Lesson 3.1.1 p. 124-125; 5-12

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

| | $2x$ | $-3$ |
|---|---|---|
| $-3$ | $-6x$ | $9$ |
| $2x$ | $4x^2$ | $-6x$ |

$4x^2-12x+9+5$

$4x^2-12x+14$

~~$4x^2-6x-6x+9+5$~~

b. $\left(\frac{3x^2y}{x^3}\right)^4$

$\frac{3x^2y}{x^3} \cdot \frac{3x^2y}{x^3} \cdot \frac{3x^2y}{x^3} \cdot \frac{3x^2y}{x^3}$

$\frac{81x^8y^4}{x^{12}}$

$\frac{81y^4}{x^4}$

6. a. $\sqrt{4x^2y^4} = 2xy^2$ [3]

b. $\sqrt{8x^2y} = 2x\sqrt{2y}$ [4]

($\sqrt{4}\sqrt{2}$)

c. $\sqrt{4x^2y} = 2x\sqrt{y}$ [1]

d. $\sqrt{16xy^2} = 4y\sqrt{x}$ [5]

e. $\sqrt{8xy^2} = 2y\sqrt{2x}$ [2]

($\sqrt{4}\sqrt{2}$)

7. Both are correct. Dylan simplified inside ( ) first.

Bonnie: $\frac{8x^{15}y^{12}}{512x^3y^9}$

$\frac{8(2)^{15}(3)^{12}}{512(2)^3(3)^9} = 1728$

Dylan: $\left(\frac{x^4y}{4}\right)^3$ let $x=2$, $y=3$

$\left(\frac{(2)^4(3)}{4}\right)^3 = (12)^3 = 1728$

Same answer, so the expressions are equivalent.

8. a. Horizontal line at $y=3$

D: $\mathbb{R}$

R: $y=3$

b. Vertical line at $x=-2$

D: $x=-2$

R: $\mathbb{R}$

c. $(-2, 3)$

9. $(342 = 23m + b) \cdot -1$

$147 = 10m + b$

$+ \quad -342 = -23m - b$

$-195 = -13m$

$m = 15$

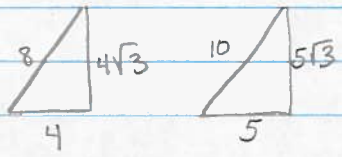
$147 = 10(15) + b$

$147 = 150 + b$

$b = -3$

$(-3, 15)$ or $b=-3$, $m=15$

10. a.




b. long leg $= n\sqrt{3}$

Hypotenuse $= 2n$

11. 3, 9, ...

| Arithmetic | Geometric |
|---|---|
| a. 3, 9, 15, 21, 27, 33, ... | b. 3, 9, 27, 81, 243, 729, ... |
| $t(n) = -3 + 6n$ | $t(n) = 1(3)^n$ |

c. 3, 4, 6, 9, 13, 18 (+1, +2, +3, +4)

$t(n+1) = t(n) + n, \quad t(0) = 3$

12. a. $25^{\frac{1}{2}} = \frac{1}{25^{1/2}} = \frac{1}{\sqrt{25}} = \frac{1}{5}$

b. $\left(\frac{1}{27}\right)^{\frac{1}{3}} = (27)^{\frac{1}{3}} = \sqrt[3]{27} = 3$

c. $9^{\frac{3}{2}} = \left(\sqrt{9}\right)^3 = 3^3 = 27$

d. $16^{-3/4} = \frac{1}{16^{3/4}} = \frac{1}{\left(\sqrt[4]{16}\right)^3} = \frac{1}{2^3} = \frac{1}{8}$

Lesson 3.1.2 (day 1) p. 129-130 :: 23-29

23 a. $(x+3)^2$ and $x^2+9$

| | | |
|---|---|---|
| 3 | 3x | 9 |
| x | $x^2$ | 3x |
| | x | 3 |

$= x^2+6x+9$

Not equivalent

b. $(x+4)^2$ and $(x^2+8x+16)$

| | | |
|---|---|---|
| 4 | 4x | 16 |
| x | $x^2$ | 4x |
| | x | 4 |

$= x^2+8x+16$

Equivalent

c. $(x+1)(2x-3)$ and $2x^2-x-3$

| | | |
|---|---|---|
| 1 | 2x | -3 |
| x | $2x^2$ | -3x |
| | 2x | -3 |

$= 2x^2-1x-3$

Equivalent

d. $3(x-4)^2+2$ and $3x^2-24x+50$

| | | |
|---|---|---|
| -4 | -4x | 16 |
| x | $x^2$ | -4x |
| | x | -4 |

$= 3(x^2-8x+16)+2$

$3x^2-24x+48+2$

$3x^2-24x+50$

Equivalent

e. $(x^3)^4$ and $x^7$

$x^3 \cdot x^3 \cdot x^3$

$x^9$

Not equivalent

f. $ab^2$ and $a^2b^2$

abb aabb

Not Equivalent

24. a. when $x=0$, then $(x+3)^2 = x^2+9$

e. when $x=0$ or $x=1$, then $(x^3)^4 = x^7$

f. when $a=0$ or $b=0$ or $a=1$, then $ab^2 = a^2b^2$

25. $2000x - 4000 = 8000$

a. $2x - 4 = 8$ or $x - 2 = 4$

b. $2x = 12$, $x = 6$ | $2000x - 4000 = 8000$, $2000x = 12000$, $x = 6$ | same solution, so they are equivalent

c. $\frac{3}{50} - \frac{x}{50} = \frac{7}{50} \Rightarrow$ $3 - x = 7$ ← equivalent expression that is easier to solve.

