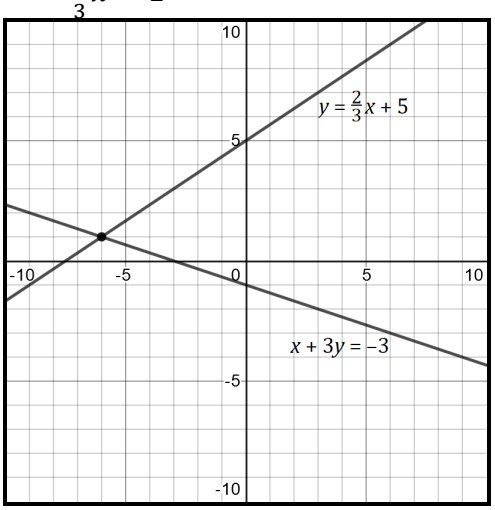


Solution: $(-5,-6)$

7. $x+3y=-3$

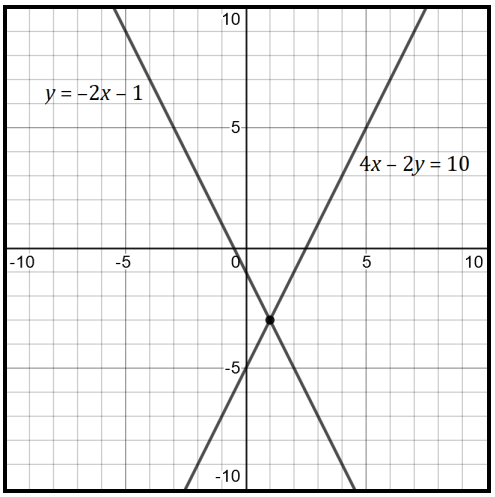
$3y=-x-3$

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



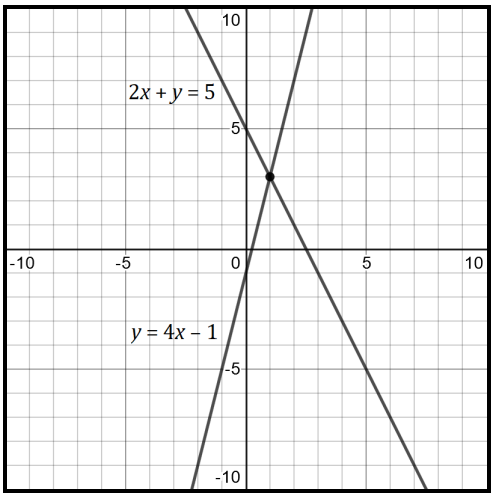
Solution: $(-6,1)$

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



Solution: $(1, -3)$

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



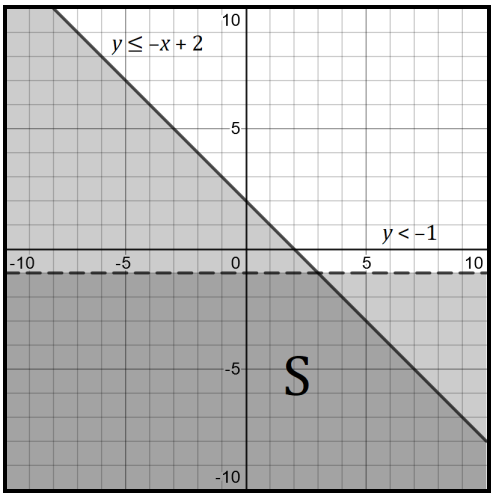
Solution: (1,3)

4.3 Solutions to Systems of Inequalities

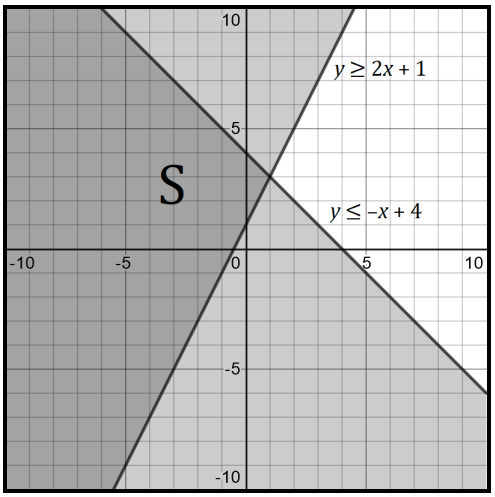
1. (1) (1,1)	2. (4) (−9,0)
3. (4) (4,0)	4. (2) (2,0)
5. (4) (2,−2)	6. (2) (2,−1)

4.4 Solve Systems of Inequalities Graphically

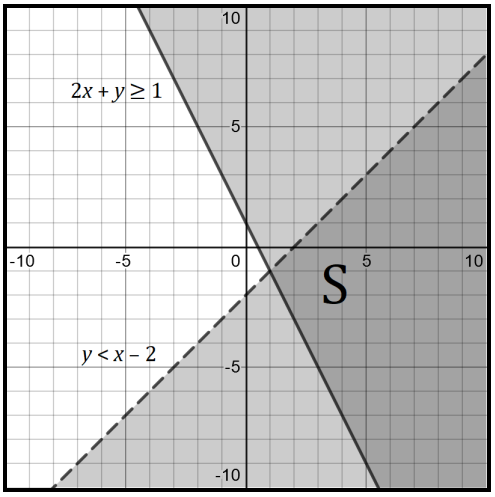
1.



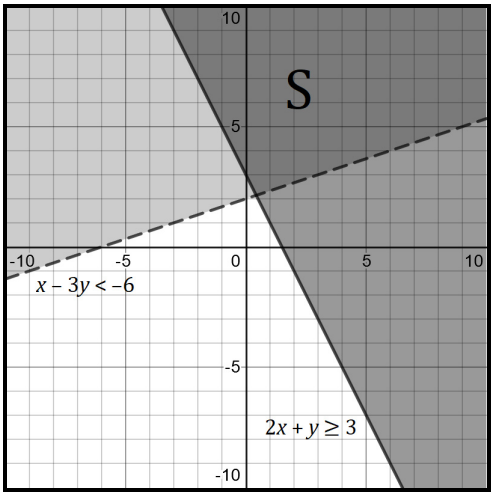
2.



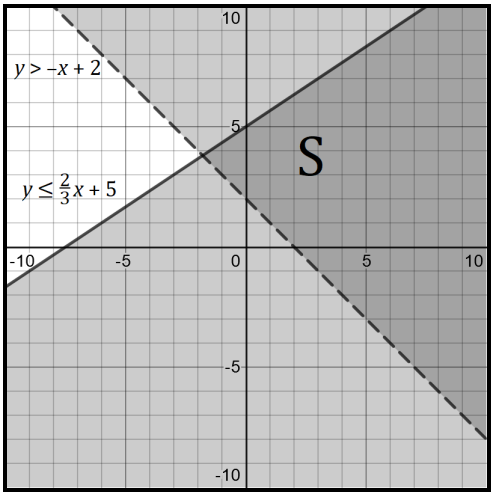
3.



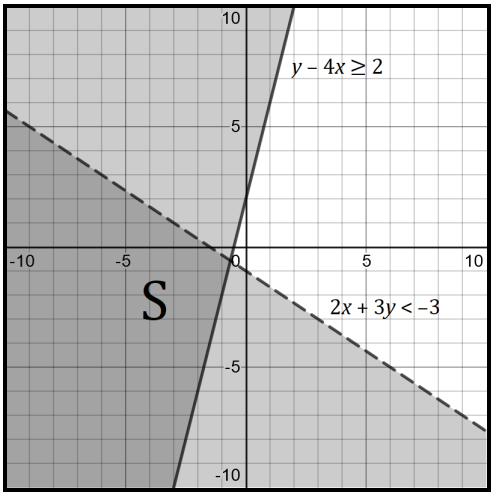
4.



5.



6.



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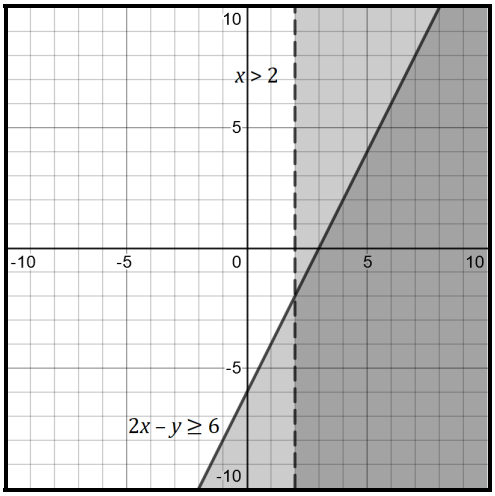
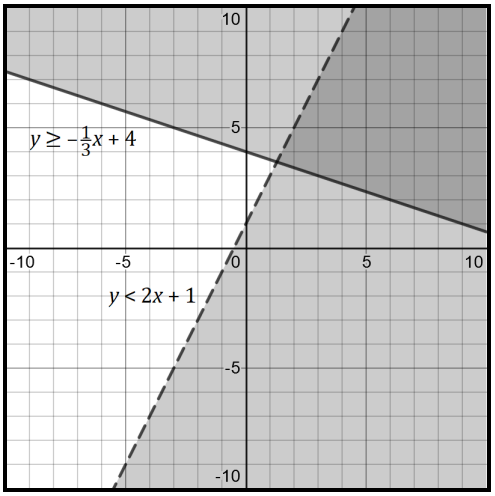


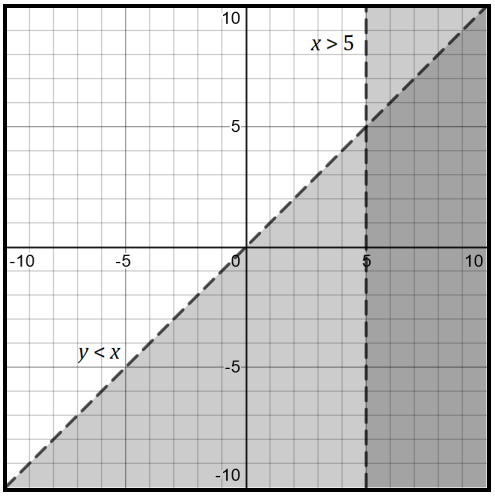
infinitely many solutions such as $(3, -3)$

8.



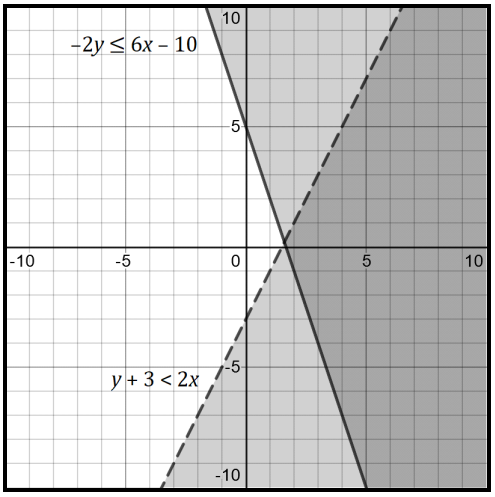
infinitely many solutions such as $(6, 6)$

9.



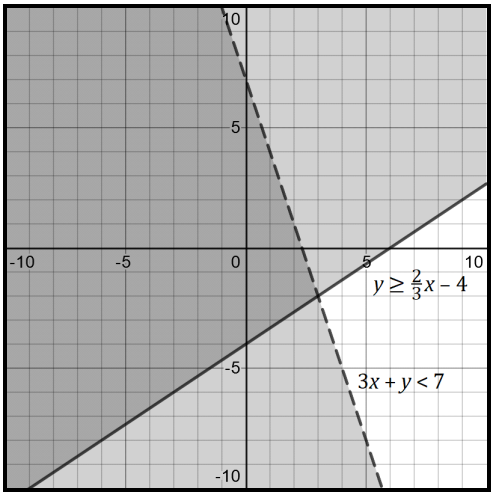
infinitely many solutions, such as (7,1)

10.



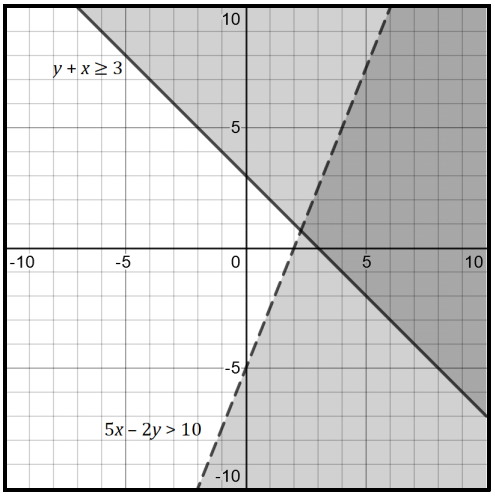
infinitely many solutions, such as (4,0)

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.

$x - y = 5$

$x + y = 59$ $\qquad (32) + y = 59$

$2x = 64$ $\qquad y = 27$

$x = 32$

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

$$p + 2c = 5 \quad \rightarrow \quad p + 2c = 5$$
$$p + 4c = 6 \quad \times(-1) \quad -p - 4c = -6$$
$$-2c = -1$$
$$c = 0.50$$

One cookie costs \$0.50.

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

$$2d + 3c = 3.30 \quad \times 2$$
$$5d + 2c = 4.95 \quad \times(-3)$$
$$4d + 6c = 6.60$$
$$-15d - 6c = -14.85$$
$$-11d = -8.25$$
$$d = 0.75$$
$$2(0.75) + 3c = 3.30$$
$$1.50 + 3c = 3.30$$
$$3c = 1.80$$
$$c = 0.60$$

Doughnuts cost 75¢ and cookies cost 60¢.

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

$$3p + 2c = 6.00 \quad \times 3$$
$$2p + 3c = 5.25 \quad \times(-2)$$
$$9p + 6c = 18.00$$
$$-4p - 6c = -10.50$$
$$5p = 7.50$$
$$p = 1.50$$
$$3(1.50) + 2c = 6.00$$
$$4.50 + 2c = 6.00$$
$$2c = 1.50$$
$$c = 0.75$$

Pizzas cost \$1.50 and colas cost \$0.75.

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

$$6s + 6g = 90 \quad \times 2$$
$$4s + 8g = 100 \quad \times(-3)$$
$$12s + 12g = 180$$
$$-12s - 24g = -300$$
$$-12g = -120$$
$$g = 10$$
$$6s + 6(10) = 90$$
$$6s + 60 = 90$$
$$6s = 30$$
$$s = 5$$

Sprayer costs \$5/hr and generator \$10/hr.

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

$$28f + 15p = 131 \quad \rightarrow$$
$$f + p = 7 \quad \times(-15)$$
$$28f + 15p = 131$$
$$-15f - 15p = -105$$
$$13f = 26$$
$$f = 2$$
$$(2) + p = 7$$
$$p = 5$$

She bought 2 fancy and 5 plain shirts.

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

$$3n + 4p = 8.50 \quad \times(-2)$$
$$5n + 8p = 14.50 \quad \rightarrow$$
$$-6n - 8p = -17.00$$
$$5n + 8p = 14.50$$
$$-n = -2.50$$
$$n = 2.50$$
$$3(2.50) + 4p = 8.50$$
$$7.50 + 4p = 8.50$$
$$4p = 1.00$$
$$p = 0.25$$

\$2.50 per notebook and \$0.25 per pencil.

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

$a + o = 108 \quad \times (-3) \quad -3a - 3o = -324$

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

$2a = 128$

$a = 64$

$64 + o = 108$

$o = 44$

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)

$t \leq 3$

$d \leq 55t$

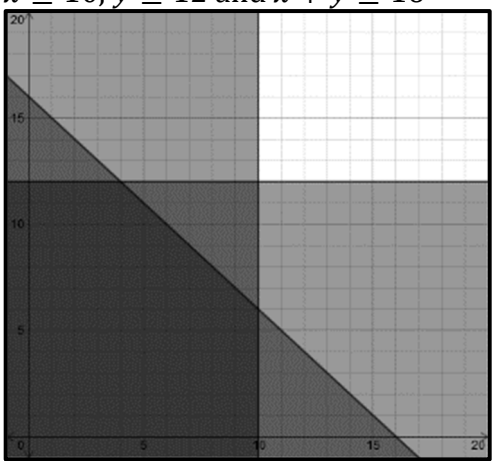
Therefore,

$d \leq 55(3)$

$d \leq 165$

b) Yes

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



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. $(x - 6)(x - 6) =$ $x^2 - 6x - 6x + 36 =$ $x^2 - 12x + 36$
10. $a^2 + 2ab + b^2$	11. (3) $ax + by$

12.

	x	3
x	x^2	$3x$
$-y$	$-xy$	$-3y$
-1	$-x$	-3

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. $6xy^4-4x^5+1$

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. $P(125) = 0.0089(125)^2 + 1.1149(125) + 78.4491 \approx 356.9$	

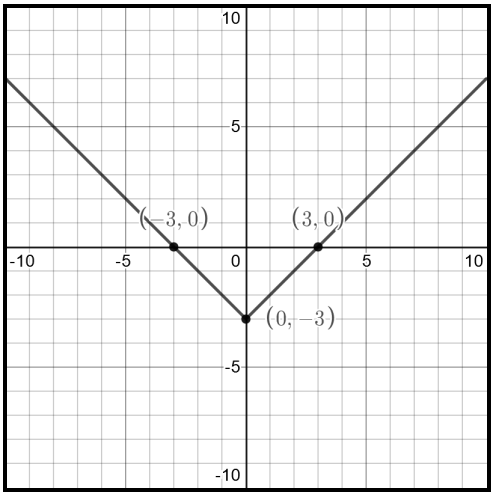
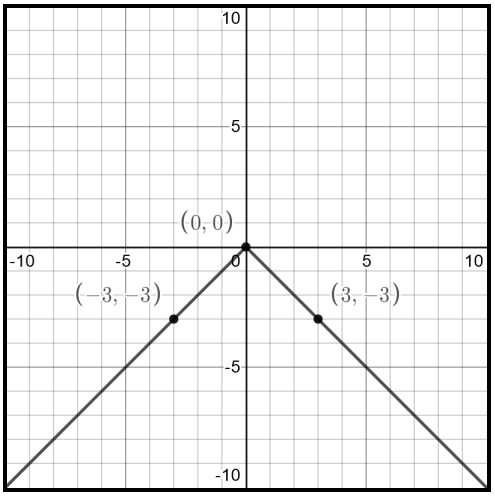
6.4 Features of Function Graphs

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 $(-1,-2)$	

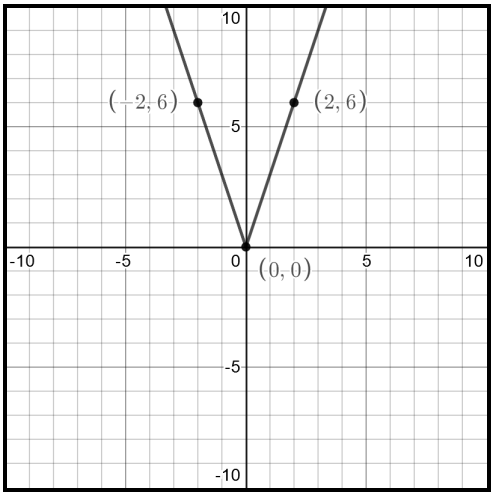
6.5 Domain and Range

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) $\{0, 5, 10, 15, \ldots 100\}$

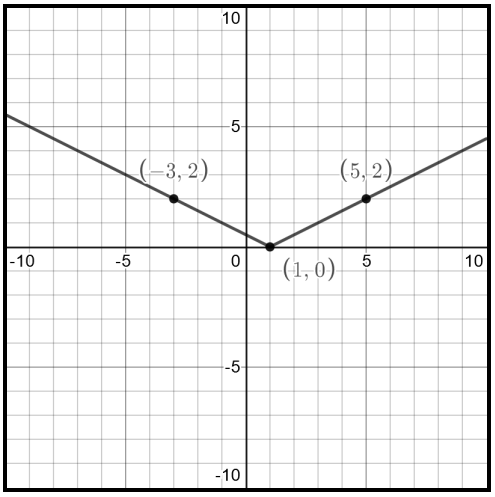
6.6 Absolute Value Functions

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

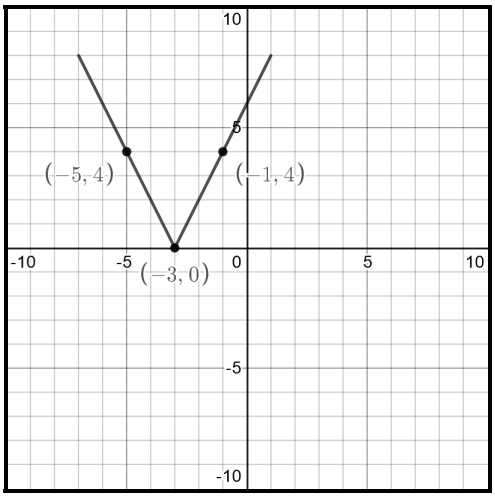
5.



6.



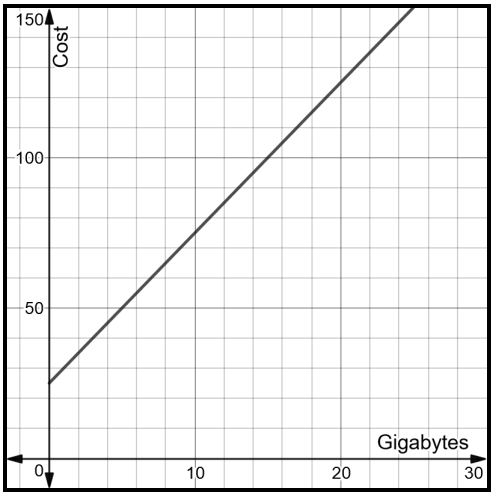
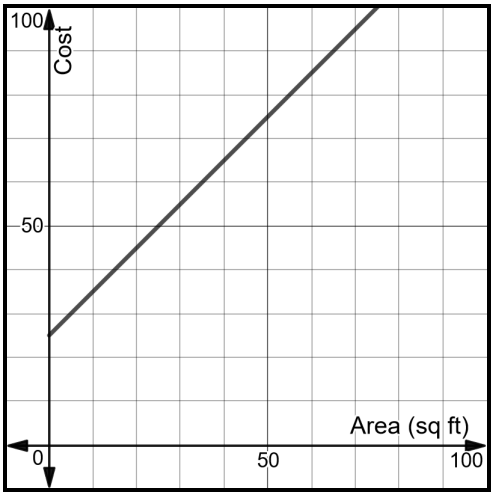
7.

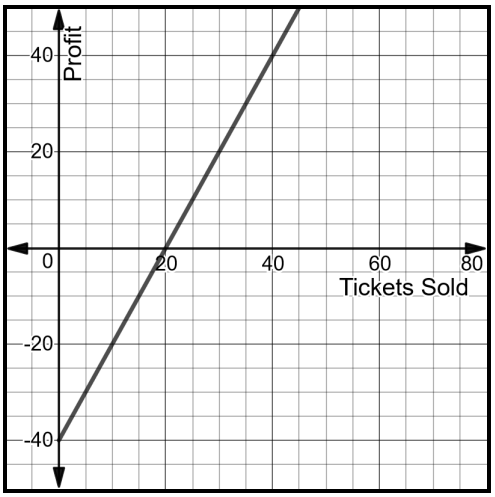
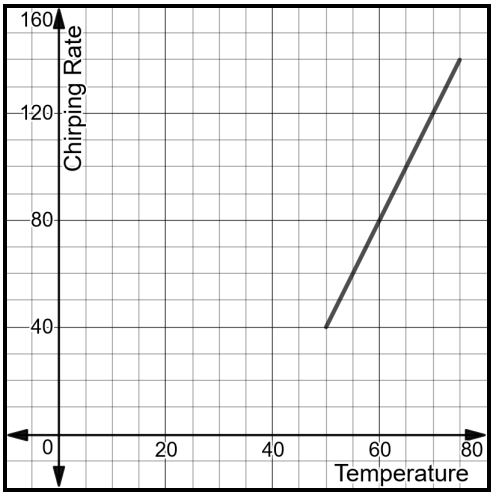


7.1 Write a Function from a Table

1. $m = \frac{13-9}{1-0} = \frac{4}{1} = 4$ and $b = f(0) = 9$ $f(x) = 4x + 9$	2. $m = \frac{15-10}{3-0} = \frac{5}{3}$ and $b = f(0) = 10$ $f(x) = \frac{5}{3}x + 10$
3. $m = \frac{10-7}{2-1} = 3$ $y - 7 = 3(x - 1)$ $f(x) = 3(x - 1) + 7$ $f(x) = 3x + 4$	4. $m = \frac{-3+5}{5-1} = \frac{2}{4} = \frac{1}{2}$ $y + 5 = \frac{1}{2}(x - 1)$ $f(x) = \frac{1}{2}(x - 1) - 5$ $f(x) = \frac{1}{2}x - 5\frac{1}{2}$
5. $m = \frac{5-9}{4-2} = \frac{-4}{2} = -2$ $y - 9 = -2(x - 2)$ $f(x) = -2(x - 2) + 9$ $f(x) = -2x + 13$	6. $m = \frac{5-0}{12-11} = 5$ $y - 0 = 5(x - 11)$ $f(x) = 5(x - 11)$ $f(x) = 5x - 55$

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) $P(c) = R(c) - E(c) = (20c + 500) - (6c) = 14c + 500$	

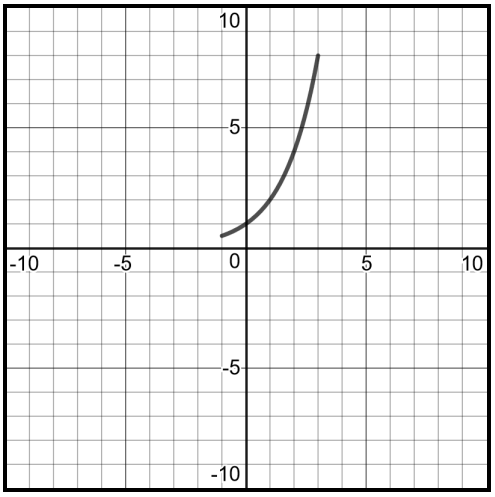
8.1 Exponential Growth and Decay

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. $256(0.25)^3 = 4$

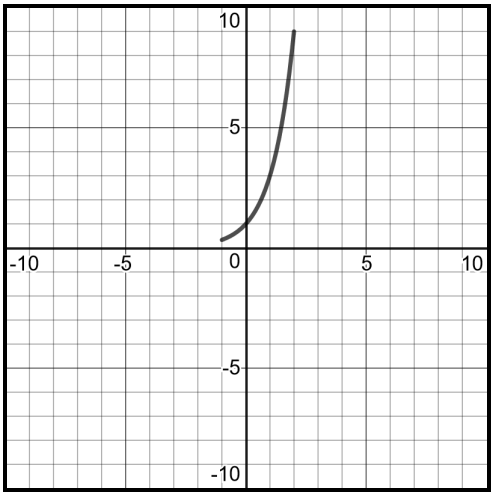
8.2 Graphs of Exponential Functions

1. (4)

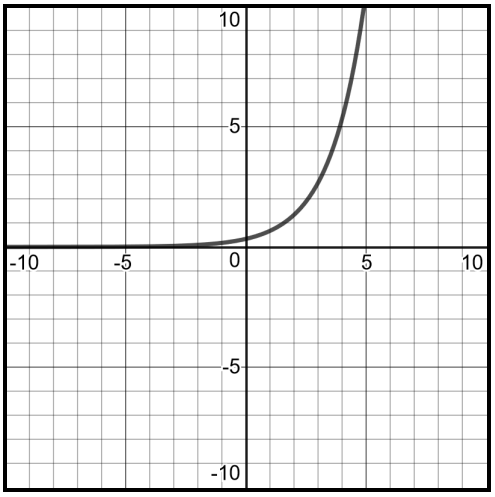
2.



