HOMEWORK & EXTRA PRACTICE SCENARIOS

Algebra 1 Series

Book 3 Homework Guide

A NOTE TO PARENTS AND TEACHERS:
Each book in the Summit Math Algebra 1 Series has 2 parts. The first half of the book is the Guided Discovery Scenarios. The second half of the book is the Homework & Extra Practice Scenarios. Each section has a separate Answer Key. If the Answer Key does not provide enough guidance, you can access more information about how to solve each scenario using the resources listed below.

1. ***GUIDED DISCOVERY SCENARIOS***

   If you would like to get step-by-step guidance for the Guided Discovery Scenarios in each Algebra 1 book, you can subscribe to the Algebra 1 Videos for $9/month or $60/year ($5/mo.). With a subscription, you can access videos for every book in the Series. The videos show you how to solve each scenario in the Guided Discovery Scenarios section of the Algebra 1 books. You can find out more about these videos at www.summitmathbooks.com/algebra-1-videos.

2. ***HOMEWORK & EXTRA PRACTICE SCENARIOS***

   If you would like to get step-by-step guidance for the Homework & Extra Practice Scenarios in the book, you can use this Homework Guide. It provides more detailed guidance for solving the Homework & Extra Practice Scenarios in Book 3 of the Algebra 1 Series. Some scenarios are not included. If you would like something included in this Homework Guide, please email the author and explain which scenario(s) you would like to see included or which scenario(s) you would like more guidance for in this Homework Guide.

ANSWER KEY

2a.
$\frac{2}{5}A = 8$ → divide both sides by $\frac{2}{5}$ or multiply both sides by the reciprocal of $\frac{2}{5}$, which is $\frac{5}{2}$.
$\frac{5}{2} \cdot \frac{2}{5}A = 8 \cdot \frac{5}{2}$ → simplify both sides
$A = \dfrac{40}{2}$
$A = 20$

2b.
$2B - 10B = 24$ → combine like terms
$-8B = 24$ → divide both sides by −3
$\frac{-8B}{-8} = \frac{24}{-8}$
$B = -3$

2c.
$C + 3(C - 2) = 34$ → distribute the multiplied 3 to both terms in parentheses
$C + 3C - 6 = 34$ → combine like terms
$4C - 6 = 34$ → add 6 to both sides
$4C = 40$ → divide by 4 on both sides
$C = 10$

3a.
$5x - 11 = -2 - 13x$ → add $13x$ on both sides
$18x - 11 = -2$ → add 11 on both sides
$18x = 9$ → divide by 18 on both sides
$\dfrac{18x}{18} = \dfrac{9}{18}$
$x = \frac{1}{2}$ or 0.5

3b.
$2x - 14 + 8x = 136$ → combine like terms: $2x + 8x = 10x$
$10x - 14 = 136$ → add 14 on both sides
$10x = 150$ → divide by 10 on both sides
$\dfrac{10x}{10} = \dfrac{150}{10}$
$x = 15$

4a.
60 is 20 more than 40. 20 is 50% of 40. 60 is 40 + 20 so 60 is 100% of 40 plus an extra 50% of 40. 60 is 150% of 40.

4b.

If you write 75% as a fraction, it is $\frac{3}{4}$. 12 is $\frac{3}{4}$ of x.

$12 = \frac{3}{4}x$ → Multiply both sides of the equation by the reciprocal of $\frac{3}{4}$

$\frac{4}{3} \cdot 12 = \frac{3}{4}x \cdot \frac{4}{3}$

$\frac{48}{3} = x$ → $x = 16$

6.

From 2005 to 2006, the wage increases from 11 to 12. It started at 11 and increased by 1. As a fraction, it increased by $\frac{1}{11}$. In decimal form, $\frac{1}{11} = 0.\overline{09}$. As a percent, that is $9.\overline{09}$%.

From 2006 to 2007, the wage increases from 12 to 13. It started at 12 and increased by 1. As a fraction, it increased by $\frac{1}{12}$. In decimal form, $\frac{1}{12} = 0.08\overline{3}$. As a percent, that is $8.\overline{3}$%.