$-x = 4$

$x = -4$ ← solution

you can only do this since the denominators are all the same

26 a.

| n | t(n) | |
|---|---|---|
| 0 | 17 | +3 |
| 1 | 14 | +3 |
| 2 | 11 | +3 |
| 3 | 8 | −6 |
| 4 | | |
| 5 | 2 | −6 |
| 6 | | |
| 7 | −4 | |

Arithmetic

$2d = -6$

$d = -3$

$t(n) = 17 - 3n$

line, y-int = (0, 17), slope = −3

26 b.

| | | |
|---|---|---|
| 0 | 50 | ÷.8 |
| 1 | 40 | ×.8 |
| 2 | 32 | |
| 3 | 25.6 | |

Geometric

$b = \frac{32}{40} = .8$

$t(n) = 50(.8)^n$

Exponential, decreasing, y-int = (0, 50)

27 $h(x) = -3x^2 - 11x + 4$

a. $h(0) = -3(0)^2 - 11(0) + 4 = \boxed{4}$

b. $h(2) = -3(2)^2 - 11(2) + 4 = \boxed{-30}$

c. $h(-1) = -3(-1)^2 - 11(-1) + 4 = \boxed{12}$

d. $h(\frac{1}{2}) = -3(\frac{1}{2})^2 - 11(\frac{1}{2}) + 4 = \boxed{-\frac{9}{4} \text{ or } -2\frac{1}{4} \text{ or } -2.25}$

$-\frac{3}{4} - \frac{11}{2} + 4$

$-\frac{3}{4} - \frac{22}{4} + \frac{16}{4}$

e. $0 = -3x^2 - 11x + 4$

| | | |
|---|---|---|
| 4 | $-12x$ | 4 |
| $x$ | $3x^2$ | $1x$ |
| | $-3x$ | 1 |

$-12x^2$, $-12x$, $1x$, $-11x$

$(x+4)(-3x+1) = 0$

$x = -4$

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

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

28. $y - x^2 = 6x$

$y = x^2 - 6x$

| | $x$ | $-6$ |
|---|---|---|
| $x$ | $x^2$ | $-6x$ |
| $x$ | $-6$ | |

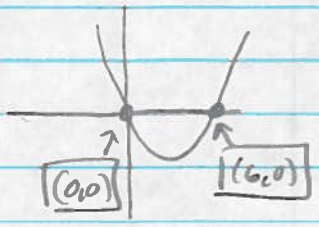
$0x^2$, $0x$, $-6x$, $-6x$

$x(x-6) = 0$

$x = 0$ $x = 6$

$(0,0)$ $(6,0)$

or




29. a. $f(x) = 2x$, $g(x) = x+3$

$f(x) \cdot g(x) = 2x(x+3)$

$= 2x^2 + 6x$

b. $f(x) = (x+3)$, $g(x) = (x-5)$

$f(x) \cdot g(x) = (x+3)(x-5)$

| | $3$ | $-15$ |
|---|---|---|
| $x$ | $x^2$ | $-5x$ |
| | $x$ | $-5$ |

$= x^2 - 2x - 15$

c. $f(x) = (2x+1)$, $g(x) = (x-3)$

$f(x) \cdot g(x) = (2x+1)(x-3)$

| | $x$ | $-3$ |
|---|---|---|
| $2x$ | $2x^2$ | $-6x$ |
| | $x$ | $-3$ |

$= 2x^2 - 5x - 3$

d. $f(x) = (x+3)$, $g(x) = (x+3)$

$f(x) \cdot g(x) = (x+3)(x+3)$

| | $3$ | $9$ |
|---|---|---|
| $x$ | $x^2$ | $3x$ |
| | $x$ | $3$ |

$= x^2 + 6x + 9$

Lesson 3.1.2 (day 2) p. 130-132 : 30-36 (35c will be a challenge!)

30. $y+3 = -2(x+1)^2$ compared to $y = x^2$

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

Parabola parent graph

Parabola, opens down,

stretch factor of 2, V (-1, -3)

31. $f(x) = x^2 - 2x - 3$

a. $0 = x^2 - 2x - 3$

| -3 | -3x | -3 |
|---|---|---|
| x | $x^2$ | 1x |
| | x | 1 |

$-3x^2$, $-3x$, $1x$, $-2x$

$(x-3)(x+1) = 0$

$x = 3$ $x = -1$

Vertex: $x = \frac{3+-1}{2} = \frac{2}{2} = 1$

$y = 1^2 - 2(1) - 3 = -4$

V(1, -4)

b. $y = x^2 - 2x - 3$

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

$y + 4 = (x-1)^2$

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

| -1 | -x | 1 |
|---|---|---|
| x | $x^2$ | -x |
| | x | -1 |

V(1, -4)

c. $f(x) = x^2 + 5x + 2$

$y - 2 = x^2 + 5x + 6.25$ (+6.25)

$y + 4.25 = (x+2.5)^2$

$y = (x+2.5)^2 - 4.25$

V(-2.5, -4.25)

| 2.5 | 2.5x | 6.25 |
|---|---|---|
| x | $x^2$ | 2.5x |
| | x | 2.5 |

d. D: $\mathbb{R}$

R: $y \geq -4.25$

32. a. $(x^3 y^{-2})^{-4}$

$\left(\frac{x^3}{y^2}\right)^{-4} = \left(\frac{y^2}{x^3}\right)^4$

$\frac{y^2}{x^3} \cdot \frac{y^2}{x^3} \cdot \frac{y^2}{x^3} \cdot \frac{y^2}{x^3} = \frac{y^8}{x^{12}}$