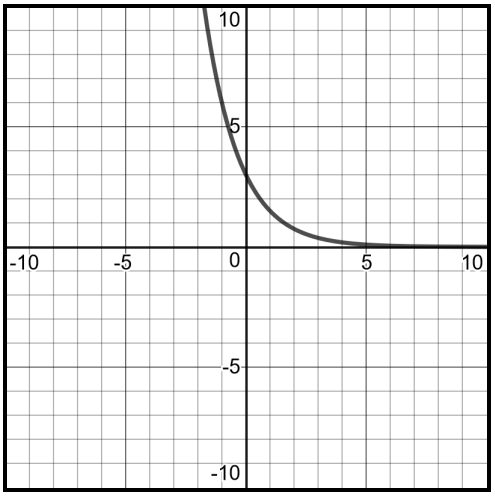
3.



4.



5.



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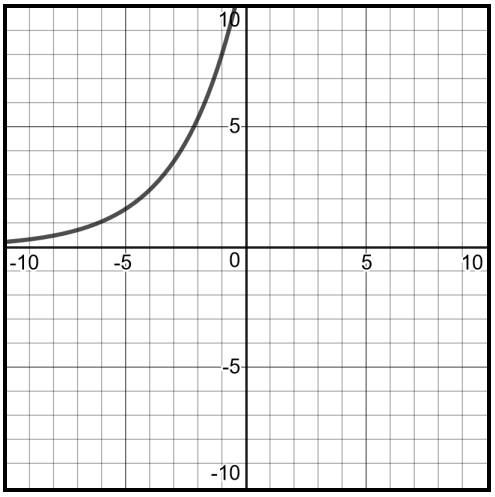

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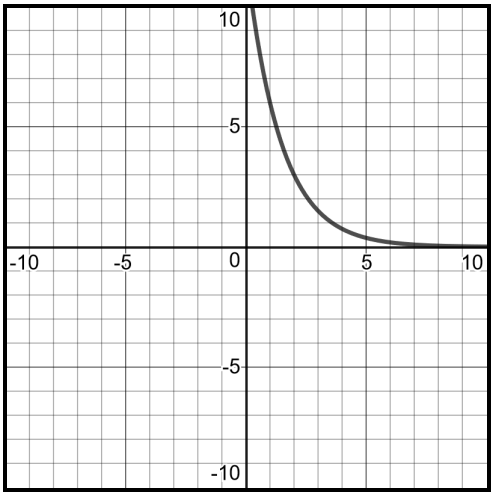

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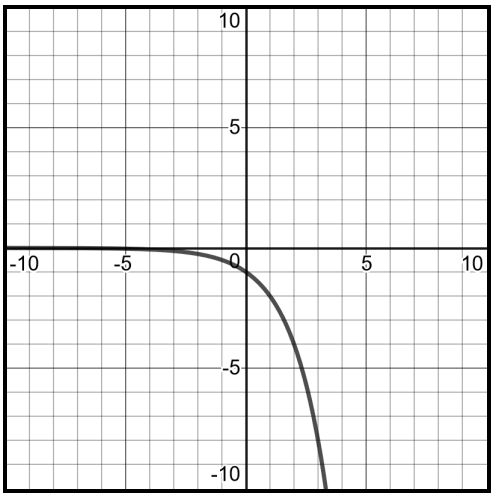
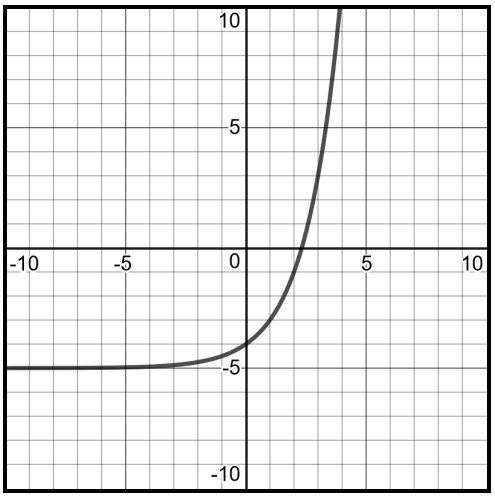


9.



It is shifted (translated) down by 5 units.

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

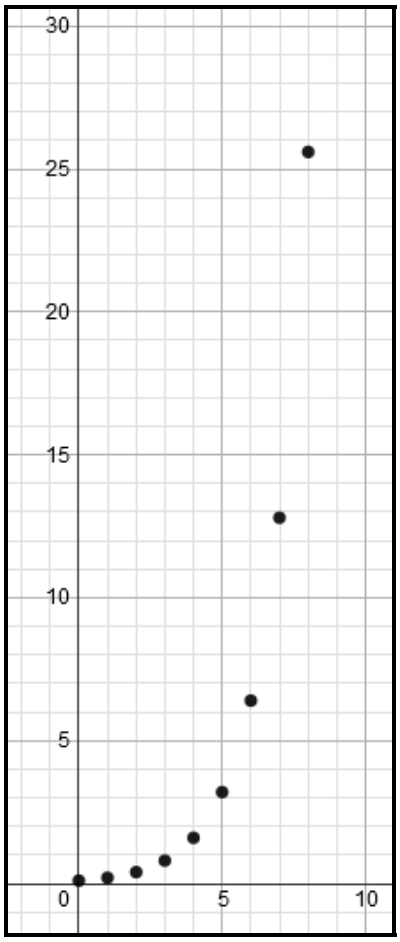
11. $y = \left(\frac{1}{4}\right)^x$

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

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

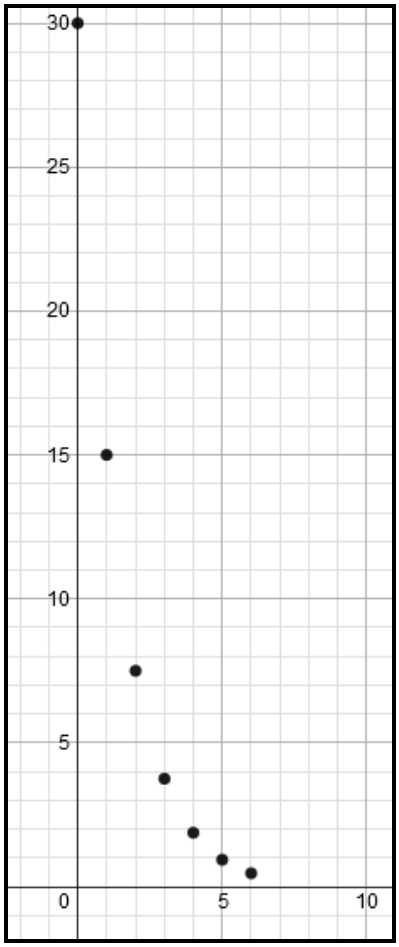
14. a) $t(n) = 0.1(2)^n$

b)



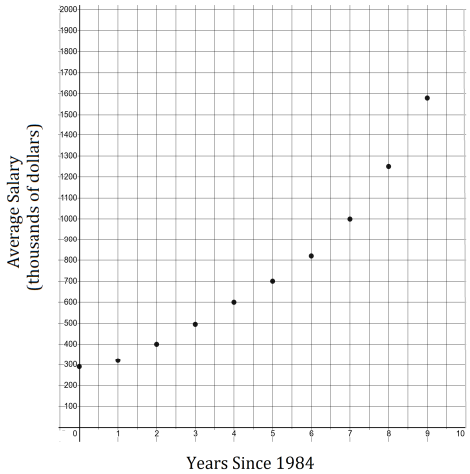
15. a) $h(n) = 30\left(\frac{1}{2}\right)^n$

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. $f(n) = 3^n$

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 $a_1 = 1$. $a_{30} = 1(2)^{29} = 536{,}870{,}912$

10.1 Simplify 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. $3\sqrt{20}\left(2\sqrt{5}-7\right) = 6\sqrt{100}-21\sqrt{20} =$ $60-42\sqrt{5}$
17. $3\sqrt{7}\left(\sqrt{14}+4\sqrt{56}\right) = 3\sqrt{7}\left(\sqrt{14}+8\sqrt{14}\right) =$ $3\sqrt{98}+24\sqrt{98} = 27\sqrt{98} = 27\sqrt{49\cdot 2} =$ $189\sqrt{2}$	18. $\left(3+\sqrt{5}\right)\left(3-\sqrt{5}\right)$ $= 9-3\sqrt{5}+3\sqrt{5}-5 = 9-5 = 4$
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. $\frac{20\sqrt{100}}{4\sqrt{2}} = 5\sqrt{50} = 5 \cdot 5\sqrt{2} = 25\sqrt{2}$
23. $\frac{\sqrt{84}}{\sqrt{3}} = \sqrt{28} = 2\sqrt{7}$	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 Rationalize 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. $\frac{1}{\sqrt{3}} \cdot \left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{3}}{3}$ $\frac{1}{\sqrt{2}} \cdot \left(\frac{\sqrt{2}}{\sqrt{2}}\right) = \frac{\sqrt{2}}{2}$ 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. $\frac{1}{\sqrt{2}} \cdot \left(\frac{\sqrt{2}}{\sqrt{2}}\right) = \frac{\sqrt{2}}{2}$ $\frac{3}{\sqrt{5}} \cdot \left(\frac{\sqrt{5}}{\sqrt{5}}\right) = \frac{3\sqrt{5}}{5}$ 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.

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

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

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. $\left(\frac{b}{2}\right)^2=\left(\frac{10}{2}\right)^2=25$ $x^2+10x-11=0$ $x^2+10x=11$ $x^2+10x+25=11+25$ ← $(x+5)^2=36$ $x+5=\pm\sqrt{36}=\pm 6$ $x=-5\pm 6$ 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. $\left(\frac{b}{2}\right)^2=\left(\frac{-4}{2}\right)^2=4$ $x^2-4x-8=0$ $x^2-4x=8$ $x^2-4x+4=8+4$ ← $(x-2)^2=12$ $x-2=\pm\sqrt{12}=\pm 2\sqrt{3}$ $x=2\pm 2\sqrt{3}$ 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 $x^2 + 100x + 2400$

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)

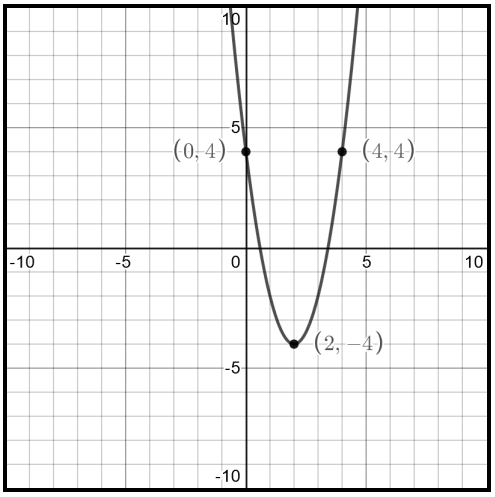
13.3 Find Vertex and Axis Algebraically

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 $(-1,2)$

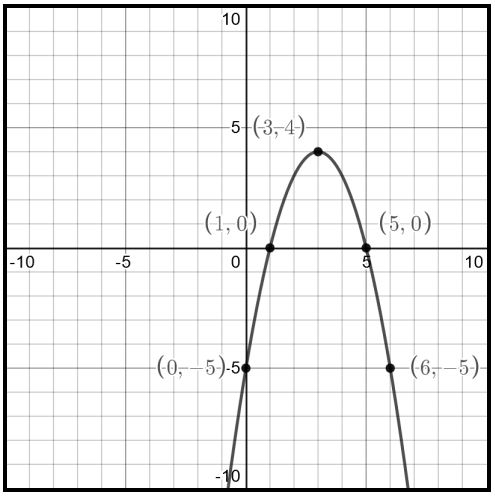
9. $x = \frac{-b}{2a} = \frac{8}{0.5} = 16$ $y = 0.25(16)^2 - 8(16) + 800 = 736$ Vertex is (16,736). So, producing 16 units will result in the minimum cost of \$736.	10. $w = \frac{-b}{2a} = \frac{-160}{-8} = 20$ workers

13.4 Graph Parabolas

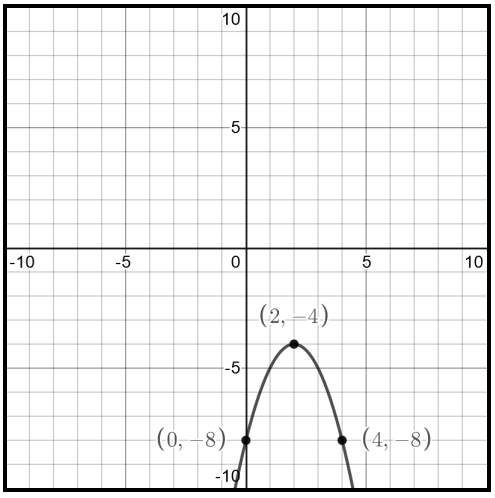
1.



2.



3.



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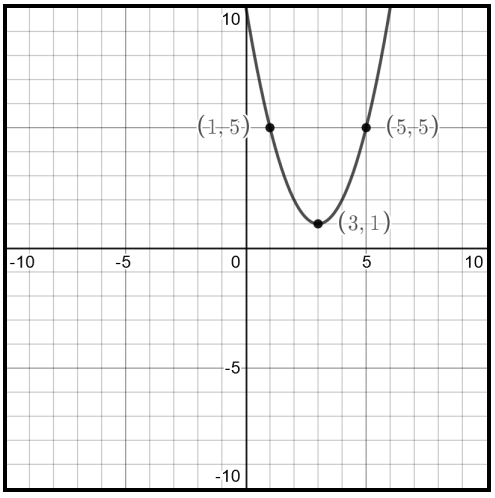
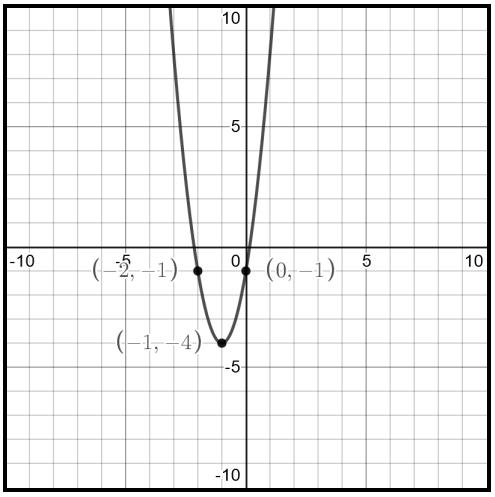
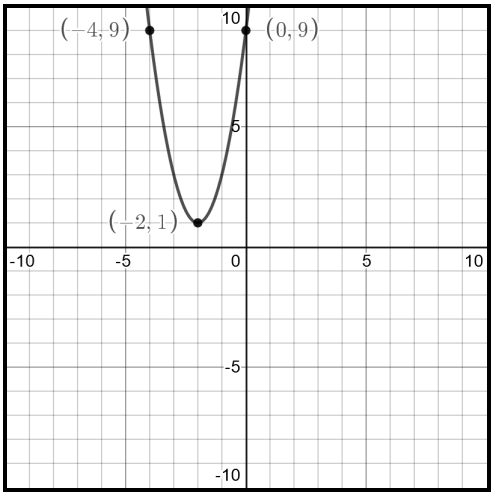


5.



6.



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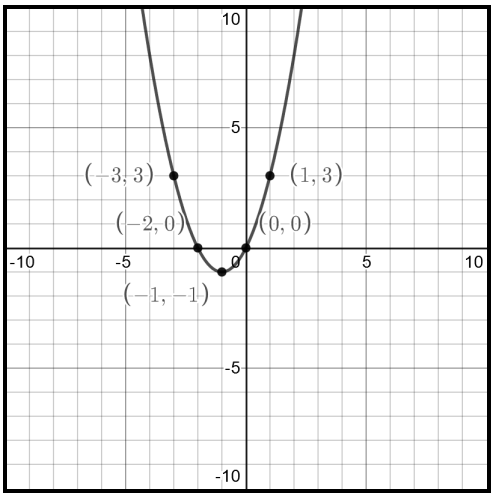
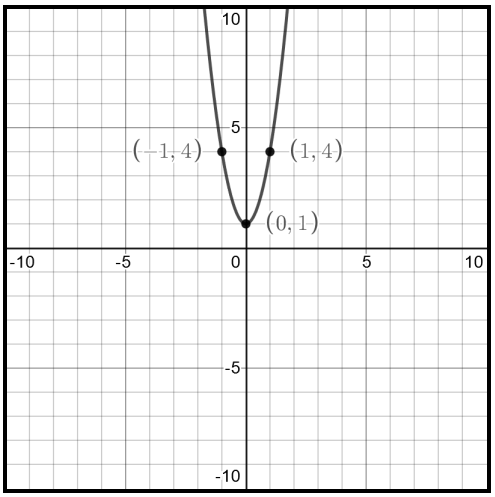
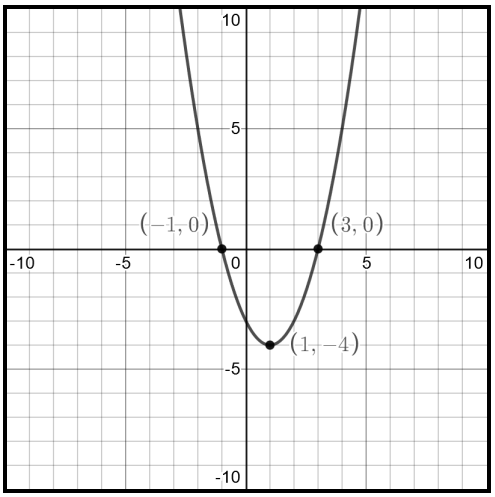


8.

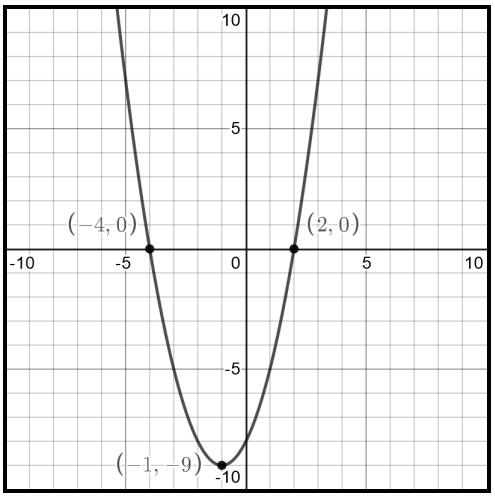


9.



Roots are –1 and 3.

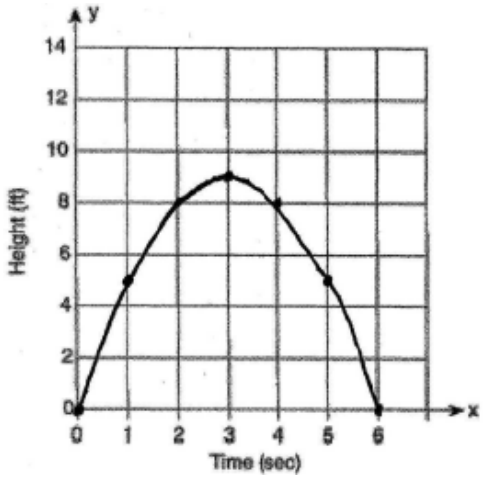
10.



Roots are –4 and 2.

11.

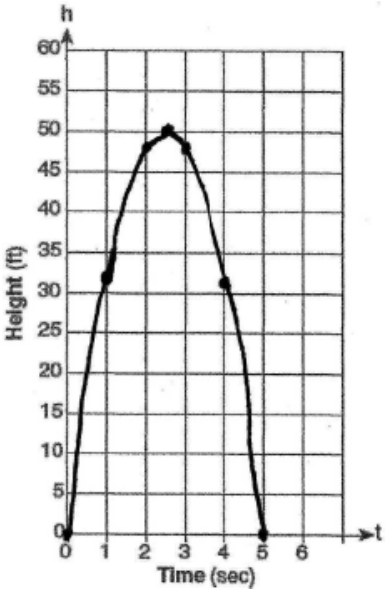
a)



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

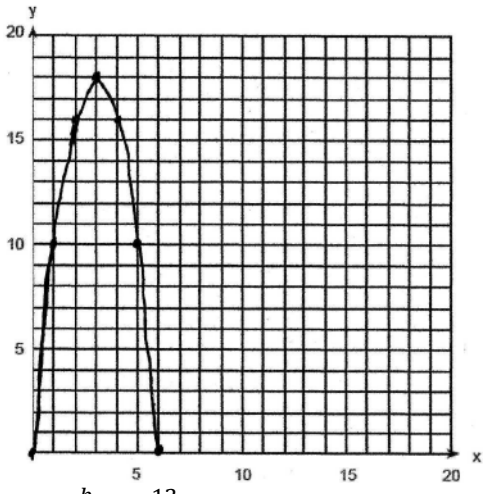
12.

a)



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

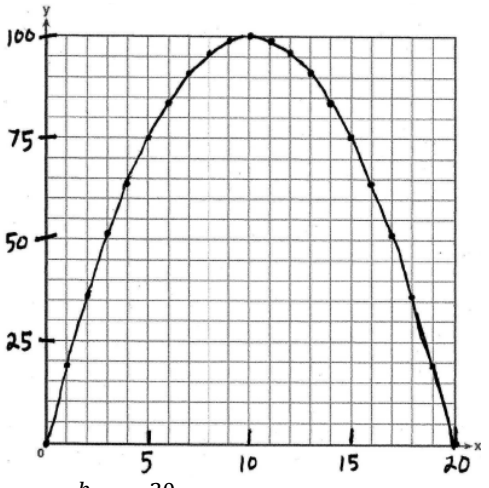
13. a)



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

$y = x^2 + 10x + 21$

$y - 21 = x^2 + 10x$

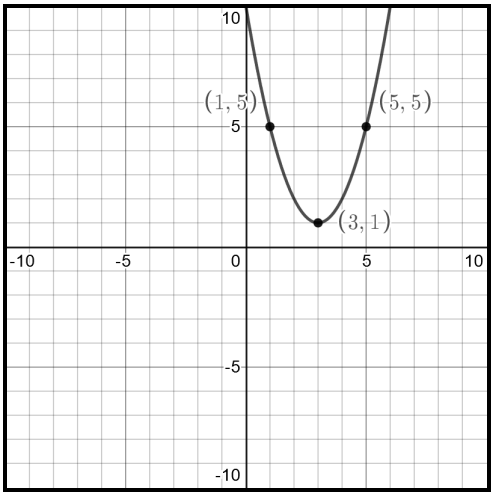
$y - 21 + 25 = x^2 + 10x + 25$

$y + 4 = (x + 5)^2$

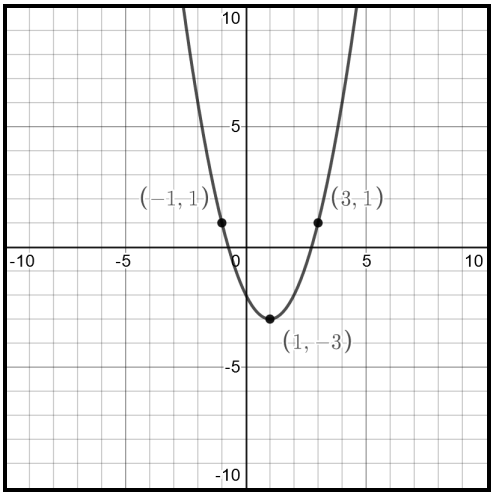
$y = (x + 5)^2 - 4$

vertex: $(-5, -4)$

3.