From 2007 to 2008, the wage decreases from 13 to 12. It started at 13 and decreased by 1. As a fraction, it decreased by $\frac{1}{13}$. In decimal form, $\frac{1}{13} = 0.0769\ldots$. As a percent, that is approximately 7.69%.

7.

The wage in 2005 was 10% higher than the wage in 2004. → Let x be the hourly wage in 2004.

The wage in 2005 was 10% higher than x. → The wage in 2005 is $11.

11 was 10% higher than x.

$11 = x + 10\%$ of x

$11 = x + 0.10x$

$11 = 1.1x$ → divide by 1.01 on both sides

$\frac{11}{1.1} = x$ → $x = \$10$

8d.

To see why the graph of $x^2 + y = 3 + x^2$ forms a line, you need to notice that there is an x^2 term on both sides of the equation. If you move one of those terms to the other side of the equation by subtracting x^2 on both sides, both of the x^2 terms become 0, so the equation is $0 + y = 3 + 0$ and that can be simplified and written as $y = 3$. The graph of the equation $y = 3$ is a horizontal line.

9a.

When the variables are y and x, a line's equation can be written as $y = \mathrm{m}x + \mathrm{b}$. In this scenario, though, the vertical axis is labeled with the variable R and the horizontal axis is labeled with the variable n. The equation for this line will have the form $R = \mathrm{m}n + \mathrm{b}$. To find the equation of the line, pick two points. Two points on this line are (20, 125) and (80, 50). To find the slope, you need to know the rise and the run. The rise is the difference between the R-values. The run is the difference between the n-values. You can also refer to the slope formula below:

$\mathrm{m} = \frac{R_2 - R_1}{n_2 - n_1}$ → $\mathrm{m} = \frac{50 - 125}{80 - 20}$ → $\mathrm{m} = \frac{-75}{60}$ → $\mathrm{m} = -\frac{5}{4}$ or -1.25

The slope is −1.25, so you can write the equation as $R = -1.25n + \mathrm{b}$. To find the R-intercept, you can replace n and R with values from a point on the line. If you use the point (80, 50), the equation is:

$50 = -1.25(80) + \mathrm{b}$

You can multiply −1.25 and 80 to get −100, which makes the equation $50 = -100 + \mathrm{b}$. Add 100 to both sides of the equation to isolate b. Since b = 150, the R-intercept of the line is 150. In Slope-Intercept Form, the equation is $R = -1.25n + 150$.

9b.

The missing value in the graph is the first number in the ordered pair (__, 95). The ordered pair is (n, R) so the R-value is 95. To find the first number, which is n, replace R with 95 in the equation and solve for n.

$95 = -1.25n + 150 \rightarrow$ subtract 150 on both sides

$-55 = -1.25n \rightarrow$ divide by -1.25 on both sides

$\frac{-55}{-1.25} = x \rightarrow x = 44$

10c.

$$\left(\frac{3}{10}\right)^2 = \frac{3}{10}\cdot\frac{3}{10} = \frac{9}{100}$$

32a.

To see the four disguised forms of 1, you can write it as $\frac{2}{2}\cdot\frac{2}{2}\cdot\frac{2}{2}\cdot\frac{2}{2}\cdot\frac{2}{1}$.

32b.

To see the one disguised form of 1, you can write it as $\frac{6}{6}\cdot\frac{6}{1}\cdot\frac{6}{1}\cdot\frac{6}{1}$.

32c.

$\frac{10\cdot10\cdot10\cdot10\cdot10\cdot10\cdot10}{10\cdot10\cdot10\cdot10\cdot10} \rightarrow \frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{1}\cdot\frac{10}{1}$.

33a.

$$\frac{2}{2}\cdot\frac{2}{2}\cdot\frac{2}{2}\cdot\frac{2}{2}\cdot\frac{2}{1} \rightarrow 1\cdot1\cdot1\cdot1\cdot2 \rightarrow 1\cdot2 \rightarrow 2 \rightarrow 2^1$$

33b.

$$\frac{6}{6}\cdot\frac{6}{1}\cdot\frac{6}{1}\cdot\frac{6}{1} \rightarrow 1\cdot6\cdot6\cdot6 \rightarrow 6\cdot6\cdot6 \rightarrow 6^3$$

33c.

$$\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{10}\cdot\frac{10}{1}\cdot\frac{10}{1} \rightarrow 1\cdot1\cdot1\cdot1\cdot10\cdot10 \rightarrow 10\cdot10 \rightarrow 10^2$$

34a.