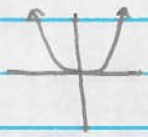
b. $-3x^2(6xy - 2x^3y^2z)$

$-18x^3y + 6x^5y^2z$

33. a. $y = 3x^3$ **odd** b/c it can be rotated 180° to fall onto itself.

b. $y = x^2 + 16$ **Even** b/c it has symmetry over the y-axis


c. $y = \frac{x^4}{2}$ **Even** b/c it has symmetry over the y-axis



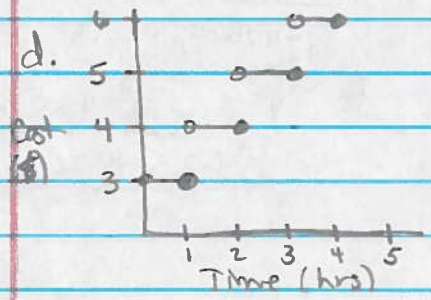
$f(-x) = \frac{(-x)^4}{2} = \frac{x^4}{2} = f(x)$

34. a. $y = 3 + 1x$ you will be charged for the full 2nd hr.
So, $y = 3 + 1 = \$4$

b. 118 min & 119 min is still inside the 2nd hr, so **$4 each**

c. 120 min is still **$4**; 121 min is into another hour, so **$5**

d.




e. No b/c there are breaks in the graph. It is called a step function.

f. The graph will translate up $2

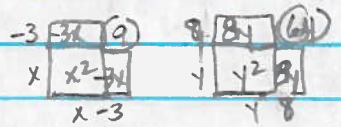
35. a. $r = 12$, $C(-2, 13)$
$(x+2)^2 + (y-13)^2 = 144$

b. $C(-1, -4)$, $r = 1$
$(x+1)^2 + (y+4)^2 = 1$

c. $x^2 + y^2 - 6x + 16y + 57 = 0$

$x^2 - 6x + 9 + y^2 + 16y + 64 = -57 + 9 + 64$

$(x-3)^2 + (y+8)^2 = 16$



36. a. 15 min to walk 6 blocks $\Rightarrow$ **24 blocks per hr**

$\frac{6 \text{ blocks}}{15 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr.}} = 24 \text{ bl/hr}$

b. 20 min to walk 6 block $\Rightarrow$ **18 blocks per hr**

$\frac{6 \text{ bl}}{20 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = 18 \text{ bl/hr}$

c. 65 min to walk, eat, walk 12 blocks total

$\Rightarrow \frac{12 \text{ block}}{65 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr.}} = 11.08 \text{ bl/hr}$

Lesson 3.1.3 (day 1) p. 135-136: 45-50

45. a. $(n+4)+n(n+2)+n=0$

$n+4+n^2+2n+n=0$

$n^2+4n+4=0$

| | $2n$ | $4$ |
|---|---|---|
| $n$ | $n^2$ | $2n$ |
| | $n$ | $2$ |

$4n^2$: $2n \times 2n$, $4n$

$(n+2)(n+2)=0$

$n=-2,\ n=-2$

b. $x\left(\frac{4}{x}\right)=(x+3)\cdot x$

$4=x^2+3x$

$x^2+3x-4=0$

| | $4x$ | $-4$ |
|---|---|---|
| $x$ | $x^2$ | $-x$ |
| | $x$ | $-1$ |

$-4x^2$: $4x \times -1x$, $3x$

$(x+4)(x-1)=0$

$x=-4,\ x=1$

46. a. $(ab)^2$ and $a^2b^2$

$ab \cdot ab$

$a^2b^2$ Equivalent

b. $3x-4y=12$ and $y=\frac{3}{4}x-3$

$-4y=-3x+12$

$y=\frac{3}{4}x-3$ Equivalent

c. $y=2(x-1)+3$ and $y=2x+1$

$y=2x-2+3$

$y=2x+1$ Equivalent

d. $(a+b)^2$ and $a^2+b^2$

| | $ab$ | $b^2$ |
|---|---|---|
| $b$ | | |
| $a$ | $a^2$ | $ab$ |
| | $a$ | $b$ |

$a^2+2ab+b^2$

Not Equivalent

e. $\frac{x^6}{x^2}$ and $x^3$

$\frac{x \cdot x \cdot x \cdot x \cdot x \cdot x}{x \cdot x}$

$x^4$ Not equivalent

f. $y=3(x-5)+2$ and $y=2x-8$

$y=3x-15+2$

$y=3x-13$ Not equivalent

47. part d would be equivalent if $a=0$ or $b=0$

part e would be equivalent if $x=1$

part f would be equivalent if $x=5$ and $y=2$ (see work below)

$3x-13=2x-8$

$x-13=-8$

$x=5$ $\quad y=3(5)-13=2$

48. $t(15)=10$, $t(63)=106$, Arithmetic

| | |
|---|---|
| 15 | 10 |
| 63 | 106 |

$m = \frac{106-10}{63-15} = \frac{96}{48} = 2$

$t(n) = b + 2n$

$10 = b + 2(15)$

$10 = b + 30$

$b = -20$

$t(n) = -20 + 2n$

Another way to do this is to make a system of eqns:

$10 = m(15)+b$ and $106 = m(63)+b$

$10 = 15m+b$ $\quad$ $106 = 63m+b$

$b = 10-15m$ $\quad$ $b = 106-63m$

$10-15m = 106-63m$

$48m = 106$ $\quad$ $b = 10-15(2)$

$48m = 96$ $\quad$ $b = -20$

$m = 2$

49. a. $t(n) = 450{,}000\,(1.03)^n$

b. $t(10) = 450{,}000\,(1.03)^{10} = 604{,}762.37$

$- \quad 450{,}000.00$

$\$154{,}762.37$ profit

$\frac{604{,}762.37}{450{,}000} = 1.3439$ which means 34.39% profit

50. $5x^3y + 35x^2y + 50xy$

$5xy\,(x^2+7x+10)$ → Factored out a gcf $= 5xy$

| | | |
|---|---|---|
| 5 | $5x$ | 10 |
| $x$ | $x^2$ | $2x$ |
| | $x$ | 2 |

$10x^2$, $5x$, $2x$, $7x$ → used the generic rectangle and diamond to factor the quadratic