4.



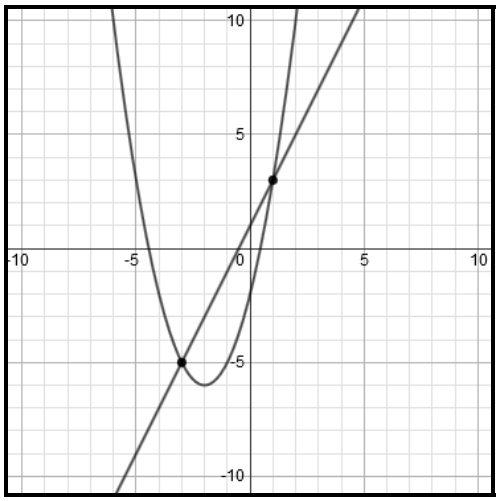
14.1 Solve Quadratic-Linear Systems Algebraically

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

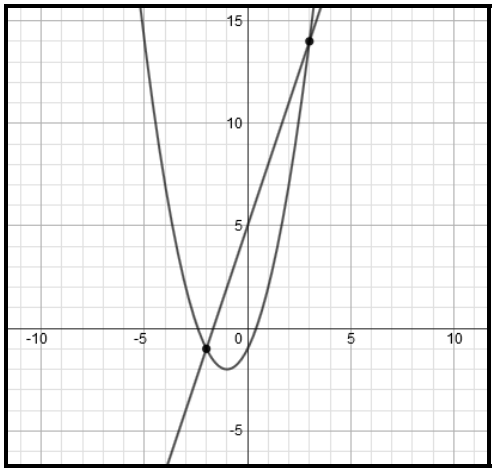
1. (2) $(-3,5)$	2. (1) $(8,9)$

3.



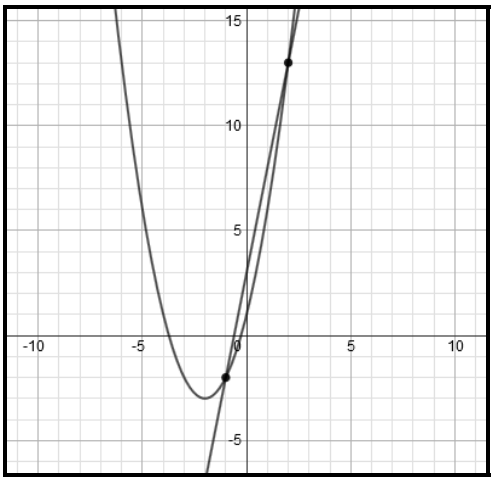
Solutions: $(1,3)$ and $(-3,-5)$

4.



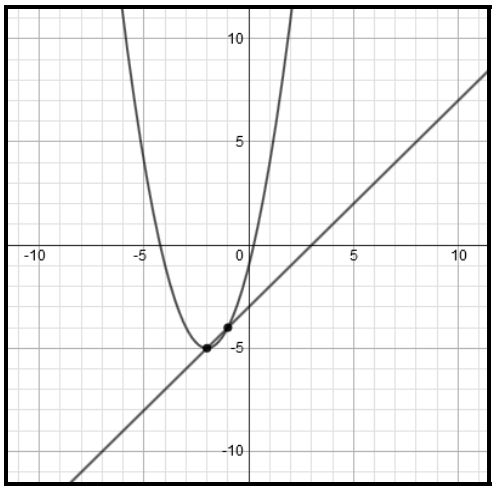
Solutions: $(3,14)$ and $(-2,-1)$

5.



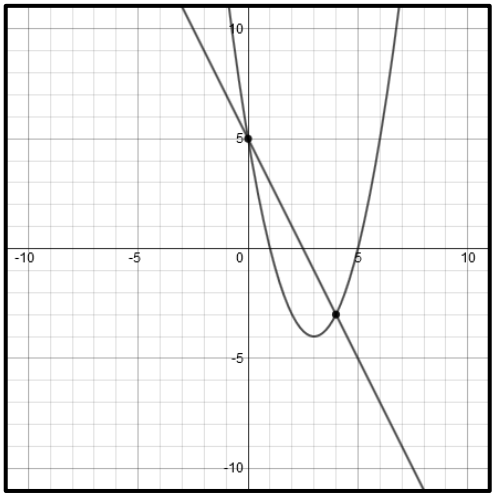
Solutions: $(2,13)$ and $(-1,-2)$

6.



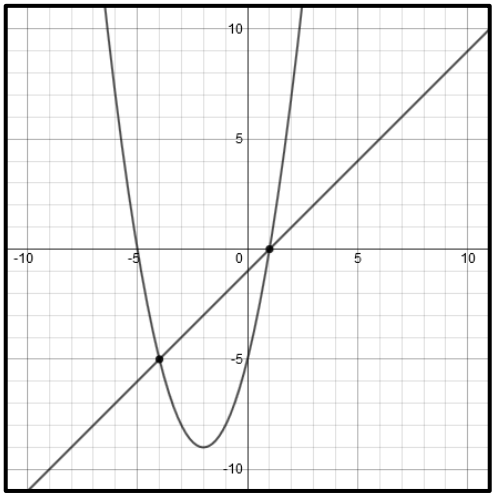
Solutions: $(-1,-4)$ and $(-2,-5)$

7.



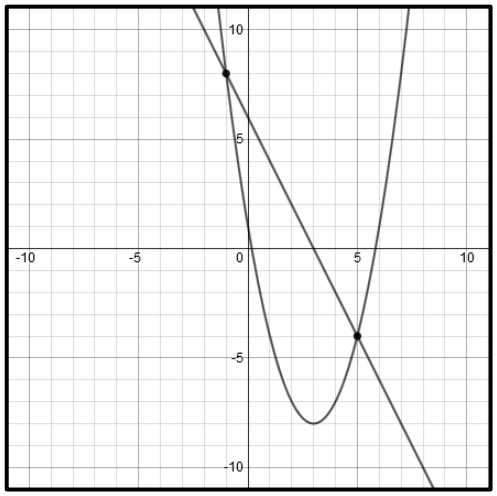
Solutions: $(0,5)$ and $(4,-3)$

8.



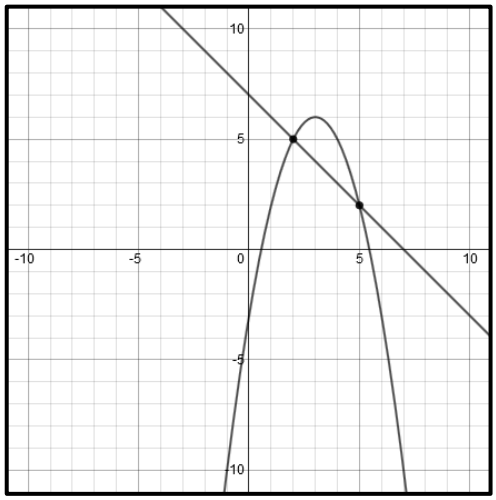
Solutions: $(-4,-5)$ and $(1,0)$

9.



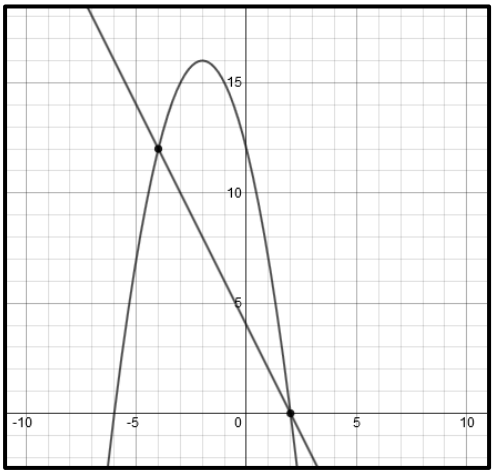
Solutions: $(-1,8)$ and $(5,-4)$

10.



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

11.

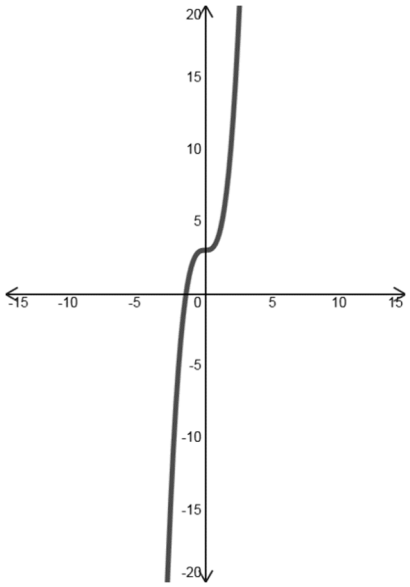


Solutions: $(-4,12)$ and $(2,0)$

15.1 Cubic Functions

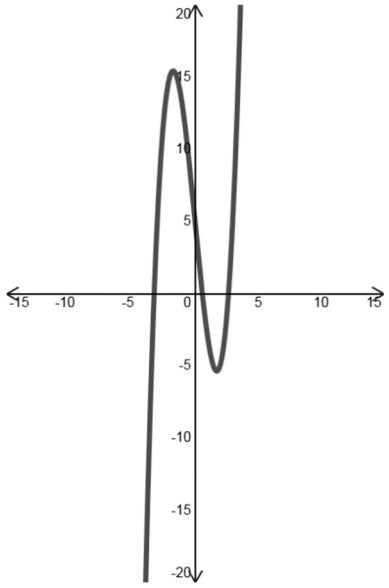
1. The function has one real root.

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

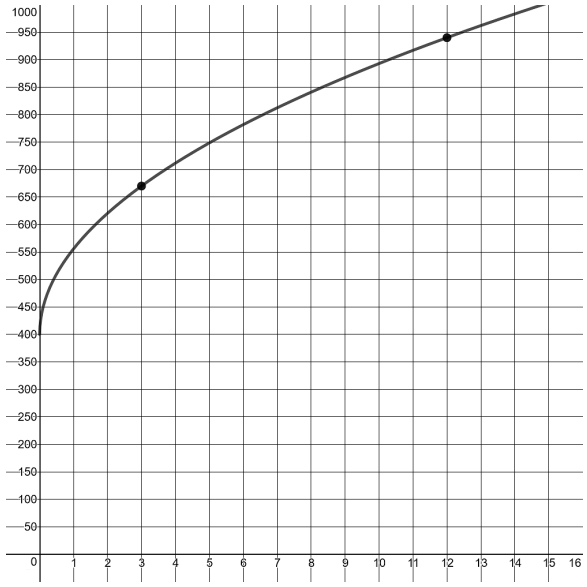
1. (2)

2.

a)

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

b)



c) 670

d) 12

16.1 Translations

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

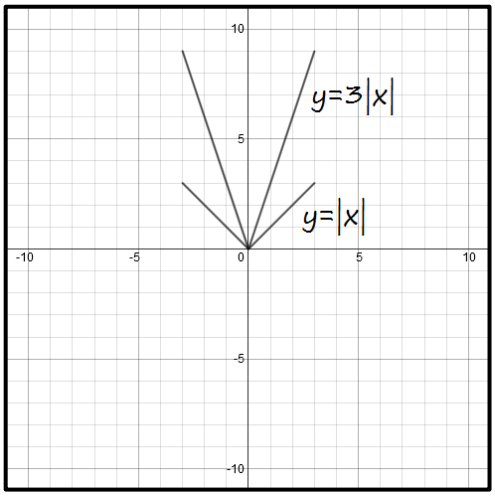
16.2 Reflections

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

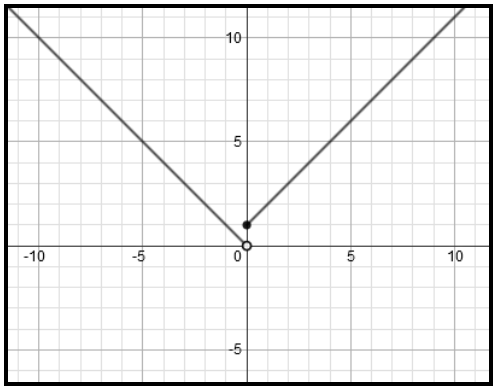
5.



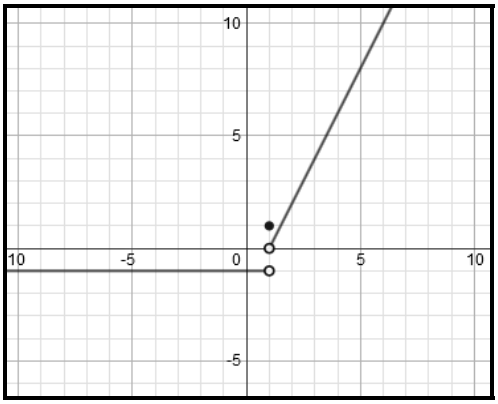
becomes narrower (vertically stretches)

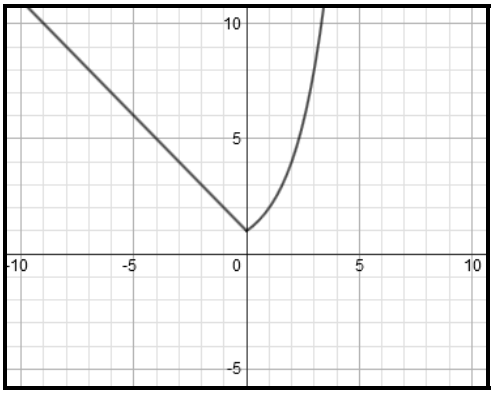
17.1 Piecewise Functions

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

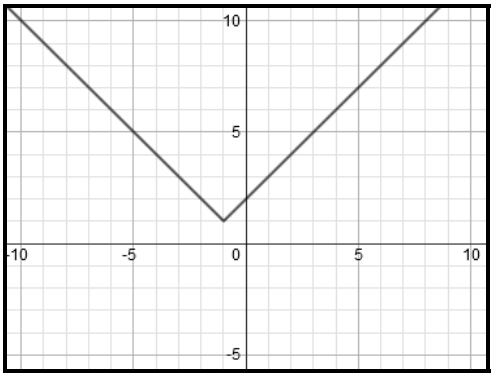
2. 

Not a continuous function.

3. 

4. 

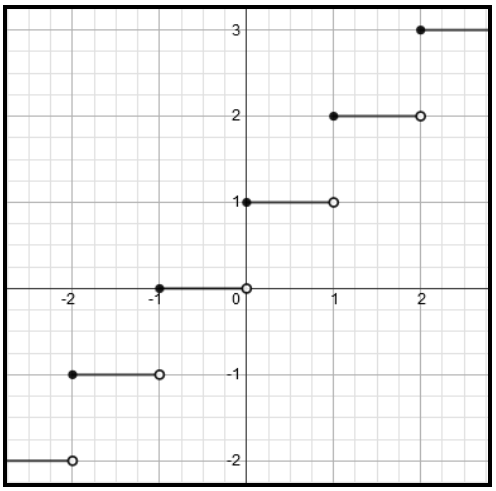
This is a continuous function.

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. 

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

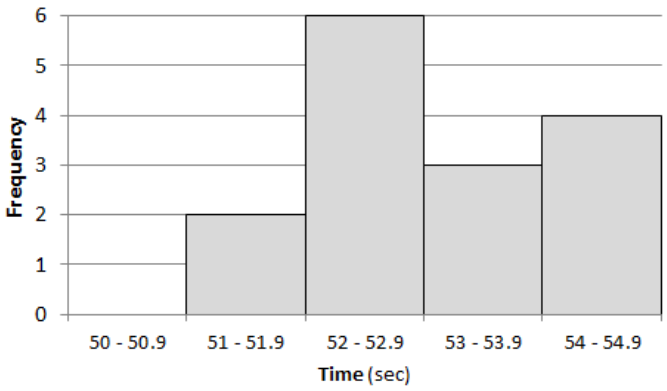
6.

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

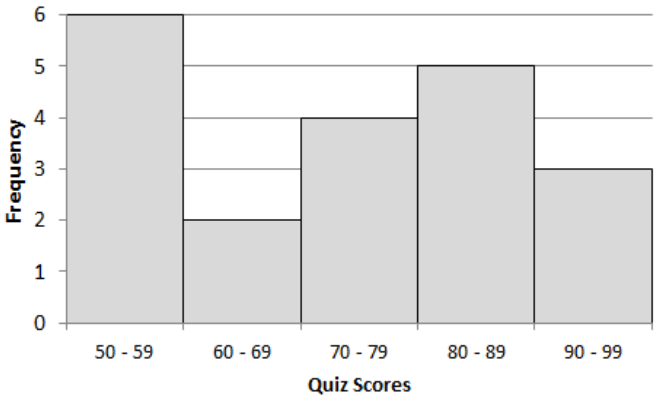
1. Add the frequencies: 2 + 4 + 5 + 4 + 1 = 16
2. Add the frequencies: 7 + 10 + 3 + 5 = 25
3. 20 (the height of the last bar)
4. 3; 0; 20
5.



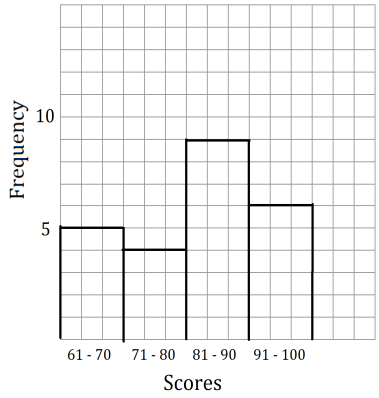
6.

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

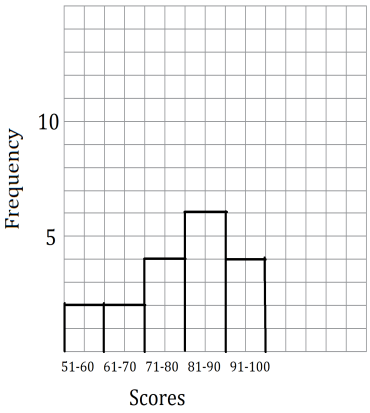


7.



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



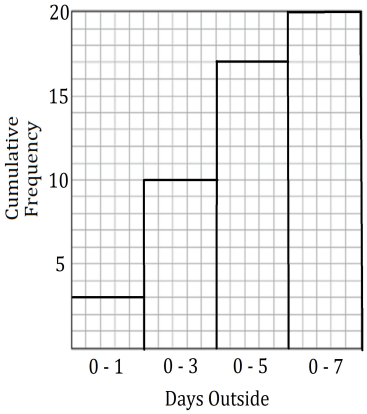
9.

Number of Days Outside

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

Number of Days Outside

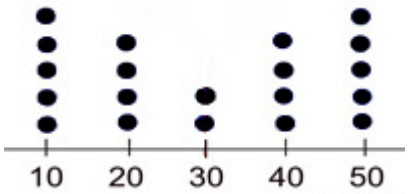
Interval	Cumulative Frequency
0–1	3
0–3	10
0–5	17
0–7	20



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 22^{nd} and 23^{rd} 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 16^{th} 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

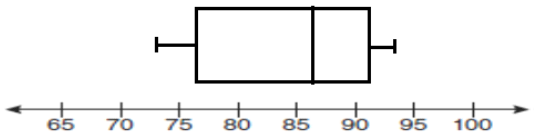
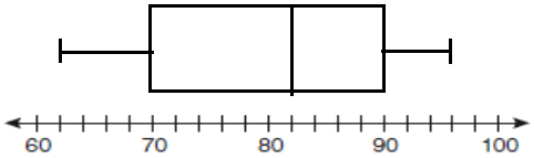
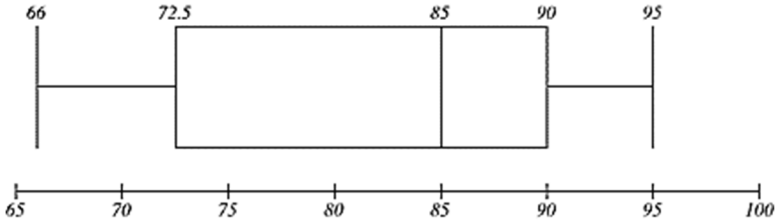
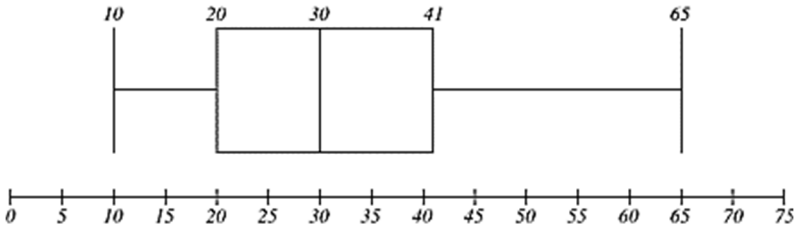
7. SD ≈ 16.8	8. SD ≈ 0.88
7. mean = 9.46; standard deviation = 3.85	8. mean $= \frac{440}{10} = 44$ $(51-44)^2 = 49, (48-44)^2 = 16$, etc. $\frac{49+16+9+4+1+1+9+16+16+25}{10-1} = \frac{146}{9} = 16.\overline{2}$ SD $= \sqrt{16.\overline{2}} \approx 4.0$
9. mean = \$610, SD ≈ 14.7	10. SD ≈ 8.1

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. 	

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.

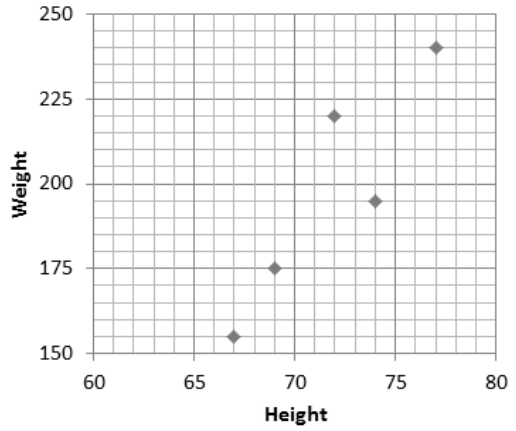
	Fiction	Nonfiction	Total
Hardcover	28	52	80
Paperback	94	36	130
Total	122	88	210

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

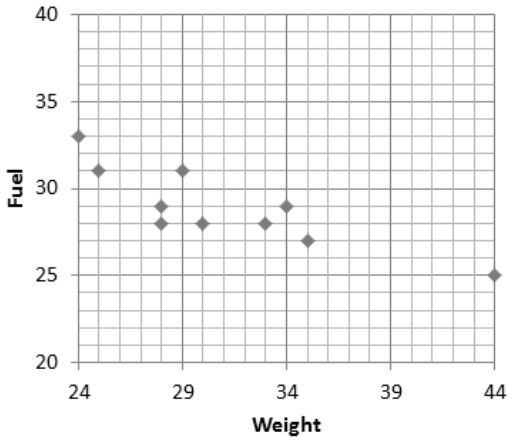
19.2 Scatter Plots

1. (2)

2.



3.