Method 1: $\frac{9^{15}}{9^{14}} \rightarrow \frac{9^{14}\cdot9^1}{9^{14}} \rightarrow \frac{9^{14}}{9^{14}}\cdot\frac{9^1}{1} \rightarrow \frac{9^{14}}{9^{14}}\cdot9 \rightarrow 1\cdot9 \rightarrow 9 \rightarrow 9^1$

Method 2: $\frac{9^{15}}{9^{14}} \rightarrow 9^{15-14} \rightarrow 9^1$

34b.

Method 1: $\frac{6^5}{6^5} = 1$

Method 2: $\frac{6^5}{6^5} = 6^{5-5} = 6^0$

Since Method 1 shows that $\frac{6^5}{6^5} = 1$ and Method 2 shows that $\frac{6^5}{6^5} = 6^0$, you can conclude that $6^0 = 1$.

34c.

Method 1: $\frac{1^7}{1^3} \rightarrow \frac{1^3 \cdot 1^4}{1^3} \rightarrow \frac{1^3}{1^3} \cdot \frac{1^4}{1} \rightarrow \frac{1^3}{1^3} \cdot 1^4 \rightarrow 1^4$ or just 1, since $1 \cdot 1 \cdot 1 \cdot 1 = 1$

Method 2: $\frac{1^7}{1^3} \rightarrow 1^{7-3} \rightarrow 1^4$ or just 1, since $1^4 = 1$

35a.

Method 1: $\frac{12^7}{12} \rightarrow \frac{12^1 \cdot 12^6}{12^1} \rightarrow \frac{12^1}{12^1} \cdot \frac{12^6}{1} \rightarrow 1 \cdot 12^6 \rightarrow 12^6$ or just 1, since $1 \cdot 1 \cdot 1 \cdot 1 = 1$

Method 2: $\frac{12^7}{12^1} \rightarrow 12^{7-1} \rightarrow 12^6$

35b.

Method 1: $\frac{20^{17}}{20^{10}} \rightarrow \frac{20^{10} \cdot 20^7}{20^{10}} \rightarrow \frac{20^{10}}{20^{10}} \cdot \frac{20^7}{1} \rightarrow 1 \cdot 20^7 \rightarrow 20^7$

Method 2: $\frac{20^{17}}{20^{10}} \rightarrow 20^{17-10} \rightarrow 20^7$

35c.

Method 1: $\frac{y^{100}}{y^{70}} \rightarrow \frac{y^{70} \cdot y^{30}}{y^{70}} \rightarrow \frac{y^{70}}{y^{70}} \cdot \frac{y^{30}}{1} \rightarrow 1 \cdot y^{30} \rightarrow y^{30}$

Method 2: $\frac{y^{100}}{y^{70}} \rightarrow y^{100-70} \rightarrow y^{30}$

36.

Method 2: $\frac{2^A}{2^B} \rightarrow 2^{A-B}$

37a.

Method 1: $\frac{x^3}{x^1} \rightarrow \frac{x^1 \cdot x^2}{x^1} \rightarrow \frac{x^1}{x^1} \cdot \frac{x^2}{1} \rightarrow 1 \cdot x^2 \rightarrow x^2$

Method 2: $\frac{x^3}{x^1} \rightarrow x^{3-1} \rightarrow x^2$

37b.

Method 1: $\frac{x^8}{x^3} \rightarrow \frac{x^3 \cdot x^5}{x^3} \rightarrow \frac{x^3}{x^3} \cdot \frac{x^5}{1} \rightarrow 1 \cdot x^5 \rightarrow x^5$

Method 2: $\frac{x^8}{x^3} \rightarrow x^{8-3} \rightarrow x^5$

37c.

Method 1: $\frac{x^3}{x^3} \rightarrow 1$

Method 2: $\frac{x^3}{x^3} \rightarrow x^{3-3} \rightarrow x^0$

Since Method 1 shows that $\frac{x^3}{x^3} = 1$ and Method 2 shows that $\frac{x^3}{x^3} = x^0$, you can conclude that $x^0 = 1$.