$5xy(x+5)(x+2)$

Lesson 3.1.3 (day 2) p. 136-137; 51-56

51. a. $150x + 300 = 600$ and $x + 2 = 4$

$150x = 300$ $x = 2$

$x = 2$ Same solution

b. She ÷ each term by 150.

c. $\frac{60t}{60} - \frac{120}{60} = \frac{300}{60}$

$t - 2 = 5$

$t = 7$

52. 10, 2, ...

a. Arithmetic so subtract 8

10, 2, -6, -14, -22, -30, ... $t(n) = 18 - 8n$

b. Geometric, so multiply by $\frac{1}{5}$ or .2

10, 2, $\frac{2}{5}$, $\frac{2}{25}$, $\frac{2}{125}$, $\frac{2}{625}$, ...

or

10, 2, .4, .08, .016, .0032, ...

$t(n) = 50\left(\frac{1}{5}\right)^n$ or $t(n) = 50(.2)^n$

c. 10, 2, -5, -11, -16, -20, ...

53. a. $\sqrt[3]{5} = 5^{\frac{1}{3}}$ b. $\sqrt[3]{9} = 9^{\frac{1}{3}}$ c. $\sqrt[8]{17^x} = (17^x)^{\frac{1}{8}}$ d. $7\sqrt[4]{x^3} = 7(x^3)^{\frac{1}{4}}$

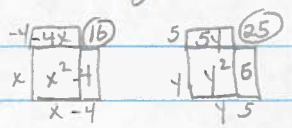
$= 17^{\frac{x}{18}}$ or $7x^{\frac{3}{4}}$

54 a. $C(0,0)$, $r=6$ $\Rightarrow$ $\boxed{x^2+y^2=36}$

b. $C(2,-3)$, $r=6$ $\Rightarrow$ $\boxed{(x-2)^2+(y+3)^2=36}$

c. $x^2+y^2-8x+10y+8=0$ Complete the square twice!

$(x^2-8x+16)+(y^2+10y+25) = -5 \overset{+16}{\overset{+25}{}}$




$\boxed{(x-4)^2+(y+5)^2=36}$

55. $T = 680(1.0004)^t - 655$ $t$ is measured in seconds

30 min = 30 x 60 = 1800 sec

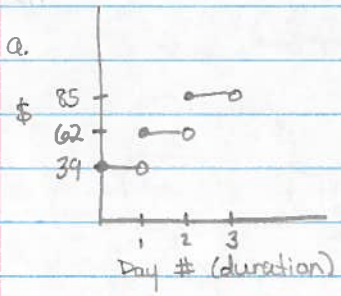
when $t=0$, $T = 680(1.0004)^0 - 655 = 25 \Rightarrow (0, 25)$

when $t=1800$, $T = 680(1.0004)^{1800} - 655 = 741.81 \Rightarrow (1800, 741.81)$

$$m = \frac{\Delta y}{\Delta x} = \frac{25-741.81}{0-1800} = \frac{-716.81}{-1800} = \boxed{.398\ ^\circ F/\text{sec} \text{ or } .4\ ^\circ F/\text{sec}}$$

56. $y = 39 + 23x$ when $x$ = day # & $y$ = cost

a.




b. The graph would translate up \$11.

Lesson 3.2.1 p. 140-141: 63-69

63.

| n | t(n) |
|---|---|
| 0 | -1 |
| 1 | 1 |
| 2 | 3 |
| 3 | 5 |
| 4 | 7 |
| 5 | 9 |

$t(n) = -1 + 2n$

$t(46) = -1 + 2(46) = -1 + 92 = $ **91 dots**

64. 1st piece: $y = 20 + 2x$
2nd piece: $y = 240 - 3x$
where $x$ = time (min), $y$ = Temp (°C)

$20 + 2x = 240 - 3x$

$20 + 5x = 240$

$5x = 220$

$x = 44$ min

65. a. multiplier = 100% + 3% = 103% = **1.03**

b. $y = 10.25(1.03)^n$

c. $y = 10.25(1.03)^{10} = $ **\$13.78**

66. $(y-2)^3 = (y-2)(y-2)(y-2)$

67. a. $\sqrt[5]{x} = x^{\frac{1}{5}}$ b. $\frac{1}{x^3} = x^{-3}$ c. $x^{\frac{2}{3}} = (\sqrt[3]{x})^2$ or $\sqrt[3]{x^2}$ d. $\frac{1}{\sqrt{x}} = \frac{1}{x^{1/2}} = x^{-\frac{1}{2}}$