19.3 Correlation and Causality

1. (3)

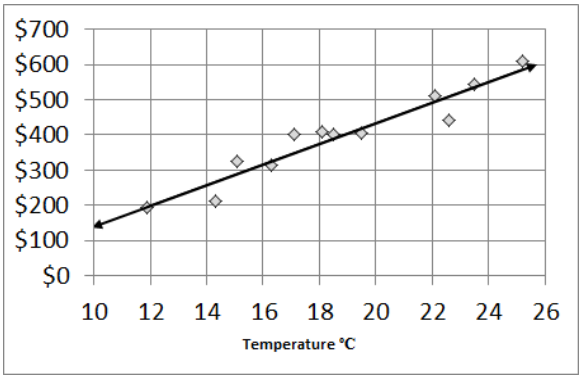
2. (2)

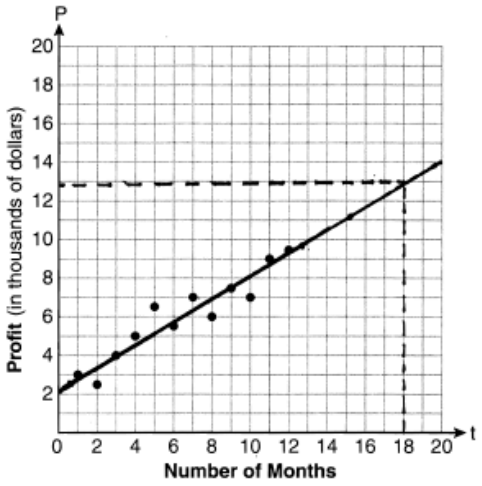
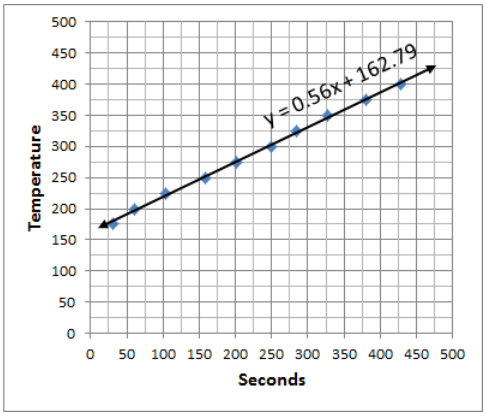
3. a) positive: children usually gain weight as they age and grow b) negative: as the volume of water increases, the remaining space decreases c) none: shoe size and hair length are unrelated d) positive: more people go to the beach when the temperature is higher	4. a) positive, causal b) positive, not 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. $r \approx -0.999$

Regents Questions

Chapter 1 Equations and Inequalities

1.1 Properties of Real Numbers

1. CC JUN '14 [1] Ans: 1
2. CC AUG '17 [1] Ans: 4
3. CC JAN '18 [1] Ans: 4
4. CC JAN '19 [8] Ans: 4
5. CC JUN '19 [9] Ans: 4
6. CC AUG '22 [19] Ans: 4
7. CC AUG '19 [26]
   Commutative; the property is correct because $-5a + 7 = 7 - 5a$.
8. CC JAN '20 [29]
   Distributive Property; Addition Property

1.2 Solve Linear Equations in One Variable

1. CC JUN '17 [19] Ans: 1
2. CC AUG '18 [4] Ans: 2
3. CC JUN '21 [2] Ans: 1
4. CC JUN '21 [6] Ans: 4
5. CC JAN '23 [7] Ans: 2
6. CC JUN '23 [25]
   $-2.4(x + 1.4) = 6.8x - 22.68$
   $-2.4x - 3.36 = 6.8x - 22.68$
   $19.32 = 9.2x$
   $2.1 = x$

1.3 Solve Equations with Fractions

1. CC JUN '14 [5] Ans: 1
2. CC AUG '14 [20] Ans: 1
3. CC AUG '17 [13] Ans: 2
4. CC JAN '18 [22] Ans: 4
5. CC JAN '19 [5] Ans: 2
6. CC AUG '19 [4] Ans: 3
7. CC JAN '20 [5] Ans: 2
8. CC AUG '22 [17] Ans: 3
9. CC AUG '23 [4] Ans: 2
10. CC JAN '24 [16] Ans: 4
11. CC JUN '18 [30]
    $6 - \frac{2}{3}(x + 5) = 4x$
    $3(6) - 3\left[\frac{2}{3}(x + 5)\right] = 3(4x)$
    $18 - 2(x + 5) = 12x$
    $18 - 2x - 10 = 12x$
    $8 - 2x = 12x$
    $8 = 14x$
    $x = \frac{8}{14} = \frac{4}{7}$
12. CC JUN '19 [25]
    $12\left[-\frac{2}{3}(x + 12)\right] + 12\left[\frac{2}{3}x\right] =$
    $12\left[-\frac{5}{4}x\right] + 12[2]$
    $-8(x + 12) + 8x = -15x + 24$
    $-8x - 96 + 8x = -15x + 24$
    $-96 = -15x + 24$
    $-120 = -15x$
    $x = 8$

1.4 Solve Linear Inequalities in One Variable

1. CC JAN '15 [7] Ans: 1
2. CC JUN '16 [9] Ans: 4
3. CC AUG '16 [7] Ans: 1
4. CC JUN '17 [13] Ans: 4
5. CC AUG '17 [11] Ans: 1
6. CC JAN '18 [17] Ans: 2
7. CC JUN '18 [1] Ans: 4
8. CC JAN '20 [3] Ans: 1
9. CC JUN '22 [7] Ans: 1
10. CC JUN '23 [22] Ans: 3
11. CC AUG '23 [10] Ans: 2
12. CC JAN '24 [18] Ans: 4
13. CC JUN '14 [27]
    $2(-1) + a(-1) - 7 > -12$
    $-9 - a > -12$
    $-a > -3$
    $a < 3$
    Ans: 2
14. CC AUG '14 [30]
    $3x + 9 \leq 5x - 3$
    $12 \leq 2x$
    $6 \leq x$
    Ans: 6
15. CC JUN '15 [30]
    $-8x + 7 < 15$
    $-8x < 8$
    $x > -1$
    Ans: 0
16. CC AUG '15 [34]
    $7x - 12x + 24 \leq 6x + 12 - 9x$
    $-5x + 24 \leq -3x + 12$
    $12 \leq 2x$
    $6 \leq x$ or $x \geq 6$
    {6,7,8} is the set of integers that are greater than or equal to 6 in the interval
17. CC JAN '17 [27]
    $1.8 - 0.4y \geq 2.2 - 2y$
    $1.6y \geq 0.4$
    $y \geq 0.25$
18. CC JAN '19 [25]
    $3600 + 1.02x < 2000 + 1.04x$
    $1600 < 0.02x$
    $80{,}000 < x$ or $x > 80{,}000$
19. CC AUG '19 [29]
    $15\left[\frac{3}{5}x\right] + 15\left[\frac{1}{3}\right] < 15\left[\frac{4}{5}x\right] - 15\left[\frac{1}{3}\right]$
    $9x + 5 < 12 - 5$
    $10 < 3x$
    $\frac{10}{3} < x$
20. CC JUN '21 [25]
    $4y - 12 \leq 8y + 4$
    $-12 \leq 4y + 4$
    $-16 \leq 4y$
    $-4 \leq y$
21. CC JAN '23 [27]
    $3\left[-\frac{2}{3}x + 6 > -12\right]$
    $-2x + 18 > -36$
    $-2x > -54$
    $x < 27$

1.5 Solve Literal Equations and Inequalities

1. CC JAN '16 [6] Ans: 3
2. CC JAN '17 [4] Ans: 3
3. CC JUN '17 [2] Ans: 2
4. CC JUN '17 [23] Ans: 3
5. CC JUN '18 [23] Ans: 4
6. CC JAN '19 [20] Ans: 2

7. CC JUN '19 [13] Ans: 4
8. CC JUN '22 [11] Ans: 1
9. CC JUN '22 [23] Ans: 4
10. CC AUG '22 [24] Ans: 4
11. CC JAN '23 [18] Ans: 2
12. CC JUN '23 [15] Ans: 4
13. CC JAN '24 [8] Ans: 2
14. CC AUG '14 [34]

$2A = h(b_1 + b_2)$

$\frac{2A}{h} = b_1 + b_2$

$\frac{2A}{h} - b_2 = b_1$

$b_1 = \frac{2 \cdot 60}{6} - 12 = 8$ ft.

15. CC JAN '16 [31]

$bx - 3b \geq ax + 7b$

$-10b \geq (a - b)x$

$-\frac{10b}{a-b} \geq x$

16. CC JUN '16 [31]

$\frac{S}{180} = n - 2$

$\frac{S}{180} + 2 = n$

17. CC AUG '16 [32]

$4ax + 12 - 3ax = 25 + 3a$

$ax + 12 = 25 + 3a$

$ax = 13 + 3a$

$x = \frac{13+3a}{a}$

18. CC AUG '18 [29]

$\frac{9}{5}K = F + 459.67$

$F = \frac{9}{5}K - 459.67$

19. CC JUN '19 [30]

$V = \frac{1}{3}\pi r^2 h$

$3V = \pi r^2 h$

$h = \frac{3V}{\pi r^2}$

20. CC AUG '19 [28]

$at = v_f - v_i$

$at + v_i = v_f$

21. CC JAN '20 [32]

$2S = n(a + b)$

$\frac{2S}{n} = a + b$

$\frac{2S}{n} - a = b$

22. CC JUN '21 [31]

$C = \frac{5}{9}(F - 32)$

$\frac{9}{5}C = F - 32$

$\frac{9}{5}C + 32 = F$

23. CC AUG '23 [28]

$\frac{d}{t} = \frac{v_i + v_f}{2}$

$\frac{2d}{t} = v_i + v_f$

$\frac{2d}{t} - v_i = v_f$

Chapter 2 Verbal Problems

2.1 Translate Expressions

1. CC AUG '15 [3] Ans: 4
2. CC JAN '17 [18] Ans: 4
3. CC AUG '17 [12] Ans: 2
4. CC AUG '19 [1] Ans: 3

2.2 Translate Equations

1. CC MAY '13 [4] Ans: 4
2. CC JUN '14 [16] Ans: 2
3. CC JAN '16 [11] Ans: 2
4. CC AUG '16 [16] Ans: 3
5. CC JUN '19 [15] Ans: 2
6. CC AUG '19 [20] Ans: 2
7. CC JUN '22 [13] Ans: 1
8. CC AUG '22 [29]
   $b = 2(a + 15)$

2.3 Linear Model in Two Variables

1. CC JUN '14 [7] Ans: 3
2. CC JUN '14 [22] Ans: 4
3. CC AUG '14 [2] Ans: 2
4. CC JAN '15 [1] Ans: 2
5. CC JAN '15 [23] Ans: 4
6. CC JUN '15 [1] Ans: 3
7. CC AUG '15 [8] Ans: 4
8. CC AUG '16 [14] Ans: 3
9. CC JAN '17 [9] Ans: 2
10. CC AUG '17 [9] Ans: 4
11. CC JAN '18 [7] Ans: 4
12. CC JUN '18 [17] Ans: 3
13. CC AUG '18 [17] Ans: 2
14. CC JUN '21 [1] Ans: 2
15. CC JUN '22 [3] Ans: 2
16. CC JAN '24 [3] Ans: 2
17. CC JUN '15 [26]
    $f(x) = 6.5x + 4(12)$
    $f(x) = 6.5x + 48$
18. CC JAN '17 [30]
    $C = 0.99(s - 1) + 1.29$
    No. $C = 0.99(52 - 1) + 1.29 = 51.78$
19. CC JAN '18 [33]
    $P(x) = 0.035x + 300$;
    $0.035(8250) + 300 = 588.75$

2.4 Word Problems – Linear Equations

1. CC AUG '15 [10] Ans: 2
2. CC MAY '13 [5]
   $12x + 9(2x) + 5(3x) = 15$
   $45x = 15$
   $x = \frac{1}{3}$
   $x + 2x + 3x = 6x = 6\left(\frac{1}{3}\right) = 2$ lbs.
3. CC JUN '21 [34]
   $1.25x + 0.55(x + 4) + 0.75(x - 2) = 16$
   $1.25x + 0.55x + 2.2 + 0.75x - 1.5 = 16$
   $2.55x + 0.7 = 16$
   $2.55x = 15.3$
   $x = 6$

2.5 Translate Inequalities

1. CC AUG '15 [5] Ans: 4
2. CC JUN '16 [7] Ans: 2
3. CC JUN '18 [6] Ans: 1
4. CC JUN '19 [10] Ans: 1
5. CC JUN '21 [7] Ans: 2
6. CC JUN '22 [5] Ans: 3
7. CC JAN '24 [12] Ans: 1

2.6 Word Problems – Inequalities

1. CC JAN '15 [13] Ans: 3
2. CC JUN '15 [24] Ans: 4
3. CC JAN '19 [4] Ans: 1
4. CC JUN '23 [14] Ans: 2
5. CC SEP '13 [9]
   $8x + 11y \geq 200$;
   $8x + 11(15) \geq 200$
   $8x + 165 \geq 200$
   $8x \geq 35$
   $x \geq 4.375$
   5 hours
6. CC AUG '18 [33]
   $135 + 72x \geq 580$
   $72x \geq 445$
   $x \geq 6.2$
   Minimum of 7 weeks
7. CC JUN '19 [33]
   $A = 5x + 50$
   $B = 6x + 25$
   $5x + 50 < 6x + 25$
   $25 < x$
   Minimum of 26 shirts
8. CC JAN '20 [26]
   $6.25a + 4.50y \leq 550$
   $6.25a + 4.50(45) \leq 550$
   $6.25a + 202.50 \leq 550$
   $6.25a \leq 377.50$
   $a \leq 55.6$
   Maximum of 55 adult-sized T-shirts
9. CC AUG '22 [35]
   $1.99x + 2.50(x + 2) + 2.99(2) \leq 25$
   $1.99x + 2.50x + 5 + 5.98 \leq 25$
   $4.49x + 10.98 \leq 25$
   $4.49x \leq 14.02$
   $x \leq 3.1225$
   Maximum of 3 pounds of grapes
10. CC AUG '23 [33]
    $15.79x + 5.69y \leq 125$;
    $15.79x + 5.69(9) \leq 125$
    $15.79x \leq 73.79$
    $x \leq 4.7$;
    4 cases can be bought; 5 cases would cost too much.

2.7 Conversions

1. CC JAN '15 [2] Ans: 2
2. CC JUN '16 [8] Ans: 1
3. CC AUG '16 [9] Ans: 3
4. CC JUN '17 [20] Ans: 4
5. CC JUN '18 [15] Ans: 1
6. CC AUG '18 [12] Ans: 3
7. CC JAN '19 [24] Ans: 4
8. CC JUN '19 [24] Ans: 1
9. CC AUG '19 [9] Ans: 4
10. CC JUN '21 [23] Ans: 2
11. CC JUN '22 [22] Ans: 1
12. CC AUG '22 [21] Ans: 2

13. CC JAN '23 [23] Ans: 4
14. CC JUN '23 [9] Ans: 2
15. CC AUG '23 [24] Ans: 1
16. CC JAN '24 [22] Ans: 2
17. CC JAN '17 [26]

$\frac{12\ \cancel{km}}{1\ hr} \times \frac{0.62\ mi}{1\ \cancel{km}} = 7.44\ mph$

$\frac{7.44\ mi}{1\ hr} = \frac{26.2\ mi}{x\ hrs}$

$x \approx 3.5\ hrs$

18. CC AUG '17 [30]

The grasshopper jumps 20 times its height. 5′9" = 69 inches. Therefore, the athlete jumps 69 × 20 = 1380 in per jump.

$1380\ in \cdot \frac{1\ ft}{12\ in} = 115$ ft per jump.

1 mile = 5280 ft would take $\frac{5280}{115} \approx 46$ jumps.

19. CC JAN '18 [27]

The rate of speed is measuring distance over time, so it would be expressed in feet per minute.

20. CC JAN '20 [27]

$\frac{4\ \cancel{pints}}{1\ \cancel{day}} \times \frac{2\ \cancel{cups}}{1\ \cancel{pint}} \times \frac{8\ ounces}{1\ \cancel{cup}} \times \frac{7\ \cancel{days}}{1\ week} = \frac{448\ ounces}{1\ week}$

Chapter 3 Linear Graphs

3.1 Determine Whether a Point is on a Line

1. CC AUG '16 [2] Ans: 3
2. CC AUG '17 [20] Ans: 3
3. CC JAN '20 [11] Ans: 1
4. CC JUN '22 [18] Ans: 4
5. CC AUG '22 [5] Ans: 4
6. CC JAN '23 [2] Ans: 4
7. CC JUN '23 [3] Ans: 1

3.2 Lines Parallel to Axes

There are no Regents exam questions on this topic.

3.3 Find Intercepts

1. CC AUG '14 [8] Ans: 1
2. CC JAN '15 [9] Ans: 4
3. CC JAN '24 [11] Ans: 3

3.4 Find Slope Given Two Points

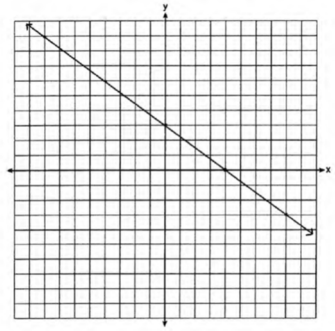
There are no Regents exam questions on this topic.

3.5 Find Slope Given an Equation

There are no Regents exam questions on this topic.

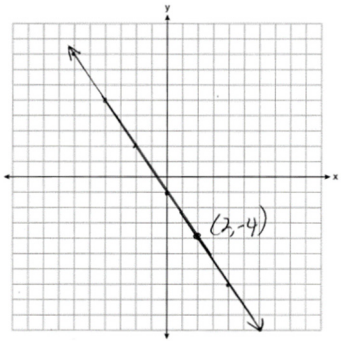
3.6 Graph Linear Equations

1. CC AUG '14 [13] Ans: 2
2. CC JUN '14 [29]



No, the point is not on the line.

3. CC AUG '19 [27]



$k = -4$

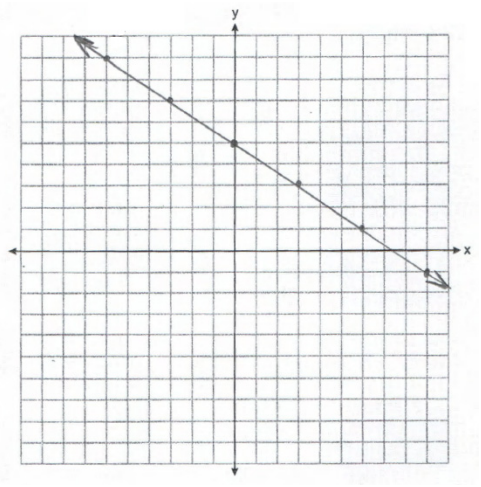
4. CC JUN '21 [27]

The height of the balloon increases 30.5 ft. per min. The balloon starts at a height of 8.7 ft.

5. CC JAN '24 [28]

$3y = -2x + 15$

$y = -\frac{2}{3}x + 5$



$(-6,9)$ is a solution because it is on the line and because $3(9) + 2(-6) = 15$.

3.7 Write an Equation Given a Point and Slope

1. CC AUG '23 [21] Ans: 1

3.8 Write an Equation Given Two Points

1. CC JAN '15 [11] Ans: 4
2. CC JUN '21 [24] Ans: 1
3. NG OCT '23 [2] Ans: 4
4. CC JUN '16 [29]

   Sue used point-slope form and Kathy used slope-intercept form. Both are correct as shown:

   $m = \frac{4-1}{-3-6} = -\frac{1}{3}$

   $y - y_1 = m(x - x_1)$

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

   $y = mx + b$

   $4 = -\frac{1}{3}(-3) + b$

   $4 = 1 + b$

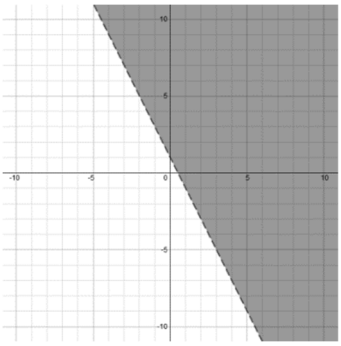
   $3 = b$

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

3.9 Graph Inequalities

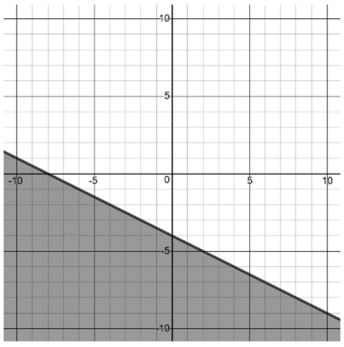
1. CC JUN '15 [5] Ans: 1
2. CC JAN '16 [5] Ans: 2
3. CC AUG '15 [26]

   $y > -2x + 1$

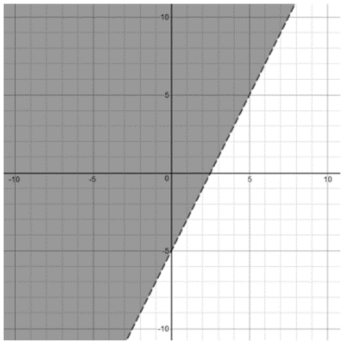


4. CC AUG '16 [34]

   The graph should be shaded below the line. Shawn may have forgotten to flip the sign when dividing by a negative while solving for y.

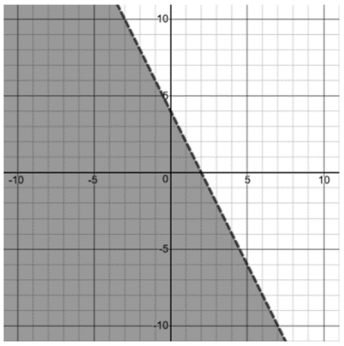


5. CC JAN '17 [29]



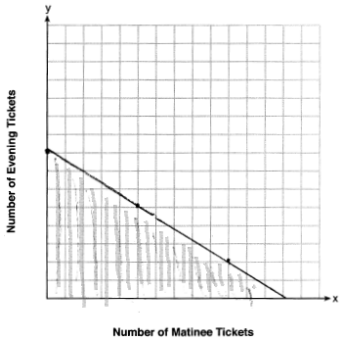
   Any point in the shaded area but not on the dashed line, such as (0,0).

6. CC JUN '17 [30]



7. CC JAN '19 [35]

   $7.5x + 12.5y \leq 100$



   $7.5x \leq 100$

   $x \leq 13.\overline{3}$, so the maximum is 13

4.1 Solve Linear Systems Algebraically

1. CC JUN '14 [14] Ans: 2
2. CC JAN '16 [21] Ans: 4
3. CC AUG '16 [22] Ans: 4
4. CC AUG '17 [24] Ans: 4
5. CC JAN '18 [15] Ans: 2
6. CC AUG '18 [22] Ans: 3
7. CC JAN '19 [22] Ans: 3
8. CC AUG '19 [22] Ans: 1
9. CC JAN '20 [20] Ans: 2
10. CC JUN '21 [20] Ans: 2

11. CC JUN '15 [33]

$$\begin{aligned} 3(8x+9y=48) &\rightarrow \quad 24x+27y=144 \\ -2(12x+5y=21) &\rightarrow \quad -24x-10y=-42 \\ \hline & \qquad 17y=102 \end{aligned}$$

$y = 6$

$y = \frac{-51}{-8.5} = 6,$

$8x + 9(6) = 48$

$8x = -6$

$x = -\frac{3}{4},$

Yes, $x = -\frac{3}{4}$ and $y = 6$ for both

4.2 Solve Linear Systems Graphically

1. CC JAN '15 [18] Ans: 3
2. CC JUN '16 [18] Ans: 4
3. CC JUN '17 [8] Ans: 1
4. CC JAN '17 [25]
   No. The two lines coincide, so there are infinitely many solutions.

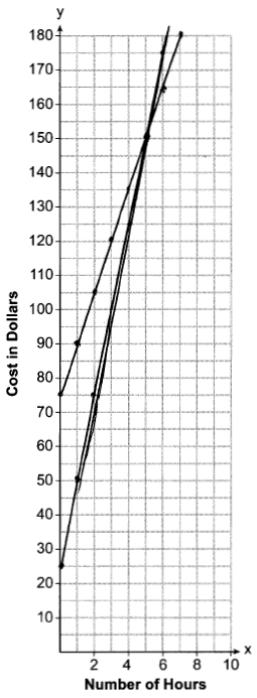
5. CC AUG '23 [37]

$a = 25x + 25$

$b = 15x + 75;$

$a = 25(10) + 25 = 275$ and

$b = 15(10) + 75 = 225$, so B costs less;



5 hours

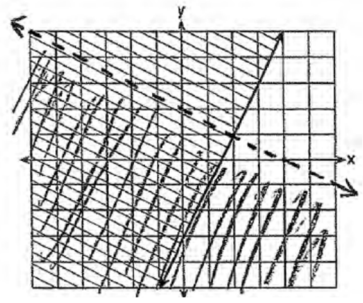
4.3 Solutions to Systems of Inequalities

1. CC SEP '13 [1] Ans: 2
2. CC JAN '17 [16] Ans: 4

4.4 Solve Systems of Inequalities Graphically

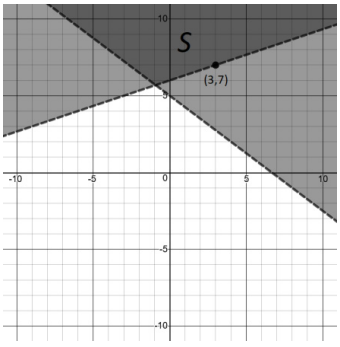
1. CC JUN '14 [4] Ans: 2
2. CC AUG '14 [7] Ans: 1
3. CC AUG '15 [6] Ans: 3
4. CC JAN '18 [20] Ans: 3
5. CC JAN '15 [34]

   $y \geq 2x - 3$,

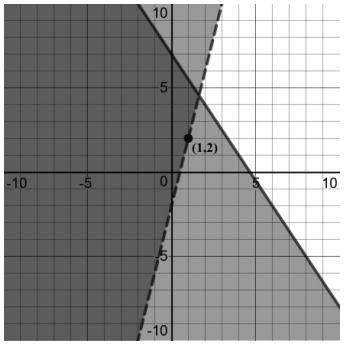
   ,

   Disagree since (2,1) is not a solution of $x + 2y < 4$
6. CC AUG '17 [35]

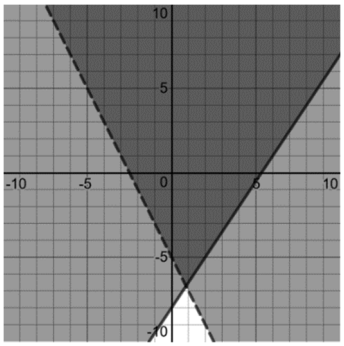
   

   (3,7) is not in the solution set because it is on a dashed boundary.
7. CC JAN '18 [28]

   (0,4) is located at the intersection of the two lines. However, since the line for the inequality $y < \frac{1}{2}x + 4$ is dashed, this point is not a solution to the system.
8. CC JUN '18 [35]

   (1,2) is not in the solution set because it lies on the dashed line.
9. CC AUG '18 [35]

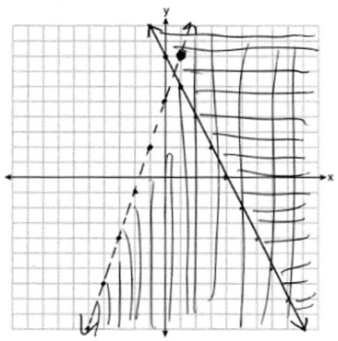
   

   (6,1) is on a solid line; (–6,7) is on a dashed line.
10. CC JUN '19 [36]

    $y < -3x + 3$ and $y \leq 2x - 2$

    Region A represents the solution set of the system. The gray region represents the solution set of $y \leq 2x - 2$.

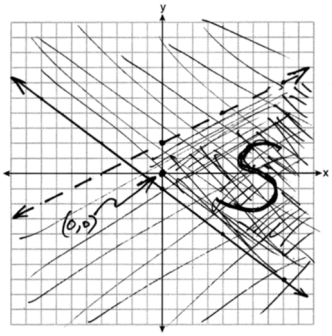
11. CC AUG '19 [33]



No, (1,8) falls on the boundary line of $y - 5 < 3x$, which is a dashed line. The points on a dashed line are not included in the solution.

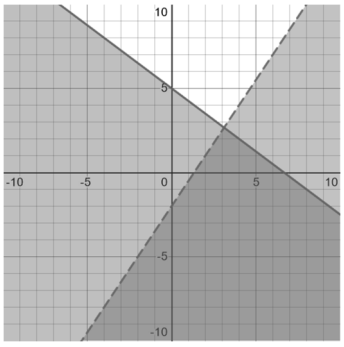
12. CC JAN '20 [34]

$y < \frac{1}{2}x + 2$ and $y \geq -\frac{3}{4}x - 1$



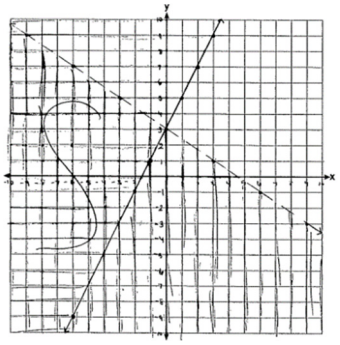
Stephen is correct because $(0,0)$ lies in the double-shaded region S, so it is in the solution set.

13. CC JUN '21 [35]



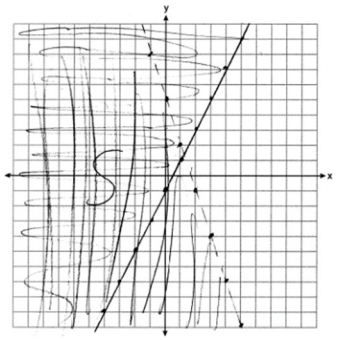
No, (6,3) does not lie in the solution set represented by the double-shaded region.

14. CC JUN '22 [36]



No, as $2(0) + 3(3) = 9$.

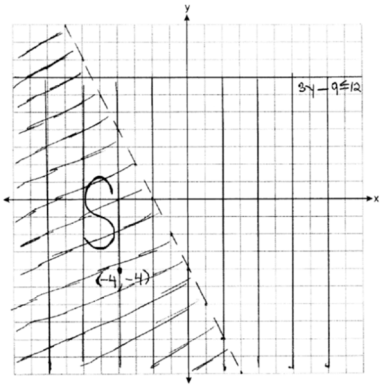
15. CC AUG '22 [36]



Yes, $(-5,0)$ is in the double-shaded region S.

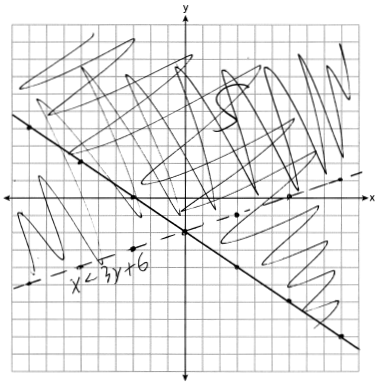
16. CC JAN '23 [36]

Eq. 1 → $y \leq 7$



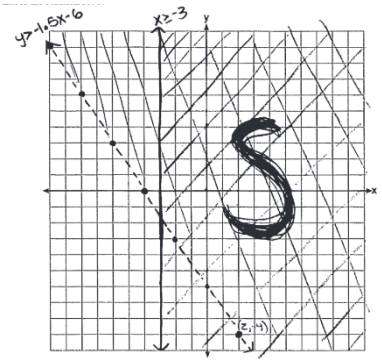
various answers such as $(-4, -4)$; the point lies in the double-shaded area

17. CC JUN '23 [35]



No, because $(4, -2)$ is a solution to the first inequality but not the second.

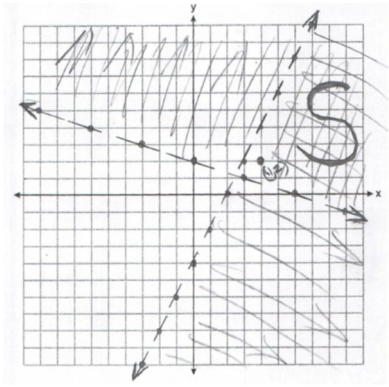
18. CC AUG '23 [36]



No, because $(2, -9)$ falls on a dashed line, which is not part of the solution set.

19. CC JAN '24 [36]

$y < 2x - 4$ and $y > -\frac{1}{3}x + 2$



Yes, (4,2) is in the double-shaded region of the solution set.

4.5 Word Problems – Linear Systems

1. CC AUG '14 [19] Ans: 4
2. CC JUN '15 [6] Ans: 3
3. CC JUN '16 [5] Ans: 1
4. CC JAN '18 [3] Ans: 1
5. CC AUG '18 [9] Ans: 2

6. CC JUN '14 [36]

$2.35c + 5.50d = 89.50$,

No because

$2.35(8) + 5.50(14) = 95.80$,

$c + d = 22$

$d = 22 - c$

$2.35c + 5.50(22 - c) = 89.50$

$121 - 3.15c = 89.50$

$-3.15c = -31.50$

$c = 10$

10 cats

7. CC JAN '15 [33]

$2p + 3d = 18.25$ and $4p + 2d = 27.50$,

Eq. 1 × –2 → $-4p - 6d = -36.50$

Eq. 2 → $4p + 2d = 27.50$

$-4d = -9$

$d = 2.25$

$2p + 3(2.25) = 18.25$

$2p + 6.75 = 18.25$

$2p = 11.50$

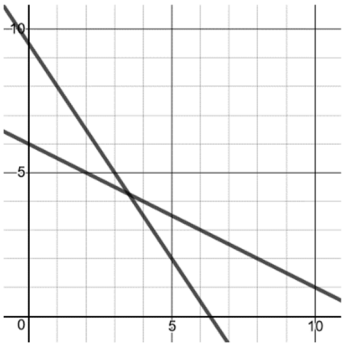
$p = 5.75$

popcorn \$5.75, drink \$2.25

8. CC JUN '16 [37]

$3x + 2y = 19$

$2x + 4y = 24$



Eq. 1 × 2 → $6x + 4y = 38$

Eq. 2 × –1 → $-2x - 4y = -24$

$4x = 14$

$x = 3.5$

$2(3.5) + 4y = 24$

$7 + 4y = 24$

$4y = 17$

$y = 4.25$

Cupcakes cost \$3.50 and brownies cost \$4.25 per package.

9. CC AUG '16 [37]

$18j + 32w = 19.92$

$14j + 26w = 15.76$

$14(0.52) + 26(0.33) = 15.86$

Eq. 1 × –7 → $-126j - 224w = -139.44$

Eq. 2 × 9 → $126j + 234w = 141.84$

$10w = 2.4$

$w = 0.24$

$18j + 32(0.24) = 19.92$

$18j + 7.68 = 19.92$

$18j = 12.24$

$j = 0.68$

A juice box is 68 cents and a water bottle is 24 cents.

10. CC JAN '17 [34]

Eq. 1 × –5 → $-5p - 10s = -79.75$

Eq. 2 × 2 → $6p + 10s = 91.80$

$p = 12.05$

11. CC JAN '17 [37]

$1000 - 60x = 600 - 20x$

$400 = 40x$

$10 = x$

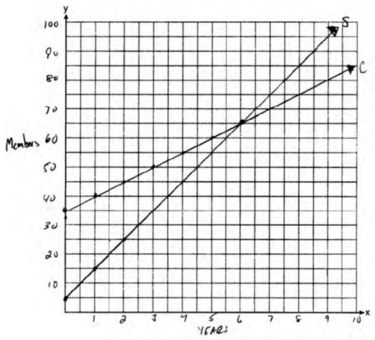
10 months

$1000 - 60(10) = \$400$

Ian is incorrect because $1000 - 60(16) = 40$, so he would still owe \$40.

12. CC JUN '17 [37]

$y = 10x + 5$ and $y = 5x + 35$.



(6,65) It took 6 years for the two clubs to have the same number of members, at which point they had 65 members each.

13. CC AUG '17 [28]

For \$50, Dylan can buy 14 games in Plan *B* but only 12 games in Plan *A*. Bobby can buy 20 games for \$65 under both plans, so he can choose either plan.

14. CC JAN '18 [37]

$d = 2c - 5$

$\frac{c+3}{d+3} = \frac{3}{4}$

No, because it doesn't make each equation true:

eg, $20 \neq 2(15) - 5$;

$\frac{c+3}{(2c-5)+3} = \frac{3}{4}$

$4(c + 3) = 3(2c - 2)$

$4c + 12 = 6c - 6$

$18 = 2c$

$c = 9$

$d = 2(9) - 5 = 13$

She had 9 cats and 13 dogs

15. CC JUN '18 [34]

$A(x) = 7 + 3(x - 2)$

$B(x) = 3.25x$

$7 + 3(x - 2) = 3.25x$

$7 + 3x - 6 = 3.25x$

$1 + 3x = 3.25x$

$1 = 0.25x$

$x = 4$ hours

16. CC JUN '18 [37]

$10d + 25q = 1755$

$d + q = 90$ or $d = 90 - q$

$10(90 - q) + 25q = 1755$

$900 - 10q + 25q = 1755$

$15q = 855$

$q = 57$

No, because $\$20.98 \times 1.08 > 90 \times 0.25$.

17. CC AUG '18 [37]

$b = 4s + 6$

$b - 3 = 7(s - 3)$

$4s + 6 - 3 = 7s - 21$

$3s = 24$

$s = 8$

$b = 4(8) + 6 = 38$

$38 + x = 3(8 + x)$

$38 + x = 24 + 3x$

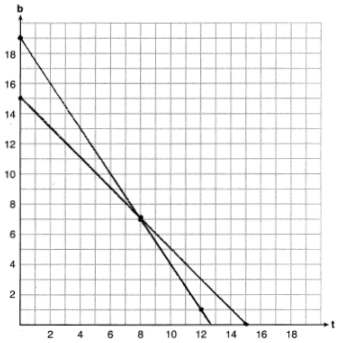
$2x = 14$

$x = 7$

18. CC JAN '19 [37]

$t + b = 15$

$3t + 2b = 38$



No, the point of intersection on the graph shows that 8 tricycles were ordered.

19. CC JUN '19 [37]

$4c + 3f = 16.53$

$5c + 4f = 21.11$

No, because $5(2.49) + 4(2.87) \neq 21.11$

Eq. $1 \times 4 \quad \rightarrow \quad 16c + 12f = 66.12$

Eq. $2 \times -3 \quad \rightarrow \underline{-15c - 12f = -63.33}$

$c = 2.79$

$4(2.79) + 3f = 16.53$

$3f = 5.37$

$f = 1.79$

20. CC AUG '19 [37]

$3.75A + 2.5D = 35$

$A + D = 12$

$3.75(12 - D) + 2.5D = 35$

$45 - 3.75D + 2.5D = 35$

$45 - 1.25D = 35$

$-1.25D = -10$

$D = 8$

$A + 8 = 12$, so $A = 4$

$7(2A + D) = 7(16) = 112$ eggs

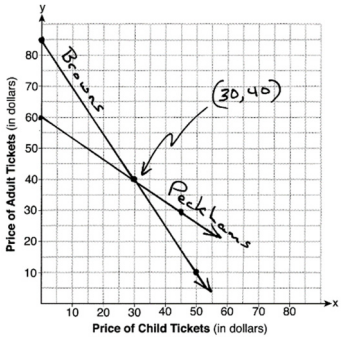
$112 \div 12 = 9\frac{1}{3}$ dozen

$\$2.50 \times 9 = \$22.50$

21. CC JAN '20 [37]

$3x + 2y = 170$

$4x + 6y = 360$



(30,40); child tickets cost \$30 and adult tickets cost \$40.

22. CC JUN '21 [37]

$4l + 8m = 40$

$5l + 2m = 28$

No, because $5(5.5) + 2(2.25) \neq 28$.

$-4l - 8m = -40$

$\underline{20l + 8m = 112}$

$16l = 72$

$l = 4.5$

$4(4.5) + 8m = 40$

$18 + 8m = 40$

$8m = 22$

$m = 2.75$

23. CC JUN '22 [37]

$4a + 2c = 325.94$

$2a + 3c = 256.95$

Eq. $1 \times -1 \rightarrow -4a - 2c = -325.94$

Eq. $2 \times 2 \rightarrow \quad \underline{4a + 6c = \quad 513.90}$

$4c = 187.96$

$c = 46.99$

$4a + 2(46.99) = 325.94$

$4a + 93.98 = 325.94$

$4a = 231.96$

$a = 57.99$

$57.99 + 3(46.99) = 198.96$

24. CC AUG '22 [37]

$30x + 50y = 420$

$15x + 35y = 270$

Peyton is wrong because

$15(2.75) + 35(6.75) = 277.50 \neq 270.$

Eq. 1 × –1 → $-30x - 50y = -420$

Eq. 2 × 2 → $\underline{30x + 70y = 540}$

$20y = 120$

$y = 6$

$30x + 50(6) = 420$

$30x = 120$

$x = 4$

Small sundaes are \$4 each and large sundaes are \$6 each

25. CC JAN '23 [35]

$l = 3w - 5$

$2l + 2w = 90;$

$2(3w - 5) + 2w = 90$

$6w - 10 + 2w = 90$

$8w = 100$

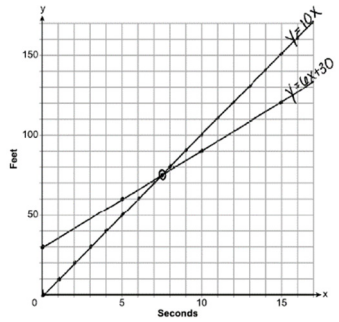
$w = 12.5$

$l = 3(12.5) - 5 = 32.5$

26. CC JAN '23 [37]

$y = 10x$

$y = 6x + 30$



$10 = 6x + 30$

$4x = 30$

$x = 7.5$ secs

27. CC JUN '23 [37]

$3r + 2d = 31.88$

$2r + d = 18.92;$

Eq. 1 → $3r + 2d = 31.88$

Eq. 2 × –2 → $\underline{-4r - 2d = -37.84}$

$-r = -5.96$

$r = 5.96$

$2(5.96) + d = 18.92$

$11.92 + d = 18.92$

$d = 7.00;$

$31.88 + 18.92 = 50.80$

$5(4.50) + 3(6.50) = 42.00$

$50.80 - 42.00 = 8.80$

28. CC JAN '24 [37]

$n + q = 28$

$0.05n + 0.25q = 4$

Eq. 1 × –0.05 → $-0.05n - 0.05q = -1.4$

Eq. 2 → $\underline{0.05n + 0.25q = 4}$

$0.20q = 2.6$

$q = 13$

$n + 13 = 28$, so $n = 15$

15 nickels and 13 quarters

$0.05x + 0.25x = 3$

$0.30x = 3$

$x = 10$

10 nickels and 10 quarters

4.6 Word Problems – Systems of Inequalities

1. CC JUN '17 [11] Ans: 1
2. CC AUG '18 [10] Ans: 2
3. CC JAN '23 [24] Ans: 2

4. CC MAY '13 [6]

$x + y \leq 800$ and $6x + 9y \geq 5000$;

yes, $6(440) + 9y \geq 5000$

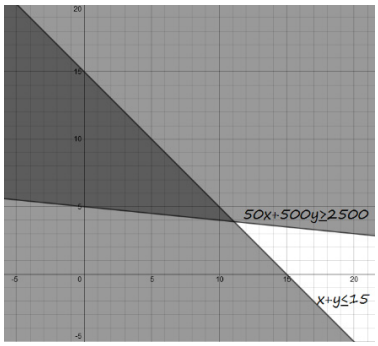
$2640 + 9y \geq 5000$

$9y \geq 2360$

$y \geq 262\frac{2}{9}$

$440 + 263 \leq 800$ ✓

5. CC JUN '15 [35]

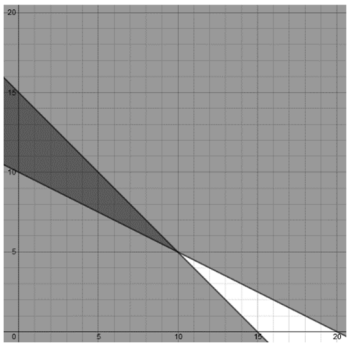


$50x + 500y \geq 2500$ and $x + y \leq 15$;

any point in the solution set, such as (4,7) for 4 printers, 7 computers

6. CC AUG '14 [37]

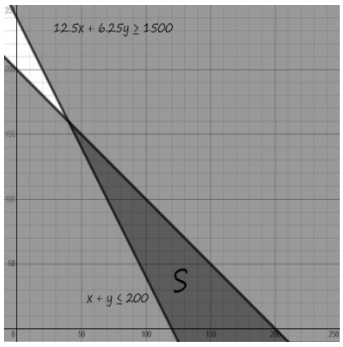
$x + y \leq 15$ and $4x + 8y \geq 80$



Solution stated such as (3,10) = 3 hrs. of babysitting and 10 hrs. at the library

7. CC JAN '16 [37]

$x + y \leq 200$ and $12.5x + 6.25y \geq 1500$

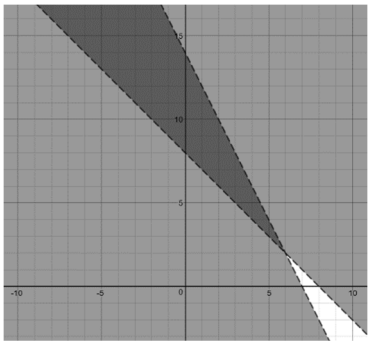


No, because the point (30,80) is not in the shaded area labelled S

8. CC JUN '16 [34]

$x + y > 8 \quad \rightarrow \quad y > -x + 8$

$2x + y < 14 \quad \rightarrow \quad y < -2x + 14$



(6,2) is not a solution as its falls on the edge of each inequality.

9. CC AUG '16 [35]

$x + y \leq 200$

$12x + 8.50y \geq 1000$

$12x + 8.50(50) \geq 1000$

$12x + 425 \geq 1000$

$12x \geq 575$

$x \geq \frac{575}{12} \approx 47.9$

Minimum of 48 tickets at the door

10. CC JAN '18 [35]

$2c + 1.5b \geq 500$

$c + b \leq 360$

$2(144) + 1.5b \geq 500$

$288 + 1.5b \geq 500$

$1.5b \geq 212$

$b \geq 141\frac{1}{3}$

At least 142 bottles must be sold

CHAPTER 5 POLYNOMIALS

5.1 Polynomial Expressions

1. CC JUN '16 [2] Ans: 4
2. CC JUN '18 [19] Ans: 3
3. CC JUN '19 [5] Ans: 1
4. CC JAN '20 [24] Ans: 4
5. CC JUN '21 [22] Ans: 4
6. CC JUN '22 [20] Ans: 2
7. CC AUG '22 [8] Ans: 1
8. CC AUG '22 [16] Ans: 2
9. CC JAN '23 [3] Ans: 3
10. CC JUN '23 [23] Ans: 4
11. CC AUG '23 [9] Ans: 3
12. CC JAN '24 [14] Ans: 3
13. CC AUG '16 [28]
    No, the leading coefficient is the coefficient of the term with the highest power, –2.

5.2 Add and Subtract Polynomials

1. CC JUN '14 [3] Ans: 2
2. CC JUN '16 [10] Ans: 2
3. CC JAN '17 [7] Ans: 4
4. CC JAN '19 [11] Ans: 3
5. CC AUG '23 [2] Ans: 3
6. CC JAN '24 [6] Ans: 2
7. CC JAN '15 [28]
   $-2x^2 + 6x + 4$
8. CC JUN '17 [25]
   $5x^2 - 10$

5.3 Multiply Polynomials

1. CC JAN '15 [10] Ans: 2
2. CC AUG '15 [9] Ans: 3
3. CC AUG '15 [24] Ans: 4
4. CC JAN '16 [10] Ans: 3
5. CC AUG '16 [12] Ans: 3
6. CC JAN '18 [13] Ans: 3
7. CC JUN '18 [3] Ans: 2
8. CC AUG '18 [13] Ans: 1
9. CC AUG '18 [24] Ans: 3
10. CC AUG '19 [3] Ans: 4
11. CC AUG '19 [12] Ans: 2
12. CC JUN '21 [8] Ans: 2
13. CC JUN '22 [17] Ans: 3
14. CC AUG '22 [6] Ans: 3
15. CC JAN '23 [1] Ans: 1
16. CC JUN '23 [4] Ans: 2
17. CC AUG '23 [8] Ans: 2
18. CC JAN '24 [15] Ans: 1
19. CC AUG '14 [28]

	x	5
$2x^2$	$2x^3$	$10x^2$
$7x$	$7x^2$	$35x$
–10	$-10x$	–50

    $2x^3 + 17x^2 + 25x - 50$
20. CC JUN '15 [28]
    $(2x^2 - 5x + 7)\left(\frac{1}{2}x^2\right) = x^4 - \frac{5}{2}x^3 + \frac{7}{2}x^2$
21. CC AUG '17 [31]
    $5x + 4x^2(2x + 7) - 6x^2 - 9x$
    $= 5x + 8x^3 + 28x^2 - 6x^2 - 9x$
    $= 8x^3 + 22x^2 - 4x$

22. CC JUN '19 [26]
$C = 3x^2 + 4 - 3(2x^2 + 6x - 5) =$
$3x^2 + 4 - 6x^2 - 18x + 15 = -3x^2 - 18x + 19$

23. CC JAN '20 [28]
$3x^2 + 21x - 4x - 28 - \frac{1}{4}x^2$
$2.75x^2 + 17x - 28$

24. CC JUN '22 [28]
$6(x^2 - xy) = 6x^2 - 6xy$ and
$3x(x - 2y) = 3x^2 - 6xy$.
$(6x^2 - 6xy) - (3x^2 - 6xy) = 3x^2$

25. CC JUN '23 [29]
$(x + 5)^2 + x^2 - 18$
$x^2 + 10x + 25 + x^2 - 18$
$2x^2 + 10x + 7$

5.4 Divide a Polynomial by a Monomial

There are no Regents exam questions on this topic.

Chapter 6 Introduction to Functions

6.1 Recognize Functions

1. CC JUN '15 [4] Ans: 3
2. CC AUG '15 [11] Ans: 2
3. CC JUN '17 [9] Ans: 3
4. CC JAN '18 [4] Ans: 2
5. CC JUN '18 [11] Ans: 4
6. CC JAN '19 [7] Ans: 4
7. CC JUN '19 [3] Ans: 4
8. CC AUG '19 [2] Ans: 4
9. CC JAN '20 [4] Ans: 2
10. CC JUN '21 [4] Ans: 4
11. CC AUG '22 [4] Ans: 4
12. CC JAN '23 [5] Ans: 1
13. CC JAN '24 [2] Ans: 3
14. CC JAN '15 [27]
    (–4,1) because the input –4 would lead to two different outputs, which a function cannot have
15. CC JAN '16 [26]
    no, it is not a function because for $x = 2$, there are two different values of y.
16. CC JAN '17 [32]
    Neither is correct. Nora is wrong; a circle is not a function because it fails the vertical line test. Mia's reason is wrong; a circle is not a function because the same x-value maps to multiple values of y.
17. CC AUG '18 [26]
    III and IV are functions. I has two y-values for $x = 6$, and II has two y-values for $x = 1$ and $x = 2$.