e. $x^{-1}y^{-8} = \frac{1}{xy^8}$

f. $(m^2)^{-3/2}$

$m^{-3}$

$\frac{1}{m^3}$

g. $(x^3y^6)^{\frac{1}{2}}$

$x^{\frac{3}{2}}y^3$

$\sqrt{x^3} \cdot y^3$

$\sqrt{x^2}\sqrt{x} \cdot y^3$

$x y^3 \sqrt{x}$

h. $(9x^3y^6)^{-2}$

$\frac{1}{9x^3y^6} \cdot \frac{1}{9x^3y^6}$

$= \frac{1}{81x^6y^{12}}$

68. yes, he can change $100x+300=500$ into $x+3=5$

a. $100x+300=500$ $\qquad$ $x+3=5$

$100x=200$ $\qquad$ $\boxed{x=2}$

$\boxed{x=2}$ ← Same Answer

b. Divide every term by 100

69. a. $(5m-1)(m+2)$

| | $m$ | $2$ |
|---|---|---|
| $-1$ | $-m$ | $-2$ |
| $5m$ | $5m^2$ | $10m$ |

$= \boxed{5m^2+9m-2}$

b. $(6-x)(2+x)$

| | $2$ | $x$ |
|---|---|---|
| $-x$ | $-2x$ | $-x^2$ |
| $6$ | $12$ | $6x$ |

$= \boxed{-x^2+4x+12}$

c. $(5x-y)^2$

| | $5x$ | $-y$ |
|---|---|---|
| $-y$ | $-5xy$ | $y^2$ |
| $5x$ | $25x^2$ | $-5xy$ |

$= \boxed{25x^2-10xy+y^2}$

d. $3x(2x-5y+4)$

| | $2x$ | $-5y$ | $4$ |
|---|---|---|---|
| $3x$ | $6x^2$ | $-15xy$ | $12x$ |

$= \boxed{6x^2-15xy+12x}$

Lesson 3.2.2 p. 145-146: 78-84 (#82 is needed in the next lesson)

78. a. $\frac{x^2-8x+16}{3x^2-10x-8} = \frac{(x-4)(x-4)}{(x-4)(3x+2)} = \boxed{\frac{x-4}{3x+2} \text{ if } x \neq 4 \text{ or } x \neq -\frac{2}{3}}$

| | | |
|---|---|---|
| -4 | -4x | 16 |
| x | $x^2$ | -4x |
| | x | -4 |

$16x^2$, $-4x$, $-4x$, $-8x$

| | | |
|---|---|---|
| -4 | -12x | -8 |
| x | $3x^2$ | 2x |
| | 3x | 2 |

$-24x^2$, $-12x$, $2x$, $-10x$

b. $\frac{10x+25}{2x^2-x-15} \overset{\text{gcf}=5}{=} \frac{5(2x+5)}{(x-3)(2x+5)} = \boxed{\frac{5}{x-3} \text{ if } x \neq 3 \text{ or } x \neq -\frac{5}{2}}$

| | | |
|---|---|---|
| -3 | -6x | -15 |
| x | $2x^2$ | 5x |
| | 2x | 5 |

$30x^2$, $-6x$, $5x$, $-1x$

c. $\frac{(k-4)(2k+1)}{5(2k+1)} \div \frac{(k-3)(k-4)}{10(k-3)} = \frac{(k-4)(2k+1)}{5(2k+1)} \cdot \frac{10(k-3)}{(k-3)(k-4)} = \boxed{2 \text{ if } k \neq -\frac{1}{2} \text{ or } k \neq 3 \text{ or } k \neq 4}$

(Switch to *, then take reciprocal)

79. a. 1 solution b/c both are linear and slopes are not equal

b. NO solution b/c 2 lines with same slope & diff y-int are parallel

c. 2 solutions b/c the eqn is Quadratic in factored form

d. $x^2-4x+4=0 \Rightarrow (x-2)(x-2)=0$

1 solution b/c the vertex is on the x-axis.

| | | |
|---|---|---|
| -2 | -2x | 4 |
| x | $x^2$ | -2x |
| | x | -2 |

$4x^2$, $-2x$, $-2x$, $-4x$

80. $4000x - 8000 = 16{,}000$

a. $\boxed{4x-8=16}$ or $\boxed{x-2=4}$

b. $4000x - 8000 = 16{,}000$ $\qquad$ $4x - 8 = 16$

$4000x = 24{,}000$ $\qquad$ $4x = 24$

$\boxed{x=6}$ ← same solution → $\boxed{x=6}$

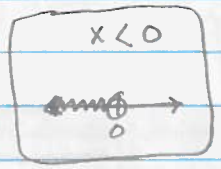
c. $\frac{x}{100} + \frac{3}{100} = \frac{8}{100} \Rightarrow x + 3 = 8$

$\boxed{x=5}$

81. a. $5 + 3x < 5$

$3x < 0$

$x < 0$




b. $-3x \geq 8 - x$

$0 \geq 8 + 2x$

$-8 \geq 2x$

$-4 \geq x$

$\boxed{x \leq -4}$


You need to know this for the next lesson

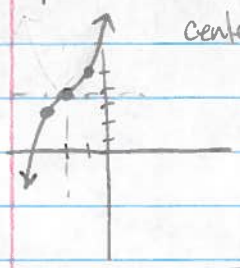
82. a. $\frac{1}{2} \cdot \frac{3}{4} = \boxed{\frac{3}{7}}$

I cross cancel whenever I can, then multiply across.

b. $\frac{3}{5} \div \frac{12}{25} \Rightarrow \frac{3}{5} \cdot \frac{25}{12} = \boxed{\frac{5}{4}}$

I re-write as multiplication, then take the reciprocal of the 2nd fraction, cross cancel, then multiply across.