6.2 Function Graphs

1. CC JUN '14 [20] Ans: 1
2. CC AUG '18 [5] Ans: 1
3. CC AUG '18 [18] Ans: 1
4. CC JUN '21 [11] Ans: 4

6.3 Evaluate Functions

1. CC JUN '15 [15] Ans: 1
2. CC AUG '15 [12] Ans: 3
3. CC AUG '16 [5] Ans: 2
4. CC AUG '16 [11] Ans: 4
5. CC JAN '17 [10] Ans: 1
6. CC JUN '17 [5] Ans: 1
7. CC AUG '17 [4] Ans: 3
8. CC JUN '18 [2] Ans: 4
9. CC JUN '18 [8] Ans: 4
10. CC AUG '18 [11] Ans: 4
11. CC JAN '19 [2] Ans: 1
12. CC JAN '19 [21] Ans: 4
13. CC JUN '19 [2] Ans: 2
14. CC JAN '20 [1] Ans: 2
15. CC JUN '21 [3] Ans: 2
16. CC JUN '21 [15] Ans: 1
17. CC JUN '22 [2] Ans: 2
18. CC AUG '22 [1] Ans: 3
19. CC JAN '23 [4] Ans: 2
20. CC JUN '23 [11] Ans: 2

21. CC AUG '23 [14] Ans: 4
22. CC AUG '23 [18] Ans: 4
23. CC JAN '24 [10] Ans: 3
24. CC JAN '16 [32]
$f(5) = 8 \cdot 2^5 = 256$
$g(5) = 2^{5+3} = 2^8 = 256$
The functions are equal since they produce the same values for all inputs, *t*. This is shown by the fact that $8 \cdot 2^t = 2^3 \cdot 2^t = 2^{t+3}$
25. CC AUG '19 [25]
$g(-2) = -4(-2)^2 - 3(-2) + 2 = -8$

6.4 Features of Function Graphs

1. CC JUN '14 [9] Ans: 3
2. CC JAN '17 [21] Ans: 1
3. CC JUN '17 [1] Ans: 3
4. CC JUN '18 [20] Ans: 3

6.5 Domain and Range

1. CC JUN '14 [2] Ans: 4
2. CC JUN '14 [17] Ans: 4
3. CC AUG '14 [11] Ans: 1
4. CC AUG '14 [23] Ans: 2
5. CC JAN '15 [6] Ans: 2
6. CC JUN '15 [9] Ans: 4
7. CC JAN '16 [15] Ans: 1
8. CC JAN '16 [19] Ans: 2
9. CC JUN '16 [23] Ans: 4
10. CC AUG '16 [20] Ans: 2
11. CC JAN '17 [19] Ans: 4
12. CC AUG '17 [10] Ans: 1
13. CC JAN '18 [12] Ans: 3
14. CC JUN '18 [16] Ans: 3
15. CC JUN '18 [21] Ans: 2
16. CC AUG '18 [6] Ans: 2
17. CC JAN '19 [14] Ans: 2
18. CC JAN '19 [17] Ans: 4
19. CC JUN '19 [20] Ans: 4
20. CC AUG '19 [21] Ans: 4
21. CC JAN '20 [18] Ans: 1
22. CC JAN '20 [21] Ans: 4
23. CC JUN '21 [16] Ans: 2
24. CC JUN '22 [6] Ans: 2
25. CC AUG '22 [22] Ans: 2
26. CC JAN '23 [13] Ans: 4
27. CC JUN '23 [20] Ans: 2
28. CC JUN '23 [24] Ans: 1
29. CC AUG '23 [22] Ans: 4
30. CC JAN '24 [24] Ans: 4
31. CC JUN '14 [30]
yes, because each number in the domain leads to a unique number in the range
32. CC AUG '17 [29]
Since fractions of cookies may be eaten, the domain is continuous.
33. CC JUN '22 [29]
Domain is all real numbers. Range is $y \geq 3$.

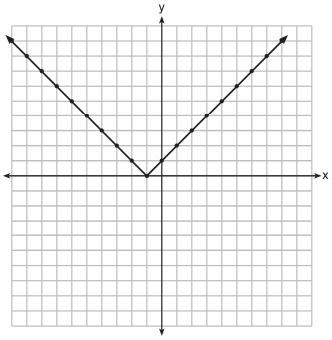
6.6 Absolute Value Functions

1. CC JUN '16 [22] Ans: 2
2. CC JAN '17 [12] Ans: 1

3. CC AUG '17 [2] Ans: 2

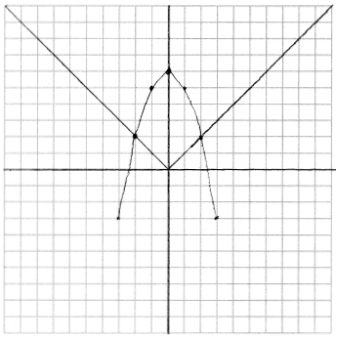
4. CC AUG '17 [18] Ans: 2

5. CC SEP '13 [10]



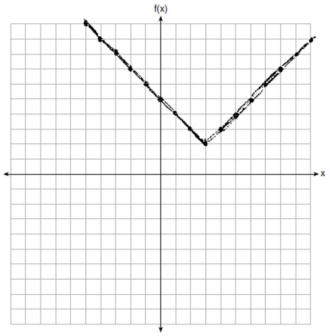
range $y \geq 0$; increasing for $x > -1$

6. CC JAN '17 [33]

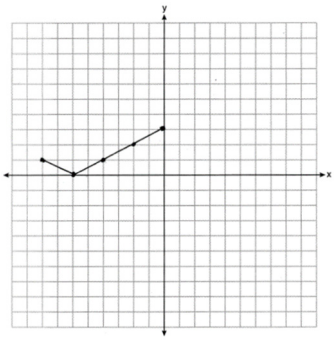


Yes, because the graph of $f(x)$ intersects the graph of $g(x)$ at $x = -2$.

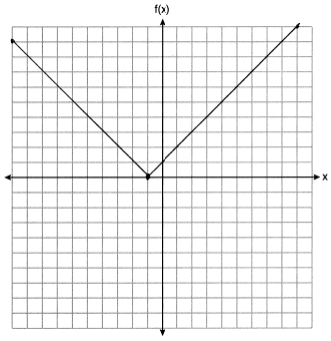
7. CC JAN '18 [25]



8. CC JUN '21 [26]



9. CC AUG '22 [25]



Chapter 7 Functions as Models

7.1 Write a Function from a Table

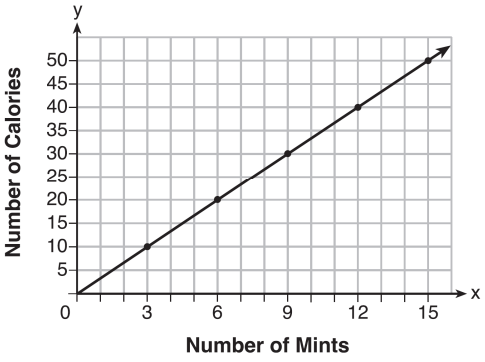
1. CC AUG '16 [4] Ans: 4
2. CC AUG '15 [25]
   $h(n) = 1.5n + 1.5$
3. CC AUG '15 [32]

d	1	2	3	4		5
$T(d)$	30	32	34	36		38

   $T(d) = 2(d-1) + 30$ or
   $T(d) = 2d + 28$
   $T(6) = 2(6) + 28 = 40$
4. CC JAN '17 [35]
   $m = \frac{9-7.50}{6-4} = 0.75$
   $f(x) = 0.75(x-4) + 7.50$
   $f(x) = 0.75x + 4.50$
   Each card costs 75¢ and start-up costs were $4.50.

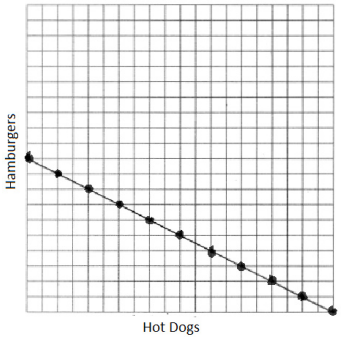
7.2 Graph Linear Functions

1. CC SEP '13 [8]



   $C(x) = \frac{10}{3}x$
   $\frac{10}{3}x = 180$
   $10x = 540$
   $x = 54$

2. CC AUG '17 [37]
   7 sodas cost $3.50, so they have $25 left to spend on food.
   $1.25x + 2.5y = 25$



   There are 11 combinations, represented by the dots in the graph.

7.3 Rate of Change for Linear Functions

1. CC AUG '15 [2] Ans: 3
2. CC JAN '16 [2] Ans: 2
3. CC AUG '16 [15] Ans: 4
4. CC JUN '17 [4] Ans: 2
5. CC JAN '16 [29]
   The slope is the amount paid per month and the y-intercept is the initial cost.

6. CC JUN '16 [30]
There are 2 inches of snow every 4 hours.

7. CC AUG '17 [33]
a) 10 hrs.
$55(4) + 65(t - 4) = 610$
$220 + 65t - 260 = 610$
$65t = 650$
$t = 10$
b) 0.3 hrs.
$55(2) + 65(t - 2) = 610$
$110 + 65t - 130 = 610$
$65t = 630$
$t \approx 9.7$
$10 - 9.7 = 0.3$

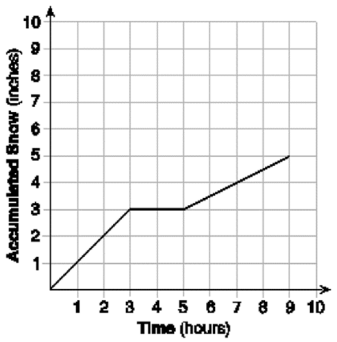
7.4 Average Rate of Change

1. CC MAY '13 [1] Ans: 4
2. CC JUN '14 [18] Ans: 1
3. CC AUG '14 [14] Ans: 4
4. CC JAN '15 [21] Ans: 1
5. CC JUN '15 [11] Ans: 3
6. CC AUG '15 [15] Ans: 1
7. CC JAN '16 [13] Ans: 4
8. CC JUN '16 [3] Ans: 1
9. CC AUG '16 [1] Ans: 1
10. CC AUG '17 [5] Ans: 2
11. CC JAN '18 [24] Ans: 2
12. CC JUN '21 [5] Ans: 2
13. CC AUG '23 [23] Ans: 4
14. CC JAN '16 [28]
from 1960–1965, because the decrease of 0.15 degrees is the largest change among the intervals (it has the steepest slope)
15. CC JAN '17 [31]
$\frac{480-140}{7-2} = 68$ mph
16. CC JAN '18 [36]
The domain may include fractions of hours, and the number of hours cannot be negative; $0 < t < 6$;
$\frac{0-120}{14-6} = -\frac{120}{8} = -15$; the business sold 15 less pairs of shoes per hour
17. CC AUG '18 [27]
$\frac{3.41-6.26}{9-3} = -0.475$
18. CC JUN '19 [29]
$\frac{33-1}{12-1} \approx 2.9$ and $\frac{36-11}{15-6} \approx 2.8$, so the interval from 1 a.m. to 12 noon has the greater rate.
19. CC JUN '22 [27]
$\frac{100-40}{4-1} = 20$ dollars per hour
20. CC JAN '24 [27]
$\frac{238-112}{4-2} = 63$ miles per hour

7.5 Functions of Time

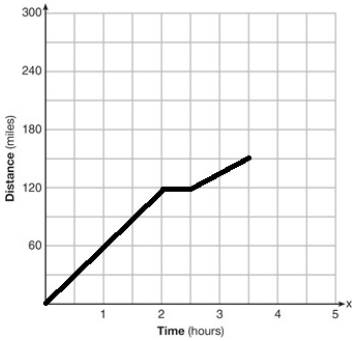
1. CC JUN '15 [2] Ans: 4
2. CC AUG '19 [18] Ans: 1
3. CC AUG '23 [1] Ans: 3
4. CC JAN '24 [1] Ans: 1

5. CC MAY '13 [7]



3.5

6. CC AUG '15 [28]



7. CC JUN '16 [35]

762 – 192 = 570 miles

92 – 32 = 60 minutes

$\frac{570}{60} = 9.5$ miles per minute

$y = 9.5x$

$192 + 9.5(120 - 32) = 1028$ miles

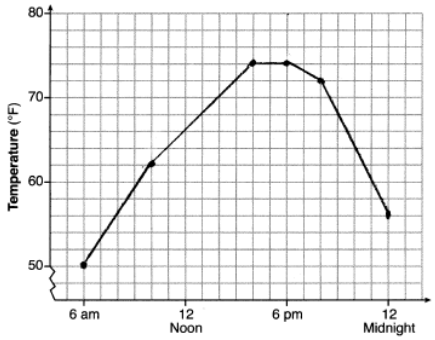
8. CC JUN '17 [34]

D to *E* because his speed was slower; Craig may have stopped to eat; $\frac{230}{7} \approx$ 32.9 mph

9. CC JAN '19 [28]

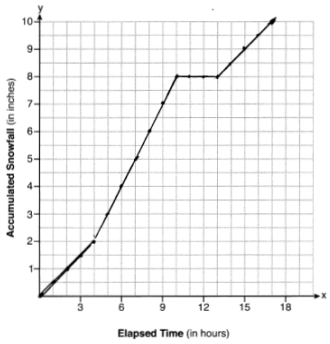
$2 < t < 6$ and $14 < t < 15$ because horizontal lines have a slope of zero.

10. CC JAN '19 [36]



6 am to 4 pm; $\frac{74-56}{6-12} = -3$

11. CC AUG '19 [36]



$\frac{10.0-0}{17.0-0} \approx 0.59$

12. CC JUN '22 [33]

The zeros represent when the height is 0, meaning that the kite is on the ground. The height is increasing over the intervals $0 < x < 0.5$ and $1 < x < 2$ minutes. The maximum height is 60 ft.

13. CC AUG '22 [33]

The bus stopped between *D* and *E*. The bus traveled fastest between *C* and *D* at 60 mph. The average rate of speed was $\frac{140}{4} = 35$ mph.

14. CC JAN '23 [33]

[20, 30]; 10,000; $\frac{4000-10000}{40-30} = -600$; The population decreases by 600 each year.

15. CC JUN '23 [34]

6 to 12; 9 to 12; $\frac{74-92}{24-12} = -\frac{3}{2}$; The temperature drops 1.5° every hour.

7.6 Systems of Functions

1. CC JAN '16 [17] Ans: 1
2. CC AUG '18 [19] Ans: 3
3. CC AUG '19 [14] Ans: 3
4. CC JAN '24 [17] Ans: 3
5. CC SEP '13 [15]
   $f(x) = 120x$ and $g(x) = 70x + 1600$
   $120x = 70x + 1600$
   $50x = 1600$
   $x = 32$
   $f(35) = 4200$, $g(35) = 4050$, so Green Thumb is less expensive
6. CC MAY '13 [8]
   $A(x) = 1.50x + 6$ and $B(x) = 2x + 2.50$
   $1.50x + 6 = 2x + 2.50$
   $3.50 = 0.50x$
   $7 = x$, so 7 rides
   $A(5) = 1.50(5) + 6 = 13.50$ and $B(5) = 2(5) + 2.50 = 12.50$, so B has a lower cost.
7. CC AUG '14 [27]
   $185 + 0.03x = 275 + 0.025x$
   $0.005x = 90$
   $x = 18{,}000$
8. CC JAN '15 [31]
   $36 + 15x = 48 + 10x$
   $5x = 12$
   $x = 2.4$
9. CC AUG '16 [30]
   –3 and 1, because the two functions intersect at (– 3,4) and (1,3).

7.7 Combine Functions

1. CC AUG '14 [6] Ans: 2
2. CC JUN '16 [25]
   $g(x) = 2(2x + 1)^2 - 1$
   $= 2(4x^2 + 4x + 1) - 1$
   $= 8x^2 + 8x + 2 - 1$
   $= 8x^2 + 8x + 1$

Chapter 8 Exponential Functions

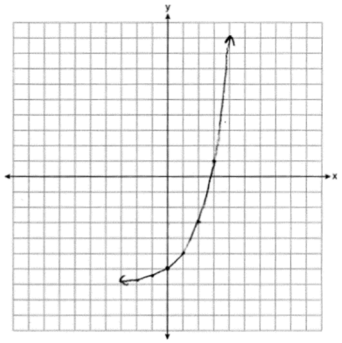
8.1 Exponential Growth and Decay

1. CC JAN '15 [4] Ans: 1
2. CC JAN '15 [8] Ans: 1
3. CC JUN '15 [17] Ans: 2
4. CC AUG '15 [7] Ans: 3
5. CC JAN '16 [3] Ans: 3
6. CC JAN '16 [8] Ans: 4
7. CC JUN '16 [17] Ans: 2
8. CC AUG '16 [17] Ans: 1
9. CC AUG '16 [24] Ans: 2
10. CC JAN '17 [24] Ans: 3
11. CC JUN '17 [12] Ans: 2
12. CC AUG '17 [14] Ans: 2
13. CC AUG '17 [16] Ans: 2
14. CC AUG '17 [21] Ans: 3
15. CC JAN '18 [2] Ans: 3
16. CC JAN '19 [12] Ans: 4
17. CC JUN '19 [23] Ans: 2
18. CC JAN '20 [2] Ans: 1
19. CC JAN '20 [14] Ans: 2
20. CC JUN '22 [21] Ans: 3
21. CC AUG '22 [9] Ans: 3
22. CC JAN '23 [11] Ans: 3
23. CC JUN '23 [8] Ans: 4
24. CC AUG '23 [12] Ans: 3
25. CC JAN '24 [5] Ans: 4
26. CC JAN '24 [20] Ans: 4
27. CC JUN '14 [26]
    rate of decay; number of milligrams of the substance at the start
28. CC AUG '14 [26]
    $B = 3000(1.042)^t$
29. CC JUN '15 [29]
    $600(1.016)^2 \approx 619.35$
30. CC AUG '15 [30]
    5%; in the decay function $y = a(1 - r)^x$, r represents the percent of change, $1 - r = 0.95$, so $r = 0.05 = 5\%$
31. CC JUN '17 [28]
    15%; in the decay function $y = a(1 - r)^x$, r represents the percent of change, $1 - r = 0.85$, so $r = 0.15 = 15\%$
32. CC JUN '18 [33]
    There are 20 rabbits at the start, and their population is growing at 1.4% per day.
    $\frac{p(100) - p(50)}{100 - 50} \approx 0.8$
33. CC AUG '18 [34]
    $V(t) = 25000(0.815)^t$
    $V(3) - V(4) \approx 2503.71$
34. CC JAN '19 [33]
    $V = 450(1.025)^t$
    No, because $(1.025)^{20} < 2$.
35. CC AUG '19 [34]
    $A(t) = 5000(1.012)^t$
    $A(32) - A(17) \approx 1200$

8.2 Graphs of Exponential Functions

1. CC AUG '14 [10] Ans: 3
2. CC JAN '15 [15] Ans: 3
3. CC JUN '19 [16] Ans: 2

4. CC JAN '15 [32]
   $y = 0.25(2)^x$, by entering (x,y) coordinates, for integer values of x from 2 to 5, into calculator, then STAT / ExpReg
5. CC JUN '15 [36]
   $y = 80(1.5)^x$; 3,030,140; No, because the number would grow so large it would be more than the number of potential customers
6. CC JAN '19 [29]



Yes, $f(4) > g(4)$ because $2^4 - 7 > 1.5(4) - 3$.

8.3 Rewrite Exponential Expressions

1.	CC JAN '15 [19]	Ans: 4	9.	CC JAN '20 [19]	Ans: 3
2.	CC JUN '15 [13]	Ans: 2	10.	CC JUN '21 [14]	Ans: 3
3.	CC JUN '16 [14]	Ans: 3	11.	CC JUN '22 [9]	Ans: 3
4.	CC JAN '17 [14]	Ans: 2	12.	CC AUG '22 [18]	Ans: 4
5.	CC JAN '18 [21]	Ans: 4	13.	CC JAN '23 [9]	Ans: 2
6.	CC AUG '18 [1]	Ans: 2	14.	CC JUN '23 [13]	Ans: 1
7.	CC JAN '19 [23]	Ans: 4	15.	CC AUG '23 [11]	Ans: 4
8.	CC AUG '19 [13]	Ans: 2	16.	CC JAN '24 [19]	Ans: 1

8.4 Compare Linear and Exponential Functions

1.	CC JUN '14 [6]	Ans: 4	16.	CC JUN '18 [14]	Ans: 4
2.	CC JUN '14 [15]	Ans: 3	17.	CC AUG '18 [2]	Ans: 1
3.	CC AUG '14 [12]	Ans: 3	18.	CC AUG '18 [23]	Ans: 4
4.	CC JAN '15 [5]	Ans: 3	19.	CC JAN '19 [16]	Ans: 3
5.	CC AUG '15 [18]	Ans: 3	20.	CC JUN '19 [6]	Ans: 1
6.	CC JAN '16 [16]	Ans: 4	21.	CC JUN '19 [11]	Ans: 3
7.	CC JAN '16 [23]	Ans: 1	22.	CC AUG '19 [7]	Ans: 2
8.	CC JUN '16 [6]	Ans: 1	23.	CC JAN '20 [17]	Ans: 3
9.	CC JUN '16 [21]	Ans: 3	24.	CC JUN '21 [17]	Ans: 4
10.	CC AUG '16 [18]	Ans: 1	25.	CC JUN '22 [8]	Ans: 3
11.	CC JAN '17 [11]	Ans: 3	26.	CC AUG '22 [13]	Ans: 2
12.	CC JUN '17 [7]	Ans: 1	27.	CC JAN '23 [8]	Ans: 1
13.	CC JUN '17 [21]	Ans: 3	28.	CC JAN '23 [16]	Ans: 2
14.	CC AUG '17 [17]	Ans: 1	29.	CC JUN '23 [7]	Ans: 1
15.	CC JAN '18 [5]	Ans: 1	30.	CC AUG '23 [17]	Ans: 3

31. CC SEP '13 [13]
$y = 836.47(2.05)^x$; The data appear to grow at an exponential rate; $y = 836.47(2.05)^2 \approx 3515$

32. CC JUN '14 [35]
$A(n) = 175 - 2.75n$
$175 - 2.75n = 0$
$n = 63.\overline{63}$
63 weeks; she won't have enough money for 64 rentals

33. CC AUG '15 [27]
exponential; the function does not grow at a constant rate; it is close to a function with a common ratio of 1.25.

34. CC JAN '16 [25]
linear; there is a constant rate of change (a slope of –1.25).

35. CC AUG '16 [27]
exponential, because the function does not grow at a constant rate.

36. CC JUN '17 [36]
$f(x) = 100x + 10$ and $g(x) = 10(2)^x$
Both, since $f(7) = 100(7) + 10 = 710$ and $g(7) = 10(2)^7 = 1280$.

37. CC JUN '18 [26]
Yes, because $f(x)$ does not have a constant rate of change.

38. CC JAN '19 [26]
Linear, because the function grows at a constant rate ($d = 87$).

39. CC JUN '21 [29]
No, Mike would be correct for a linear function, but not for an exponential function.

40. CC AUG '22 [26]
Exponential, because it does not decrease at a constant rate ($r \approx 0.53$).

41. CC JUN '23 [27]
No. The number of blocks increases at a constant amount, not a constant rate.

Chapter 9 Sequences

9.1 Arithmetic Sequences

1. CC JUN '14 [24] Ans: 2
2. CC AUG '14 [16] Ans: 2
3. CC JUN '16 [13] Ans: 3
4. CC JUN '18 [7] Ans: 1
5. CC AUG '18 [20] Ans: 4
6. CC JUN '19 [19] Ans: 2
7. CC JAN '20 [8] Ans: 2
8. CC JUN '21 [18] Ans: 4
9. CC JUN '22 [15] Ans: 3
10. CC JUN '23 [5] Ans: 2
11. CC JAN '23 [28]
    $d = \frac{15-3}{4-1} = \frac{12}{3} = 4$
12. CC AUG '23 [30]
    $d = \frac{17-5}{5-1} = \frac{12}{4} = 5$;
    $a_{21} = 5 + (21-1)(3) = 65$

9.2 Geometric Sequences

1. CC AUG '19 [24] Ans: 1
2. CC AUG '22 [2] Ans: 1
3. CC JAN '23 [17] Ans: 1
4. CC JAN '24 [4] Ans: 3
5. CC AUG '17 [26]
   Yes, because the sequence has a common ratio, 3.

Chapter 10 Irrational Numbers

10.1 Simplify Radicals

There are no Regents exam questions on this topic.

10.2 Operations with Radicals

1. NG OCT '23 [1] Ans: 1

10.3 Rationalize Denominators

1. NG OCT '23 [3]
   $\frac{3}{2\sqrt{6}} \cdot \left(\frac{\sqrt{6}}{\sqrt{6}}\right) = \frac{3\sqrt{6}}{12}$

10.4 Closure

1. CC JUN '14 [13] Ans: 3
2. CC AUG '14 [1] Ans: 1
3. CC JUN '15 [8] Ans: 2
4. CC AUG '15 [22] Ans: 2
5. CC JAN '16 [4] Ans: 1
6. CC JAN '18 [8] Ans: 3
7. CC JAN '19 [3] Ans: 3
8. CC JUN '19 [7] Ans: 1
9. CC JUN '21 [9] Ans: 3
10. CC JUN '23 [2] Ans: 3
11. CC JAN '15 [25]
    correct; 4.2 is rational and $\sqrt{2}$ is irrational, and the sum of a rational and irrational is always irrational
12. CC JUN '16 [26]
    $3\sqrt{2} \cdot 8\sqrt{18} = 24\sqrt{36} = 24(6) = 144$
    144 is an integer and all integers are rational.
13. CC AUG '16 [29]
    The sum is $7\sqrt{2}$, which is irrational. 7 is rational and $\sqrt{2}$ is irrational, and the product of a rational and irrational is always irrational.
14. CC JAN '17 [28]
    No. The second fraction is irrational because it is the quotient of an irrational and a rational. The sum is irrational because it is the sum of a rational and an irrational.
15. CC JUN '17 [27]
    Irrational. 7 is rational and $\sqrt{2}$ is irrational, and the difference of a rational and irrational is always irrational.

16. CC AUG '17 [25]
a is irrational. *b* and *c* are rational (*c* = 15). *a + b* is irrational because the sum of a rational and irrational is always irrational, and *b + c* is rational because the sum of two rationals is always rational.

17. CC JUN '18 [31]
Rational; $\sqrt{16} = 4$, so it is rational, and $\frac{4}{7}$ is a ratio of two integers, so it is also rational. The product of two rationals is always rational. (The product is $\frac{16}{7}$.)

18. CC AUG '19 [30]
No. For example, the product of irrational numbers $\sqrt{2}$ and $\sqrt{8}$ is $\sqrt{16}$, which is the rational number 4.

19. CC JAN '20 [30]
Product is irrational. $\sqrt{3}$ is irrational and $\sqrt{9} = 3$ is rational, and the product of an irrational number and a rational number is always irrational.

20. CC JUN '22 [25]
Product is –108.8, which is rational. $\sqrt{1024} = 32$ and -3.4 are both rational, and the product of two rational numbers is always rational.

21. CC AUG '22 [27]
Product is rational. Both $\sqrt{8} = 2\sqrt{2}$ and $\sqrt{98} = 7\sqrt{2}$ are irrational, so this alone tells us nothing about the product. However, $2\sqrt{2} \cdot 7\sqrt{2} = 14 \cdot 2 = 28$, which is rational.

22. CC JAN '23 [29]
$11\sqrt{3} + 3\sqrt{3} = 14\sqrt{3}$, which is irrational (the sum of two irrationals is always irrational);
$(11\sqrt{3})(3\sqrt{3}) = 99$, which is rational

23. CC AUG '23 [25]
Rational. The expression is equivalent to $\frac{2}{12} + \frac{13}{3}$ and the sum of two rational numbers is rational.

24. CC JAN '24 [26]
Irrational. $2\sqrt{3}$ is irrational because 3 is not a perfect square, and 6 is rational. The sum of a rational and an irrational is always irrational.

Chapter 11 Factoring

11.1 Factor Out the Greatest Common Factor

There are no Regents exam questions on this topic.

11.2 Factor a Trinomial

1. CC AUG '14 [15] Ans: 1
2. CC JUN '18 [10] Ans: 1
3. CC AUG '18 [3] Ans: 3
4. CC JAN '20 [12] Ans: 4
5. CC JUN '22 [4] Ans: 4
6. CC AUG '14 [25]
   $(x + 6)(x + 4)$ or $(x + 4)(x + 6)$, so 4 and 6

11.3 Factor the Difference of Perfect Squares

1. CC JUN '15 [3] Ans: 2
2. CC JUN '16 [1] Ans: 3
3. CC JUN '17 [6] Ans: 3
4. CC AUG '17 [3] Ans: 3
5. CC JAN '18 [9] Ans: 3
6. CC AUG '18 [7] Ans: 3
7. CC JUN '19 [1] Ans: 4
8. CC AUG '19 [8] Ans: 3
9. CC AUG '22 [3] Ans: 3
10. CC JUN '23 [1] Ans: 1

11.4 Factor Completely

1. CC JAN '15 [22] Ans: 3
2. CC JAN '16 [12] Ans: 3
3. CC AUG '16 [8] Ans: 2
4. CC JAN '17 [1] Ans: 2
5. CC AUG '19 [16] Ans: 3
6. CC JAN '20 [6] Ans: 3
7. CC JAN '20 [16] Ans: 2
8. CC JAN '23 [14] Ans: 1
9. CC JAN '24 [21] Ans: 3
10. CC JUN '14 [31]
    $(x^2 + 7)(x^2 - 1) =$
    $(x^2 + 7)(x + 1)(x - 1)$
11. CC JUN '21 [28]
    $(x^2 + 4)(x^2 - 4) =$
    $(x^2 + 4)(x + 2)(x - 2)$
12. CC JUN '22 [31]
    $x^2(x^2 - 36) = x^2(x + 6)(x - 6)$
13. CC AUG '22 [32]
    $3(y^2 - 4y - 96) = 3(y + 8)(y - 12)$
14. CC JAN '23 [31]
    $x(4x^2 - 49) = x(2x + 7)(2x - 7)$
15. CC JUN '23 [31]
    $2(x^2 + 8x - 9) = 2(x + 9)(x - 1)$
16. CC AUG '23 [31]
    $2(9x^2 - 1) = 2(3x + 1)(3x - 1)$
17. CC JAN '24 [32]
    $4(9 - x^2) = 4(3 + x)(3 - x)$

Chapter 12 Quadratic Functions

12.1 Solve Simple Quadratic Equations

1. CC JUN '14 [23] Ans: 1
2. CC AUG '14 [3] Ans: 3
3. CC JAN '15 [16] Ans: 1
4. CC JUN '15 [19] Ans: 2
5. CC JAN '17 [15] Ans: 4
6. CC JUN '23 [18] Ans: 4
7. CC SEP '13 [6]
   $\frac{1}{2}x^2 - 4 = 0$
   $x^2 - 8 = 0$
   $x^2 = 8$
   $x = \pm 2\sqrt{2}$
8. CC AUG '15 [35]
   $r = \sqrt{\frac{V}{\pi h}}$
   $d = 2r = 2\sqrt{\frac{V}{\pi h}} = 2\sqrt{\frac{66}{3.3\pi}} \approx 5$
9. CC JUN '16 [33]
   a) $H(1) = -16(1)^2 + 144 = 128$
      $H(2) = -16(2)^2 + 144 = 80$
      $128 - 80 = 48$ ft.
   b) $0 = -16t^2 + 144$
      $16t^2 = 144$
      $t^2 = 9$
      $t = \pm 3$
      3 secs (reject –3)
10. CC AUG '17 [27]
    $V = \frac{1}{3}\pi r^2 h$
    $3V = \pi r^2 h$
    $\frac{3V}{\pi h} = r^2$
    $r = \sqrt{\frac{3V}{\pi h}}$
    (reject negative radius)
11. CC JAN '18 [30]
    $r^2 = \frac{GM_1M_2}{F_g}$
    $r = \sqrt{\frac{GM_1M_2}{F_g}}$
12. CC JAN '19 [32]
    $4x^2 = 80$
    $x^2 = 20$
    $x = \pm\sqrt{20}$
13. CC JUN '19 [28]
    $5x^2 = 180$
    $x^2 = 36$
    $x = \pm 6$
14. CC AUG '19 [31]
    $6x^2 = 42$
    $x^2 = 7$
    $x = \pm\sqrt{7}$

12.2 Solve Quadratic Equations by Factoring

1. CC JUN '15 [10] Ans: 4
2. CC AUG '15 [13] Ans: 4
3. CC JAN '16 [9] Ans: 1
4. CC JUN '16 [12] Ans: 1
5. CC JAN '17 [2] Ans: 3
6. CC JUN '18 [4] Ans: 3
7. CC JUN '14 [33]
   $m(x) = 9x - 3x^2 - 3 + x + 4x^2 + 19$
   $m(x) = x^2 + 10x + 16$
   $x^2 + 10x + 16 = 0$
   $(x + 8)(x + 2) = 0$
   $\{-8, -2\}$

8. CC JAN '16 [27]
$y^2 - 6y + 9 = 4y - 12$
$y^2 - 10y + 21 = 0$
$(y - 3)(y - 7) = 0$
$\{3,7\}$

9. CC AUG '16 [36]
$0 = (B + 3)(B - 1)$
$0 = (8x + 3)(8x - 1)$
$\left\{-\frac{3}{8}, \frac{1}{8}\right\}$
Janice substituted *B* for 8*x*, resulting in a simpler quadratic to factor. Once factored, she could replace the 8*x* for *B*.

10. CC JAN '18 [26]
$x^2 - 4x + 3 = 0$
$(x - 1)(x - 3) = 0$
$\{1,3\}$

11. CC JAN '19 [27]
$x^2 - 8x - 9 = 0$
$(x - 9)(x + 1) = 0$
$\{-1, 9\}$
I factored the trinomial.

12. CC AUG '23 [29]
$x^2 - 9x - 36 = 0$
$(x - 12)(x + 3) = 0$
$\{-3, 12\}$

12.3 Find Quadratic Equations from Given Roots

1. CC MAY '13 [3] Ans: 2
2. CC JUN '14 [12] Ans: 3

12.4 Equations with the Square of a Binomial

1. CC AUG '14 [18] Ans: 4
2. CC JUN '15 [21] Ans: 1
3. CC AUG '15 [23] Ans: 3
4. CC JUN '16 [19] Ans: 3
5. CC JAN '18 [14] Ans: 1
6. CC JAN '20 [15] Ans: 3
7. CC AUG '16 [31]
$(x - 3)^2 - 49 = 0$
$(x - 3)^2 = 49$
$x - 3 = \pm 7$
$x = 3 \pm 7$
$\{-4,10\}$

12.5 Complete the Square

1. CC JUN '14 [8] Ans: 2
2. CC JUN '14 [10] Ans: 2
3. CC JAN '15 [17] Ans: 4
4. CC JUN '15 [23] Ans: 1
5. CC AUG '15 [20] Ans: 1
6. CC JAN '16 [14] Ans: 2
7. CC JAN '17 [22] Ans: 1
8. CC JUN '17 [22] Ans: 2
9. CC JUN '18 [12] Ans: 3
10. CC JAN '19 [15] Ans: 1
11. CC AUG '22 [15] Ans: 1
12. CC JAN '23 [19] Ans: 4
13. CC JUN '23 [6] Ans: 1
14. CC AUG '23 [20] Ans: 2
15. CC AUG '14 [32]
$9, c = \left(\frac{b}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = 9$
16. CC AUG '17 [32]
$x^2 - 6x + 9 = 15 + 9$
$(x - 3)^2 = 24$
$x - 3 = \pm\sqrt{24}$
$x = 3 \pm 2\sqrt{6}$

17. CC AUG '18 [30]
$x^2 + 4x + 4 = 2 + 4$
$(x + 2)^2 = 6$
$x + 2 = \pm\sqrt{6}$
$x = -2 \pm \sqrt{6}$

18. CC JAN '20 [31]
$x^2 - 8x = -6$
$x^2 - 8x + 16 = -6 + 16$
$(x - 4)^2 = 10$
$x - 4 = \pm\sqrt{10}$
$x = 4 \pm \sqrt{10}$

19. CC JUN '22 [32]
$x^2 - 8x = 5$
$x^2 - 8x + 16 = 5 + 16$
$(x - 4)^2 = 21$
$x - 4 = \pm\sqrt{21}$
$x = 4 \pm \sqrt{21}$

20. NG OCT '23 [4]
$x^2 + 6x = 41$
$x^2 + 6x + 9 = 41 + 9$
$(x + 3)^2 = 50$
$x + 3 = \pm\sqrt{50}$
$x = -3 \pm 5\sqrt{2}$

21. CC JAN '24 [31]
$x^2 - 8x + 16 = -41 + 16$
$(x - 4)^2 = -25$

12.6 Quadratic Formula and the Discriminant

1. CC SEP '13 [2] Ans: 1
2. CC JUN '18 [22] Ans: 3
3. CC JUN '19 [21] Ans: 2
4. CC AUG '15 [29]
no real solutions; the discriminant $b^2 - 4ac = (-2)^2 - 4(1)(5) = -16$ is negative
5. CC JAN '16 [34]
completing the square or quadratic formula;
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-16 \pm \sqrt{16^2 - 4(4)(9)}}{2(4)}$
$\approx -2 \pm 1.3 \approx \{-3.3, -0.7\}$
6. CC JUN '17 [35]
$2x^2 + 3x + 10 = 4x + 32$
$2x^2 - x - 22 = 0$
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{1 \pm \sqrt{(-1)^2 - 4(2)(-22)}}{2(2)}$
$\approx 0.25 \pm 3.33 \approx \{-3.1, 3.6\}$
Chose the quadratic formula because the equation could not be solved by factoring, and completing the square would require fractions.
7. CC JUN '18 [27]
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{1^2 - 4(1)(-5)}}{2(1)}$
$\approx 0.5 \pm 2.29 \approx \{-2.8, 1.8\}$
8. CC AUG '18 [28]
Irrational, since the discriminant $b^2 - 4ac = 3^2 - 4(2)(-10) = 89$ is not a perfect square.

9. CC JAN '23 [30]

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

$\approx 2 \pm 1.73 \approx \{0.27, 3.73\}$

10. CC JUN '23 [32]

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

$\approx 1.33 \pm 0.88 \approx \{0.5, 2.2\}$

11. CC AUG '23 [32]

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-3 \pm \sqrt{(3)^2-4(1)(-9)}}{2(1)}$

$\approx -1.5 \pm 3.354 \approx \{-4.85, 1.85\}$

12. CC JAN '24 [29]

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

$\approx 0.333 \pm 1.453 \approx \{-1.12, 1.79\}$

12.7 Word Problems – Quadratic Equations

1. CC AUG '14 [9] Ans: 3
2. CC JUN '16 [24] Ans: 2
3. CC AUG '17 [23] Ans: 4
4. CC JUN '23 [12] Ans: 2
5. CC AUG '23 [6] Ans: 1
6. CC JUN '14 [34]

$(2x + 16)(2x + 12) = 396$, the length of the garden plus walkway times the width of the garden plus walkway,

$4x^2 + 56x - 204 = 0$

$4(x^2 + 14x - 51) = 0$

$4\cancel{(x + 17)}(x - 3) = 0$

width = 3 m

7. CC AUG '14 [36]

$x(x + 40) = 6000$

$x^2 + 40x - 6000 = 0$

$\cancel{(x + 100)}(x - 60) = 0$

60 and 100

8. CC JAN '15 [37]

$(2x)(x - 3) = 1.25x^2$; the product of the new length and width give an area that is 1.25 larger;

$2x^2 - 6x = 1.25x^2$

$0.75x^2 - 6x = 0$

$x(0.75x - 6) = 0$

$\cancel{x = 0}$ or $x = 8$

$1.25(8)^2 = 80$

80 square meters

9. CC JUN '15 [27]

$60 + 5x = x^2 + 46$

$0 = x^2 - 5x - 14$

$0 = (x + 2)(x - 7)$

$\cancel{x = -2}$ or $x = 7$

Set the equations equal and solve for a positive *x*.

10. CC JUN '15 [32]

$w(2w) = 34$

$2w^2 = 34$

$w^2 = 17$

$w = \sqrt{17} \approx 4.1$

11. CC AUG '15 [31]

$0 \le t \le 4$, the roots 0 and 4 represent the start time and when it hits the ground in 4 seconds

12. CC AUG '15 [37]

$(2x + 8)(2x + 6) = 100$

$4x^2 + 28x - 52 = 0$

$x^2 + 7x - 13 = 0$

If *x* is the width of the frame, add 2*x* to each dimension to account for both sides, then multiply to find the area

$x = \frac{-7 \pm \sqrt{7^2-4(1)(-13)}}{2(1)} = \cancel{-8.5}$ or 1.5

13. CC JAN '16 [36]

width $= \frac{48-2x}{2} = 24 - x$

$x(24 - x) = 108$

$24x - x^2 = 108$

$-x^2 + 24x - 108 = 0$

$x^2 - 24x + 108 = 0$

$(x - 6)(x - 18) = 0$

{6,18} dimensions are 6 and 18 meters

14. CC JUN '18 [29]

$-16t^2 + 256 = 0$

$16t^2 = 256$

$t^2 = 16$

$t = 4$ (reject –4)

15. CC JAN '20 [36]

length $= \frac{w}{2} + 6$

$w\left(\frac{w}{2} + 6\right) = 432$

$\frac{w^2}{2} + 6w = 432$

$2\left[\frac{w^2}{2}\right] + 2[6w] = 2[432]$

$w^2 + 12w = 864$

$w^2 + 12w + 36 = 864 + 36$

$(w + 6)^2 = 900$

$w + 6 = \pm 30$

$w = -6 \pm 30$

width $w = 24$ (reject $w = -36$)

length = $\frac{24}{2} + 6 = 18$

16. CC JAN '24 [35]

$x(2x + 4) = 96$

$2x^2 + 4x - 96 = 0$

$2(x + 8)(x - 6) = 0$

Kelly's age $x = 6$ (reject $x = -8$)

Julia's age $2(6) + 4 = 16$

There is a difference of 10 years.

Chapter 13 Parabolas

13.1 Find Roots Given a Parabolic Graph

1. CC MAY '13 [2] Ans: 3
2. CC AUG '14 [5] Ans: 4
3. CC JAN '17 [6] Ans: 4
4. CC JAN '19 [9] Ans: 3
5. CC JUN '19 [18] Ans: 3
6. CC AUG '22 [7] Ans: 3
7. CC AUG '23 [15] Ans: 2
8. CC JUN '17 [33]
   $x^2 + 3x - 18 = 0$
   $(x + 6)(x - 3) = 0$
   $\{-6,3\}$
   The zeros are the x-intercepts on the graph of $r(x)$.
9. CC JAN '18 [32]
   yes, because the x-intercepts (roots) are –2 and 3.

13.2 Find Vertex and Axis Graphically

1. CC JAN '24 [13] Ans: 1

13.3 Find Vertex and Axis Algebraically

1. CC JUN '15 [14] Ans: 3
2. CC AUG '15 [21] Ans: 4
3. CC JAN '16 [22] Ans: 3
4. CC JUN '16 [11] Ans: 2
5. CC JAN '18 [23] Ans: 2
6. CC JUN '18 [13] Ans: 2
7. CC AUG '19 [17] Ans: 3
8. CC AUG '19 [23] Ans: 4
9. CC JAN '23 [20] Ans: 1
10. CC AUG '23 [16] Ans: 2
11. CC AUG '14 [29]
    the vertex for f is $(1,6)$ so the maximum is 6;
    for the vertex of g,
    $x = \frac{-4}{2\left(-\frac{1}{2}\right)} = 4$
    $y = -\frac{1}{2}(4)^2 + 4(4) + 3 = 11$
    the vertex is $(4,11)$ so the maximum is 11; therefore, $g(x)$ has the larger maximum

12. CC JAN '16 [33]

$t = \frac{-64}{2(-16)} = 2$

maximum at the vertex where $t = 2$ seconds;

$-16t^2 + 64t + 80 = 0$

$-16(t^2 - 4t - 5) = 0$

$-16(t + 1)(t - 5) = 0$

$t = 5$ (reject –1)

decreases from the vertex until it hits the ground at $h(t) = 0$, or when $2 < t < 5$

13. CC AUG '17 [36]

$x = \frac{-128}{2(-16)} = 4$

$h(4) = -16(4)^2 + 128(4) + 9000 = 9256$

$(4, 9256)$ The y-coordinate is the pilot's maximum height above the ground after being ejected.

$9256 - 9000 = 256$, so she was 256 feet above the aircraft.

14. CC JAN '18 [29]

$(x + 3)(x - 5) = 0$

$x^2 - 2x - 15 = 0$

$x = \frac{-(-2)}{2(1)} = 1$

(Alternate solution: $x = \frac{-3+5}{2} = 1$)

15. CC JUN '21 [36]

height is 112 ft.

$t = \frac{-96}{2(-16)} = 3$

$f(3) = -16(3)^2 + 96(3) + 112 = 256$

Vertex is $(3, 256)$; The ball reaches a maximum height of 256 ft. after 3 secs.

$-16t^2 + 96t + 112 = 0$

$t^2 - 6t - 7 = 0$

$(t - 7)(t + 1) = 0$

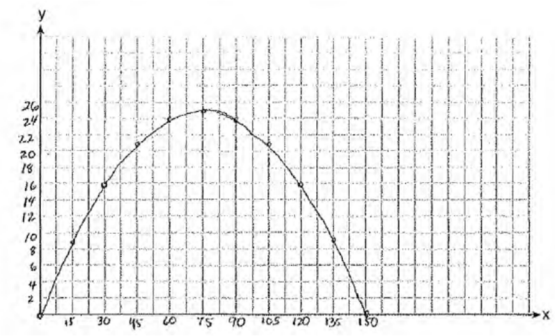
$t = 7$ (reject $t = -1$)

The height decreases over $3 < t < 7$.

13.4 Graph Parabolas

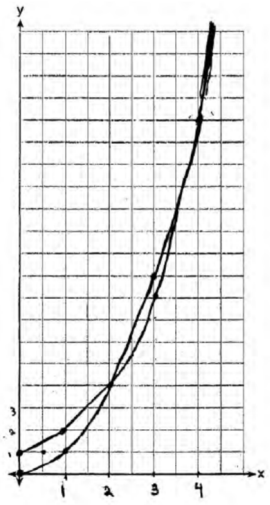
1. CC AUG '16 [13] Ans: 3
2. CC JUN '17 [24] Ans: 1
3. CC JAN '18 [11] Ans: 2
4. CC JAN '19 [13] Ans: 1
5. CC JUN '19 [14] Ans: 3
6. CC AUG '19 [10] Ans: 1
7. CC JAN '20 [13] Ans: 2
8. CC JAN '23 [15] Ans: 2

9. CC JUN '15 [37]



(75,25), maximum height of 25 feet at a distance of 75 feet; no, 45 yds = 135 ft and $h(135) = 9$.

10. CC AUG '15 [33]

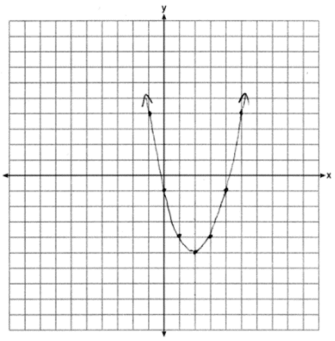


$f(20) = 400$ and $g(20) = 1{,}048{,}576$, so $g(x)$ is greater

11. CC JUN '16 [27]

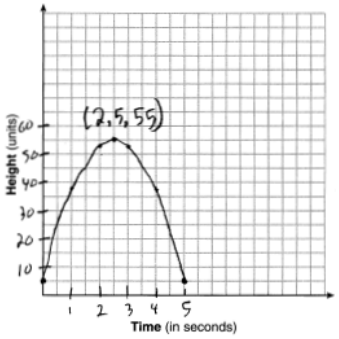
$x = \frac{-(-4)}{2(1)} = 2$

$y = (2)^2 - 4(2) - 1 = -5$



$x = 2$

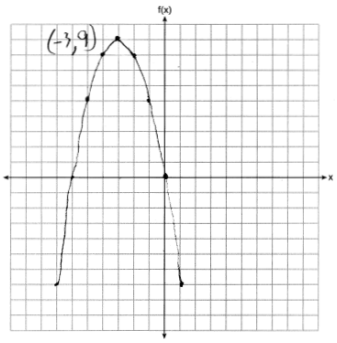
12. CC JAN '17 [36]



(2.5,55)

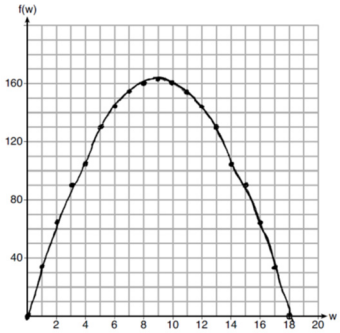
The ball reaches a maximum height of 55 units at 2.5 seconds.

13. CC JUN '17 [26]



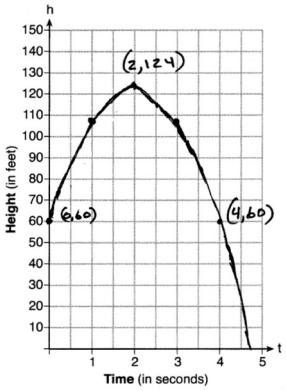
$(-3,9)$

14. CC AUG '18 [36]



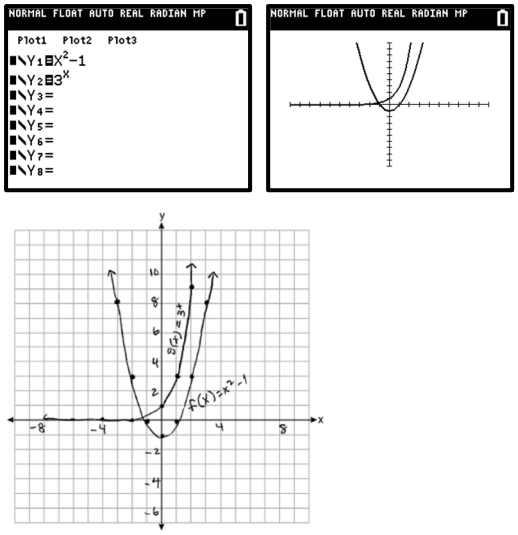
If the width is 9 ft, its area is 162 ft^2.