83. $y = (x+2)^3 + 4$



center $(-2, 4)$

a. Parent graph is a cubic, $y = x^3$ shifted left 2, up 4

b. $y = (x+2)(x+2)(x+2) + 4$

| | $x^2$ | $2x$ |
|---|---|---|
| $x$ | $x^3$ | $2x^2$ |
| $2$ | $2x^2$ | $4x$ |

$x \quad 2$

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

| | $2x^2$ | $8x$ | $8$ |
|---|---|---|---|
| $x$ | $x^3$ | $4x^2$ | $4x$ |

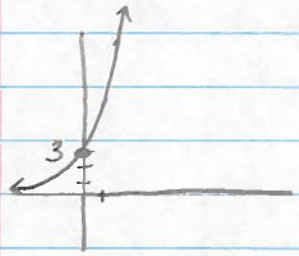
$x^2 \quad 4x \quad 4$

$= x^3 + 6x^2 + 12x + 8 + 4$

$= \boxed{x^3 + 6x^2 + 12x + 12}$

c. $\boxed{\text{The graphs would not differ}}$

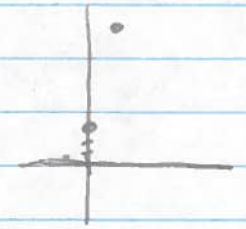
84. $f(x) = 3(5)^x$




a. D: $\mathbb{R}$

b.

| n | t(n) |
|---|---|
| 0 | 3 |
| 1 | 15 |
| 2 | 75 |
| -1 | 3/5 = .6 |
| -2 | 3/25 = .12 |



c. f(x) is a function that includes all x-values in the domain, so it makes sense to connect the pts with a curve.

t(n) is a sequence that only includes positive integer values in the domain, so it doesn't make sense to connect the points.

Lesson 3.2.3 p. 148-149: 90-96

90. a. $\frac{x-7}{9(2x-1)} \div \frac{(x+5)(x-7)}{6x(x+5)} = \frac{x-7}{9(2x-1)} \cdot \frac{6x(x+5)}{(x+5)(x-7)} = \boxed{\frac{2x}{3(2x-1)}}$

b. $\frac{6x^2-x-1}{3x^2+25x+8} \cdot \frac{x^2+4x-32}{2x^2+7x-4} = \frac{(2x-1)(3x+1)}{(x+8)(3x+1)} \cdot \frac{(x+8)(x-4)}{(x+4)(2x-1)} = \boxed{\frac{x-4}{x+4}}$

| | | |
|---|---|---|
| -1 | -3x | -1 |
| 2x | $6x^2$ | 2x |
| | 3x | 1 |

| | | |
|---|---|---|
| 8 | 24x | 8 |
| x | $3x^2$ | 1x |
| | 3x | 1 |

| | | |
|---|---|---|
| 8 | 8x | -32 |
| x | $x^2$ | -4x |
| | x | -4 |

| | | |
|---|---|---|
| 4 | 8x | -4 |
| x | $2x^2$ | -1x |
| | 2x | -1 |

$-3x \cdot 2x = -6x^2$, $-3x + 2x = -1x$

$24x \cdot 1x = 24x^2$, $24x + 1x = 25x$

$8x \cdot -4x = -32x^2$, $8x + -4x = 4x$

$8x \cdot -1x = -8x^2$, $8x + -1x = 7x$

91 a. $\boxed{x \neq -4 \text{ or } x \neq 2}$

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

b. $\frac{8(x+2)(x+2)(x+2)(x-3)(x-3)(x-3)}{4(x+2)(x+2)(x-3)(x-3)(x-3)(x-3)} = \boxed{\frac{2(x+2)}{(x-3)(x-3)}}$

$\boxed{x \neq -2,\ x \neq 3}$

92. 1) Get a common denominator of 15

2) mult. top/bottom of $\frac{1}{3}$ by 5

3) mult. top/bottom of $\frac{2}{5}$ by 3

4) Rewrite both fractions with the same denominator

5) Add the numerators

6) use the same denominator

7) simplify if possible

$\frac{5}{5} \cdot \frac{1}{3} + \frac{2 \cdot 3}{5 \cdot 3}$

$\frac{5}{15} + \frac{6}{15}$

$\boxed{\frac{11}{15}}$

93. a. $3x-3=y$

$6x-5y=12$

$y=3\left(\frac{1}{3}\right)-3$

$y=1-3$

$y=-2$

$\left(\frac{1}{3},-2\right)$

$6x-5(3x-3)=12$

$6x-15x+15=12$

$-9x=-3$

$x=\frac{-3}{-9}$

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

b. $(3x-2y=30)\cdot 3$

$(2x+3y=-19)\cdot 2$

$9x-6y=90$

$4x+6y=-38$

$13x=52$

$x=4$

$3(4)-2y=30$

$12-2y=30$

$-2y=18$

$y=-9$

$(4,-9)$

94.

| x | y |
|---|---|
| 0 | ? |
| 15 | 72 million (*1/3 ↓, *3 ↑) |
| 16 | |

$y=a(3)^x$

$72=a(3)^{15}$

$72{,}000{,}000=14{,}348{,}907\,a$

$a\approx 5$

5 bacteria were present at first, so Janelle does not have a case.

95. EVEN because it will reflect over the y-axis onto itself.

96. a. $\frac{m}{6}\times\frac{m+1}{5}$

$5m=6m+6$

$-m=6$

$m=-6$

b. $\frac{3x-5}{2}\times\frac{4x+1}{4}$

$12x-20=8x+2$

$4x=22$

$x=\frac{22}{4}$

$x=5.5$

c. $\frac{8}{k}\times\frac{14}{k+3}$

$8k+24=14k$

$24=6k$

$k=4$

d. $\frac{x}{9}\times\frac{10}{1}$

$x=90$

Lesson 3.2.4 p. 153-154: 102-109

102. a. b/c it will make the denominator equal to 0

b. $x \neq -\frac{1}{3}$ and $x \neq 5$, $x \neq 3$ and $x \neq -3$

c. $\frac{1}{(x+6)(3x-1)}$

103. a. $\frac{4x}{x^2-2x-8} + \frac{4}{x-4} = \frac{4x}{(x+2)(x-4)} + \frac{4}{x-4}\cdot\frac{(x+2)}{(x+2)}$

$\frac{4x}{(x+2)(x-4)} + \frac{4x+8}{(x-4)(x+2)} = \frac{8x+8}{(x-4)(x+2)} = \boxed{\frac{8(x+1)}{(x-4)(x+2)}}$

| | | |
|---|---|---|
| -4 | $4x$ | $-8$ |
| $x$ | $x^2$ | $2x$ |
| | $x$ | $2$ |

$-8x^2$, $-4x$, $2x$, $-2x$

b. $\frac{16x-12}{4x^2+5x-6} - \frac{3}{x+2} = \frac{4(4x-3)}{(x+2)(4x-3)} - \frac{3}{x+2} = \boxed{\frac{1}{x+2}}$

| | | |
|---|---|---|
| 2 | $8x$ | $-6$ |
| $x$ | $4x^2$ | $-3x$ |
| | $4x$ | $-3$ |

$-24x^2$, $8x$, $-3x$, $5x$

104 a. $|5x+8| \geq -4$

All Real Numbers

b. $x^2+x-20 < 0$ $\quad (x+5)(x-4) < 0$

$x=-5 \quad x=4$

$\boxed{-5 < x < 4}$

| | | |
|---|---|---|
| 5 | $5x$ | $-20$ |
| $x$ | $x^2$ | $-4$ |
| | $x$ | $-4$ |

$-20x^2$, $5x$, $-4$, $1x$

c. $2x^2-6x=-5$

$2x^2-6x+5=0$

| | |
|---|---|
| | $5$ |
| $2x^2$ | |

$10x^2$, $-6x$

doesn't factor

$x = \frac{6 \pm \sqrt{(-6)^2-4\cdot2\cdot5}}{2\cdot2}$

$= \frac{6 \pm \sqrt{-4}}{4}$

Does not exist

NO Solution

d. $9\left(\frac{5}{9}\right) - \left(\frac{x}{3}\right)^9 = \left(\frac{4}{9}\right)^9$

$5 - 3x = 4$

$-3x = -1$

$\boxed{x = \frac{1}{3}}$

105. a. $\frac{(x-4)^3(2x-1)}{(2x-1)(x-4)^2} = \frac{(x-4)(x-4)(x-4)(2x-1)}{(x-4)(x-4)(2x-1)} = \boxed{x-4}$

b. $\frac{7m^2-22m+3}{3m^2-7m-6} = \frac{(m-3)(7m-1)}{(m-3)(3m+2)} = \boxed{\frac{7m-1}{3m+2}}$

| -3 | $-21m$ | 3 |
|---|---|---|
| $m$ | $7m^2$ | $-1m$ |
| | $7m$ | $-1$ |

$21m^2$, $-21m$, $-1m$, $-22m$

| -3 | $-9m$ | $-6$ |
|---|---|---|
| $m$ | $3m^2$ | $2m$ |
| | $3m$ | $2$ |

$-18m^2$, $-9m$, $2m$, $-7m$

c. $\frac{(z+2)^9(4z-1)^2}{(z+2)^{10}(4z-1)^5} = \boxed{\frac{(4z-1)(4z-1)}{z+2}}$

d. $\frac{(x+2)(x^2-6x+9)}{(x-3)(x^2-4)} = \frac{(x+2)(x-3)(x-3)}{(x-3)(x+2)(x-2)} = \boxed{\frac{x-3}{x-2}}$

| -3 | $-3x$ | 9 |
|---|---|---|
| $x$ | $x^2$ | $-3x$ |
| | $x$ | $-3$ |

$9x^2$, $-3x$, $-3x$, $-6x$

106. $100\% + 4.7\% = 104.7\% = 1.047$

a. $y = 1500(1.047)^3 = \boxed{1722 \text{ students}}$ ← # students now

b. $y = 1722(1.047)^{-5} = \boxed{1369 \text{ students}}$ ← # students 5 yrs. ago

c. $\boxed{y = 1500(1.047)^{n+3}}$

107 a. $\frac{(3x-1)(x+7)}{2(2x-5)} \cdot \frac{5(2x-5)}{(4x+1)(x+7)} = \boxed{\frac{5(3x-1)}{2(4x+1)}}$

b. $\frac{(m-3)(m+11)}{(2m+5)(m-3)} \div \frac{(4m-3)(m+11)}{(4m-3)(2m+5)} = \frac{m+11}{2m+5} \cdot \frac{2m+5}{m+11} = \boxed{1}$

c. $\frac{2p^2+5p-12}{2p^2-5p+3} \cdot \frac{p^2+8p-9}{3p^2+10p-8} = \frac{(2p-3)(p+4)}{(2p-3)(p-1)} \cdot \frac{(p-1)(p+9)}{(3p-2)(p+4)} = \boxed{\frac{p+9}{3p-2}}$

d. $\frac{4(x-3)}{(x+5)(x-2)} \cdot \frac{(2x-7)(x+5)}{(2x-7)(x-3)} = \boxed{\frac{4}{x-2}}$