15. CC JAN '20 [33]



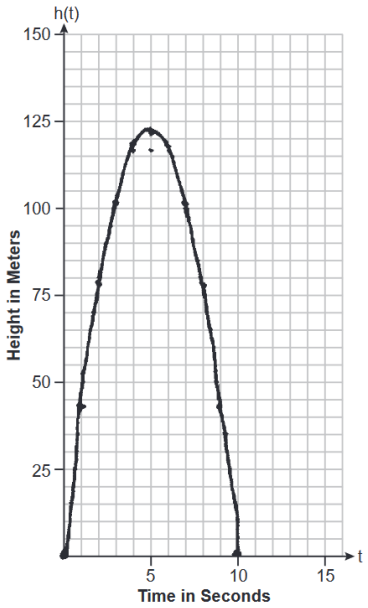
$\frac{124-60}{2-0} = 32$ ft/sec

16. CC JUN '22 [34]



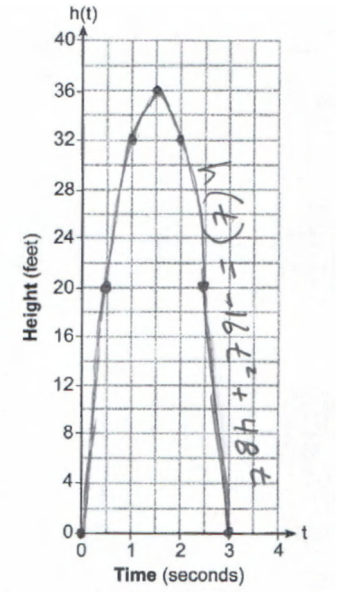
$f(x) = g(x)$ for one value of x because there is one point of intersection.

17. CC AUG '23 [34]



(5,122.5); After 5 seconds the rocket had reached a height of 122.5 meters.

18. CC JAN '24 [33]



36 feet; 3 seconds.

13.5 Vertex Form

1. CC JAN '16 [1] Ans: 2
2. CC JAN '16 [7] Ans: 4
3. CC JUN '16 [16] Ans: 3
4. CC JUN '17 [17] Ans: 3
5. CC AUG '19 [11] Ans: 1
6. CC JUN '23 [19] Ans: 3

7. CC JUN '19 [32]

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

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

$y + 8 + 1 = x^2 - 2x + 1$

$y + 9 = (x - 1)^2$

$y = (x - 1)^2 - 9$

Vertex is $(1, -9)$

8. CC JUN '21 [30]

$y = x^2 - 14x - 15$

$y + 15 = x^2 - 14x$

$y + 15 + 49 = x^2 - 14x + 49$

$y + 64 = (x - 7)^2$

$y = (x - 7)^2 - 64$

Vertex is $(7, -64)$

Chapter 14 Quadratic-Linear Systems

14.1 Solve Quadratic-Linear Systems Algebraically

1. CC AUG '15 [17] Ans: 2
2. CC JAN '19 [18] Ans: 3
3. CC JAN '23 [12] Ans: 4
4. CC JUN '17 [31]

   $x^2 = x$

   $x^2 - x = 0$

   $x(x-1) = 0$

   $\{0,1\}$

5. NG OCT '23 [5]

   $-y = -x + 5$

   $y = x - 5$

   $x - 5 = x^2 + 5x - 17$

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

   $(x+6)(x-2) = 0$

   $x = \{-6, 2\}$

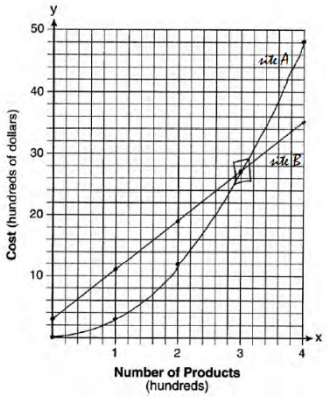
   $y = (-6) - 5 = -11$

   $y = (2) - 5 = -3$

   $(-6, -11)$ and $(2, -3)$

14.2 Solve Quadratic-Linear Systems Graphically

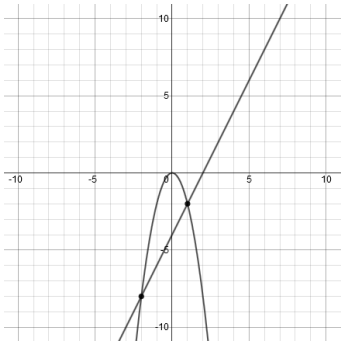
1. CC JAN '17 [23] Ans: 2
2. CC JAN '18 [10] Ans: 3
3. CC JUN '22 [16] Ans: 4
4. CC JUN '14 [37]



   3 because the graphs intersect where $x = 3$;

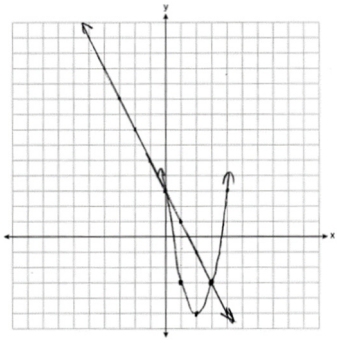
   site A because the costs $A(x) < B(x)$ at $x = 2$

5. CC AUG '14 [35]



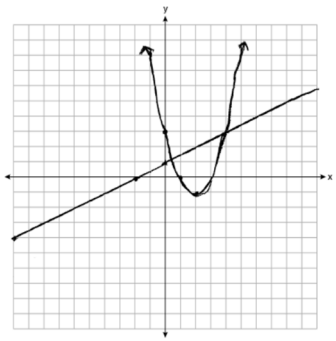
   –2 and 1

6. CC JUN '19 [34]



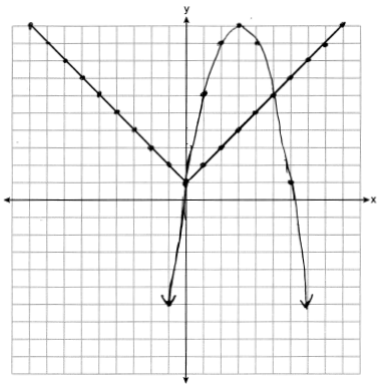
   0 and 3

7. CC AUG ‘22 [34]



$x = 0.5$ or $x = 4$, because these are the values of x where the graphs intersect.

8. CC JUN ‘23 [33]



0 and 5

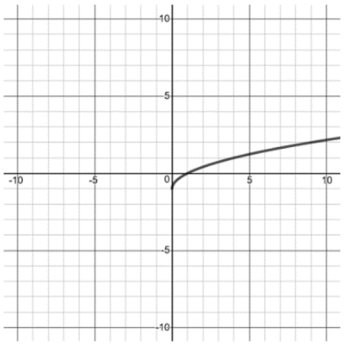
Chapter 15 Cubic and Radical Functions

15.1 Cubic Functions

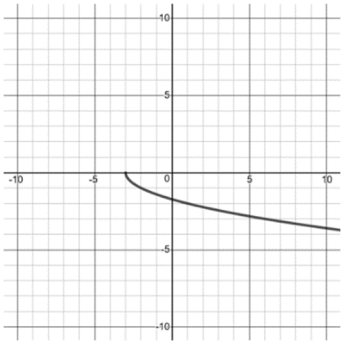
1. CC JAN '15 [24] Ans: 1
2. CC JUN '15 [12] Ans: 2
3. CC AUG '15 [4] Ans: 1
4. CC AUG '16 [23] Ans: 1
5. CC JUN '17 [10] Ans: 3
6. CC AUG '17 [7] Ans: 1
7. CC AUG '17 [19] Ans: 3
8. CC JAN '18 [6] Ans: 4
9. CC JUN '18 [18] Ans: 2
10. CC JUN '19 [8] Ans: 3
11. CC JAN '20 [9] Ans: 2
12. CC JUN '21 [12] Ans: 1
13. CC JAN '23 [22] Ans: 3
14. CC JUN '23 [10] Ans: 3
15. CC AUG '23 [3] Ans: 1
16. CC AUG '23 [13] Ans: 3
17. CC JAN '24 [23] Ans: 3
18. CC AUG '18 [25]
    Set each factor equal to zero and solve for x, or graph the function and find the x-intercepts. $-3, 1, 8$.
19. CC JAN '19 [30]
    $3x^3 + 21x^2 + 36x = 0$
    $3x(x^2 + 7x + 12) = 0$
    $3x(x + 4)(x + 3) = 0$
    $\{0, -4, -3\}$
20. CC JUN '23 [26]
    $\{-2, 2, 3\}$. The zeroes are the x-intercepts of f.

15.2 Square Root Functions

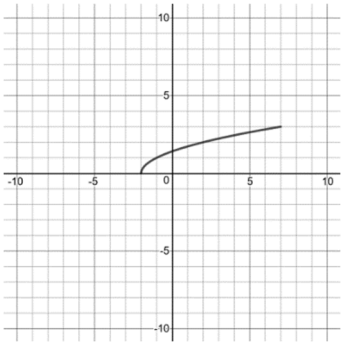
1. CC JUN '17 [3] Ans: 4
2. CC AUG '22 [14] Ans: 2
3. CC JUN '14 [25]



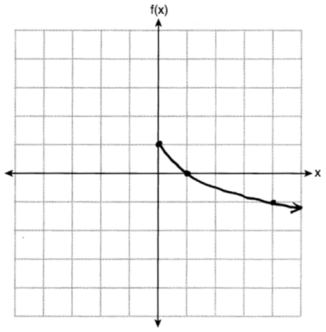
4. CC AUG '16 [25]



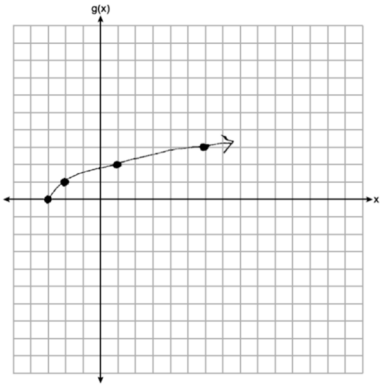
5. CC JUN '18 [25]



6. CC JAN ‘20 [25]

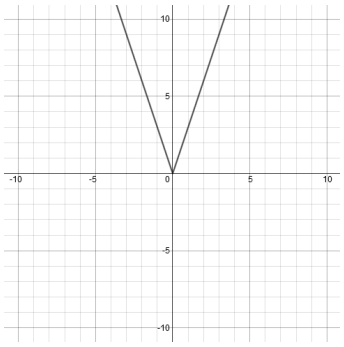


7. CC JAN ‘23 [25]



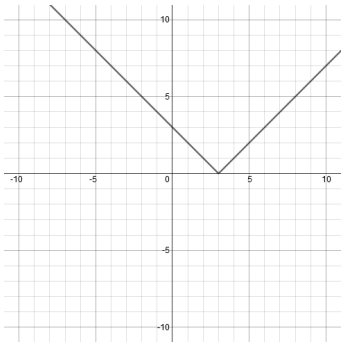
16.1 Translations

1. CC AUG '15 [1] Ans: 2
2. CC JAN '16 [20] Ans: 1
3. CC JAN '18 [19] Ans: 2
4. CC AUG '18 [8] Ans: 3
5. CC JAN '19 [10] Ans: 3
6. CC JUN '19 [4] Ans: 2
7. CC AUG '19 [5] Ans: 1
8. CC JAN '20 [7] Ans: 4
9. CC JUN '21 [13] Ans: 3
10. CC AUG '23 [5] Ans: 1
11. CC JAN '24 [7] Ans: 3
12. CC JUN '14 [28]
    $(4, -1)$, function is shifted 2 to the right
13. CC AUG '14 [33]



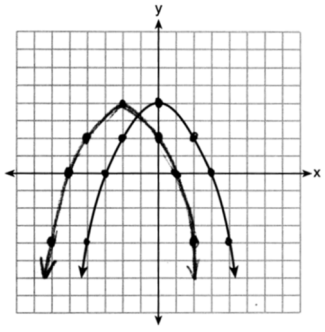
shifted 2 units down; shifted 4 units to the right

14. CC JUN '15 [25]



shifted 3 units to the right

15. CC JUN '16 [32]
    $g(x) = x^3 + 2x^2 - 4$ because $g(x)$ is a translation 4 units down.
16. CC AUG '16 [26]
    Translated 2 units right and 3 units down
17. CC JUN '17 [32]
    $g(x)$ is a translation a units right and $h(x)$ is a translation a units down.
18. CC JUN '18 [28]



19. CC JUN '22 [26]
    Translated 3 units right and 4 units down
20. CC AUG '22 [30]
    Translated 2 units left

16.2 Reflections

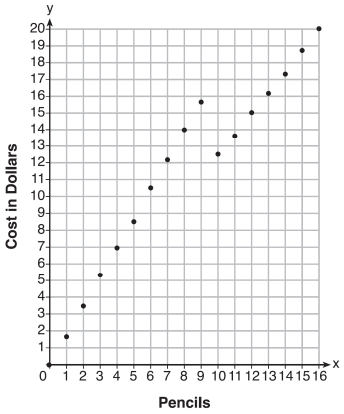
There are no Regents exam questions on this topic.

16.3 Stretches

1. CC AUG '14 [17] Ans: 1
2. CC JAN '15 [12] Ans: 2
3. CC JAN '17 [17] Ans: 2
4. CC AUG '22 [11] Ans: 4
5. CC JAN '23 [10] Ans: 1
6. CC JUN '23 [16] Ans: 3

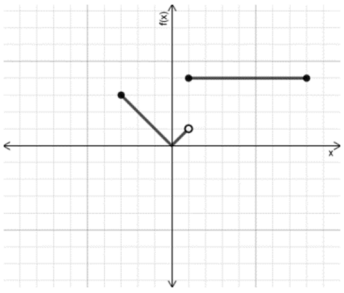
17.1 Piecewise Functions

1. CC AUG '14 [22] Ans: 2
2. CC AUG '15 [16] Ans: 2
3. CC AUG '18 [15] Ans: 4
4. CC JUN '22 [10] Ans: 3
5. CC SEP '13 [12]



Since according to the graph, 8 pencils cost \$14 and 10 pencils cost \$12.50, the cashier is correct.

6. CC JAN '15 [30]



7. CC JUN '15 [34]

$15(52 - 40) + 400 = 580$

$10(38) = 380$

$580 - 380 = \$200$

$15(x - 40) + 400 = 445$

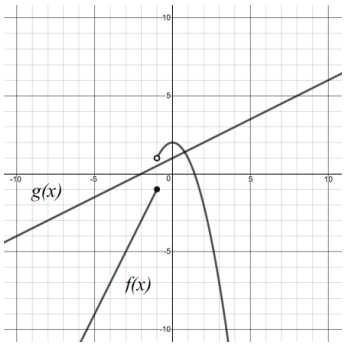
$15x - 600 + 400 = 445$

$15x = 645$

$x = 43$

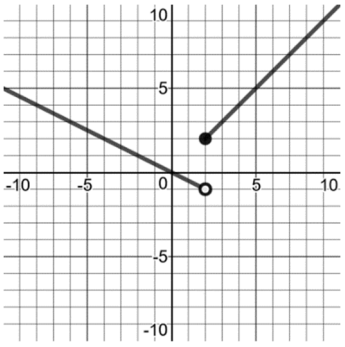
Solve $15(x - 40) + 400 = 445$ for x

8. CC JUN '16 [36]

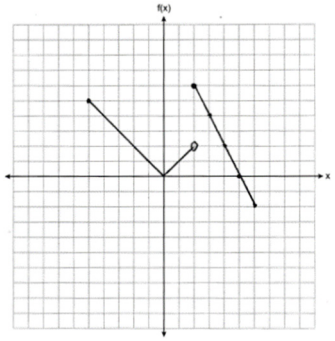


1, because there is one point of intersection

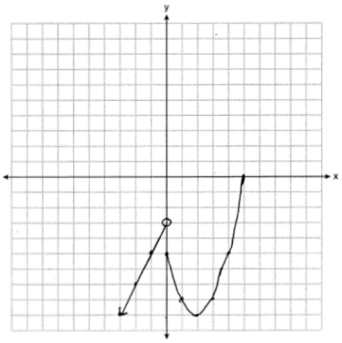
9. CC JUN '18 [32]



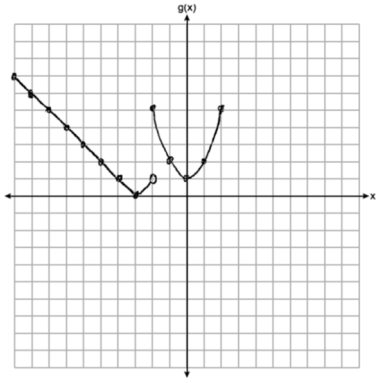
10. CC JUN '19 [27]



11. CC AUG ‘19 [32]



12. CC JAN ‘23 [32]



13. CC JUN ‘23 [30]
Answers may vary, such as:
I. Change (4,20) or (4,30) to an open circle, and II. Remove (–4,0) or (–4,4).

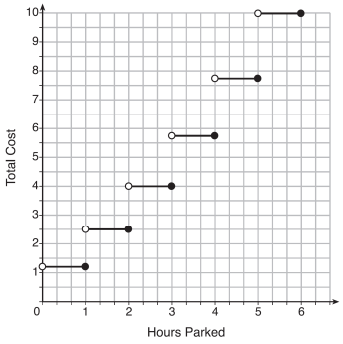
14. CC AUG ‘23 [27]
The function is not defined at $x = 3$ or for $x > 4$.

15. CC JAN ’24 [30]
$3 \leq 3$, so use the bottom expression.
$f(3) = -(3)^2 + 15 = -9 + 15 = 6$

17.2 Step Functions

1. CC JUN ‘15 [7] Ans: 1

2. CC SEP ‘13 [11]



The cost for each additional hour increases after the first 2 hours.

Chapter 18 Univariate Data

18.1 Types of Data

There are no Regents exam questions on this topic.

18.2 Frequency Tables

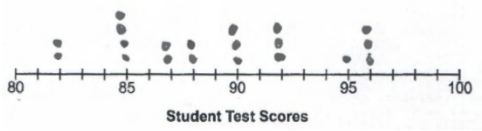
There are no Regents exam questions on this topic.

18.3 Histograms

There are no Regents exam questions on this topic.

18.4 Central Tendency

1. CC AUG '14 [4] Ans: 3
2. CC JUN '15 [20] Ans: 3
3. CC JAN '18 [16] Ans: 1
4. CC JAN '24 [25]



Median $= \frac{88 + 90}{2} = 89$

18.5 Distribution

1. CC JAN '17 [20] Ans: 4

18.6 Standard Deviation

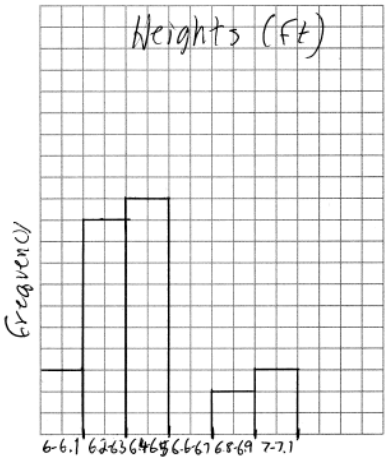
1. CC AUG '15 [19] Ans: 1
2. CC JUN '19 [22] Ans: 1
3. CC JAN '19 [31]
   Los Angeles because the standard deviation for LA (≈3.64) is less than the standard deviation for Miami (≈7.23)

18.7 Percentiles and Quartiles

1. CC JUN '14 [19] Ans: 3
2. CC JUN '16 [20] Ans: 3
3. CC JUN '17 [15] Ans: 4
4. CC JUN '22 [14] Ans: 3

5. CC AUG '17 [34]

Interval	Frequency
6.0 – 6.1	3
6.2 – 6.3	10
6.4 – 6.5	11
6.6 – 6.7	0
6.8 – 6.9	2
7.0 – 7.1	3



For 29 players, the upper quartile would be taller than 21 heights ($29 \times 0.75 = 21.75$). The 22nd value is in the 6.4 – 6.5 interval.

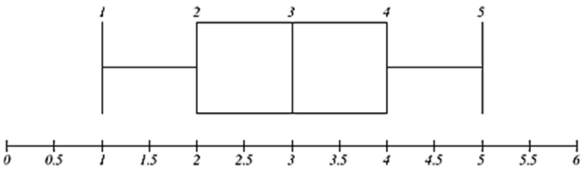
6. CC AUG '18 [31]
4th Period because the IQR and σ_x are greater for 4th Period.

7. CC AUG '22 [28]
$Q_3 = 61.5$ and $Q_1 = 51$, so the IQR is $61.5 - 51 = 10.5$.

18.8 Box Plots

1. CC JAN '15 [14] Ans: 4
2. CC AUG '16 [3] Ans: 4
3. CC JUN '18 [5] Ans: 2
4. CC AUG '19 [15] Ans: 1
5. CC JAN '20 [22] Ans: 4
6. CC JUN '21 [19] Ans: 3
7. CC AUG '22 [10] Ans: 1
8. CC JAN '23 [6] Ans: 3
9. CC AUG '23 [7] Ans: 3

10. CC JUN '14 [32]



11. CC JUN '23 [28]

Chapter 19 Bivariate Data

19.1 Two-Way Frequency Tables

1. CC JUN '16 [15] Ans: 4
2. CC JAN '17 [5] Ans: 2
3. CC JUN '18 [9] Ans: 1
4. CC AUG '18 [14] Ans: 2
5. CC JUN '19 [12] Ans: 2
6. CC AUG '19 [6] Ans: 2
7. CC JAN '20 [10] Ans: 3
8. CC AUG '22 [12] Ans: 2
9. CC JUN '23 [17] Ans: 2
10. CC JAN '24 [9] Ans: 4
11. CC JAN '15 [26]
    $\frac{33+12}{180} = 25\%$
12. CC JAN '16 [30]
    $\frac{70}{105} = \frac{2}{3}$; $\frac{2}{3} \times 351 = 234$
    234 males
13. CC JUN '17 [29]

	Watch Sports	Don't Watch Sports	Total
Like Pop	26	28	54
Don't Like Pop	34	12	46
Total	60	40	100

14. CC JAN '23 [26]
    $\frac{46}{39+46+37} \approx 38\%$
15. CC AUG '23 [26]

	Horse	Dolphin	Penguin	Total
Male	28	18	23	69
Female	14	42	25	81
Total	42	60	48	150

19.2 Scatter Plots

There are no Regents exam questions on this topic.

19.3 Correlation and Causality

1. CC JAN '17 [13] Ans: 2
2. CC AUG '17 [8] Ans: 2
3. CC AUG '18 [21] Ans: 3
4. CC JUN '22 [1] Ans: 2

19.4 Identify Correlation in Scatter Plots

1. CC JUN '16 [4] Ans: 2

19.5 Lines of Fit

1. CC AUG '14 [21] Ans: 4
2. CC JAN '19 [1] Ans: 2
3. CC SEP '13 [7]
   $y = 0.05x - 0.92$
4. CC AUG '16 [33]
   $y = 17.159x - 2.476$
   $y = 17.159(0.65) - 2.476 \approx 8.7$

5. CC JAN '18 [34]
$y = -8.5x + 99.2$; the y-intercept represents the original length of the rope; the slope represents how much shorter the rope gets (8.5 cm) after each knot.

19.6 Correlation Coefficients

1. CC JUN '14 [11] Ans: 3
2. CC JUN '15 [16] Ans: 2
3. CC AUG '16 [6] Ans: 2
4. CC JAN '17 [3] Ans: 4
5. CC JUN '17 [14] Ans: 1
6. CC AUG '17 [22] Ans: 1
7. CC AUG '22 [23] Ans: 1
8. CC JAN '15 [35]
0.94; it shows a strong positive relationship between the calories and mg of sodium
9. CC AUG '15 [36]
$y = 0.16x + 8.27$; 0.97, a strong association
10. CC JAN '16 [35]
$f(t) = -58t + 6182$; –0.94; yes, because it is close to –1
11. CC JAN '18 [31]
$y = 0.81x + 15.19$; 0.92; there is a high positive correlation between mathematics and physics scores.
12. CC JUN '18 [36]
$y = 0.96x + 23.95$; 0.92; there is a high positive correlation between scoring 85 or better on the math and English exams.
13. CC JAN '19 [34]
$y = 1.9x + 29.8$; $r = 0.3$, which represents a weak correlation between a dog's mass and height.
14. CC JUN '19 [35]
$y = 7.79x + 34.27$; $r = 0.98$, which represents a high positive correlation between hours spent studying and test scores.
15. CC AUG '19 [35]
$y = -7.76x + 246.34$; $r = -0.88$. There is a negative correlation; as the distance from Times Square increases, the cost of a room decreases.
16. CC JAN '20 [35]
$f(p) = -0.79p + 249.86$; $r = -0.95$. There is a strong negative correlation; as the sales price increases, the number of new homes available decreases.
17. CC JUN '21 [33]
$y = 1.72x + 69.4$; $r = 0.97$. There is a strong positive correlation; as the number of jumping jacks increases, the heart rate increases.
18. CC JUN '22 [35]
$y = -0.96x + 64.74$; $r = -0.98$. There is a strong negative correlation; as the driver's age increases, the percentage of accidents caused by speeding decreases.
19. CC JAN '23 [34]
$y = -2.81x + 97.55$; $r = -0.97$. There is a strong negative correlation.

20. CC JUN ‘23 [36]
$y = 184.89x - 1706.07$; $r = 0.99$.
There is a strong positive correlation; as the height of the horse increases, the weight of the horse increases.
21. CC AUG ‘23 [35]
$y = 0.41x - 2.31$; $r = 0.99$; it is a very strong positive correlation.
22. CC JAN ’24 [34]
$y = 40.48x + 363.81$; $r = 0.84$; there is a strong positive correlation between attendance at SAT Prep classes and Math SAT scores.