108. $g(x) = \frac{x+2}{x-1}$

x-int

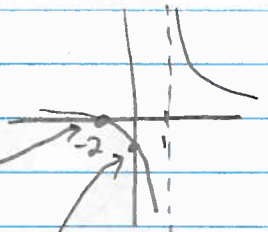
$0 = \frac{x+2}{x-1}$

$0 = x+2$

$x = -2$

y-int

$y = -2$




x-int: $(-2, 0)$

y-int: $(0, -2)$

there is an asymptote at $x=1$ b/c ÷ by 0 is undefined

109. $f(x) = 3x-9$ and $g(x) = -x^2$

a. $f(-2) = 3(-2) - 9 = \boxed{-15}$

b. $g(-2) = -(-2)^2 = \boxed{-4}$

c. $0 = 3x-9$

$9 = 3x$

$\boxed{x=3}$

d. $\boxed{g(m) = -m^2}$

Lesson 3.2.5 p. 157-159: 113, 116, 118, 121, 125, 126

113 a. $\frac{2x}{3x^2+16x+5} + \frac{10}{3x^2+16x+5} = \frac{2x+10}{3x^2+16x+5} = \frac{2(x+5)}{(x+5)(3x+1)}$

| 5 | $15x$ | 5 |
|---|---|---|
| $x$ | $3x^2$ | $1x$ |
| | $3x$ | 1 |

$15x^2$, $15x$, $1x$, $16x$

$= \frac{2}{3x+1}$

b. $\frac{x^2-x-12}{3x^2-11x-4} \cdot \frac{3x^2-20x-7}{x^2-9} = \frac{(x-4)(x+3)}{(x-4)(3x+1)} \cdot \frac{(x-7)(3x+1)}{(x+3)(x-3)} = \frac{x-7}{x-3}$

| $-4$ | $-4x$ | $-12$ |
|---|---|---|
| $x$ | $x^2$ | $3x$ |
| | $x$ | 3 |

$-12x^2$, $-4x$, $3x$, $-1x$

| $-4$ | $-12x$ | $-4$ |
|---|---|---|
| $x$ | $3x^2$ | $1x$ |
| | $3x$ | 1 |

$-12x^2$, $-12x$, $1x$, $-11x$

| $-7$ | $-21x$ | $-7$ |
|---|---|---|
| $x$ | $3x^2$ | $1x$ |
| | $3x$ | 1 |

$-21x^2$, $-21x$, $1x$, $-20x$

c. $\frac{2x^2+8x-10}{2x^2+15x+25} \div \frac{4x^2+20x-24}{2x^2+x-10} = \frac{2(x+5)}{(2x+10)(x-1)} \cdot \frac{(2x+5)(x-2)}{(4x+24)(x-1)} = \frac{x-2}{2(x+6)}$

$\frac{4}{2}(x+6)$

| 10 | $10x$ | $-10$ |
|---|---|---|
| $2x$ | $2x^2$ | $-2x$ |
| | $x$ | $-1$ |

$-20x^2$, $10x$, $-2x$, $8x$

| 5 | $10x$ | 25 |
|---|---|---|
| $x$ | $2x^2$ | $5x$ |
| | $2x$ | 5 |

$50x^2$, $10x$, $5x$, $15x$

| 24 | $24x$ | $-24$ |
|---|---|---|
| $4x$ | $4x^2$ | $-4x$ |
| | $x$ | $-1$ |

$-96x^2$, $24x$, $-4x$, $20x$

| 5 | $5x$ | $-10$ |
|---|---|---|
| $2x$ | $2x^2$ | $-4x$ |
| | $x$ | $-2$ |

$-20x^2$, $5x$, $-4x$, $1x$

d. $\frac{16x-12}{4x^2+5x-6} - \frac{3}{x+2} = \frac{4}{x+2} - \frac{3}{x+2} = \frac{4-3}{x+2} = \frac{1}{x+2}$

$\frac{4(4x-3)}{(x+2)(4x-3)}$

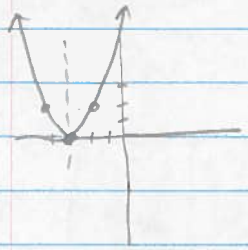
| 2 | $8x$ | $-6$ |
|---|---|---|
| $x$ | $4x^2$ | $-3x$ |
| | $4x$ | $-3$ |

$-24x^2$, $8x$, $-3x$, $5x$

116. $g(x) = 2(x+3)^2$ $V(-3,0)$

D: $\mathbb{R}$

R: $y \geq 0$



$g(-5) = 2(-5+3)^2 = 2(-2)^2 = 8$

$g(a+1) = 2(a+1+3)^2$

$= 2(a+4)^2$

$= 2(a^2+8a+16)$

$= 2a^2+16a+32$

| | | |
|---|---|---|
| 4 | 4a | 16 |
| a | $a^2$ | 4a |
| | a | 4 |

$32 = 2(x+3)^2$

$\sqrt{16} = \sqrt{(x+3)^2}$

$x+3 = \pm 4$

$x = -3 \pm 4$

$x = 1$ or $x = -7$

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

$\sqrt{0} = \sqrt{(x+3)^2}$

$x+3 = 0$

$x = -3$

118. a. 1

b. 3

c. 2

121. $(\sqrt{x+2})^2 = (8)^2$

$x+2 = 64$

$x = 62$

125. P(point not in shaded region) = $\frac{6}{7}$

126. a. $25x^2 - 1$

$(5x+1)(5x-1)$

b. $5x^3 - 125x$

$5x(x^2-25)$

$5x(x+5)(x-5)$

c. $x^2 + x - 72 = (x+9)(x-8)$

| | | |
|---|---|---|
| 9x | -72 | |
| $x^2$ | -8x | x |
| x | -8 | |

$-72x^2$: $9x$, $-8x$

d. $x^3 - 3x^2 - 18x$

$x(x^2-3x-18)$

| | | |
|---|---|---|
| -6x | -18 | -6 |
| $x^2$ | 3x | x |
| x | 3 | |

$-18x^2$: $-6x$, $3x$

$x(x-6)(x+3)$