37d.

Method 1: $\frac{x^{12}}{x^6} \rightarrow \frac{x^6 \cdot x^6}{x^6} \rightarrow \frac{x^6}{x^6} \cdot \frac{x^6}{1} \rightarrow 1 \cdot x^6 \rightarrow x^6$

Method 2: $\frac{x^{12}}{x^6} \rightarrow x^{12-6} \rightarrow x^6$

37e.

Method 2: $\frac{x^C}{x^D} \rightarrow x^{C-D}$

38a.
$$\frac{2}{8x} \to \frac{2}{8}\cdot\frac{1}{x} \to \frac{1}{4}\cdot\frac{1}{x} \to \frac{1}{4x}$$

38b.
$$\frac{6}{3x} \to \frac{6}{3}\cdot\frac{1}{x} \to \frac{2}{1}\cdot\frac{1}{x} \to \frac{2}{x}$$

38c.
$$\frac{5x}{50} \to \frac{5}{50}\cdot\frac{x}{1} \to \frac{5}{5}\cdot\frac{1}{10}\cdot\frac{x}{1} \to 1\cdot\frac{1}{10}\cdot\frac{x}{1} \to \frac{1}{10}\cdot\frac{x}{1} \to \frac{x}{10}$$

38d.
$$\frac{12y}{6y^2} \to \frac{12}{6}\cdot\frac{y}{y^2} \to \frac{6}{6}\cdot\frac{2}{1}\cdot\frac{y}{y}\cdot\frac{1}{y} \to 1\cdot\frac{2}{1}\cdot1\cdot\frac{1}{y} \to \frac{2}{1}\cdot\frac{1}{y} \to \frac{2}{y}$$

40a.
Method 1:
$$\frac{25f^7}{5f^4} \to \frac{25}{5}\cdot\frac{f^7}{f^4} \to \frac{5}{5}\cdot\frac{5}{1}\cdot\frac{f^4}{f^4}\cdot\frac{f^3}{1} \to 1\cdot\frac{5}{1}\cdot1\cdot\frac{f^3}{1} \to \frac{5}{1}\cdot\frac{f^3}{1} \to \frac{5f^3}{1} \to 5f^3$$
Method 2:
$$\frac{25f^7}{5f^4} \to \frac{25}{5}\cdot\frac{f^7}{f^4} \to \frac{5}{1}\cdot\frac{f^{7-4}}{1} \to 5f^3$$

40b.
Method 1:
$$\frac{12x^2y^5}{18x^2y} \to \frac{12}{18}\cdot\frac{x^2}{x^2}\cdot\frac{y^5}{y} \to \frac{6}{6}\cdot\frac{2}{3}\cdot\frac{x^2}{x^2}\cdot\frac{y}{y}\cdot\frac{y^4}{1} \to 1\cdot\frac{2}{3}\cdot1\cdot1\cdot\frac{y^4}{1} \to \frac{2}{3}\cdot\frac{y^4}{1} \to \frac{2y^4}{3}$$
Method 2:
$$\frac{12x^2y^5}{18x^2y} \to \frac{12}{18}\cdot\frac{x^2}{x^2}\cdot\frac{y^5}{y} \to \frac{2}{3}\cdot1\cdot\frac{y^{5-1}}{1} \to \frac{2}{3}\cdot\frac{y^4}{1} \to \frac{2y^4}{3}$$

41a.
Method 1:
$$\frac{3p^{12}g^{40}}{12p^{10}g^{39}} \to \frac{3}{12}\cdot\frac{p^{12}}{p^{10}}\cdot\frac{g^{40}}{g^{39}} \to \frac{3}{3}\cdot\frac{1}{4}\cdot\frac{p^{10}}{p^{10}}\cdot\frac{p^2}{1}\cdot\frac{g^{39}}{g^{39}}\cdot\frac{g^1}{1}\cdot \to 1\cdot\frac{1}{4}\cdot1\cdot\frac{p^2}{1}\cdot1\cdot\frac{g^1}{1}\cdot \to \frac{1}{4}\cdot\frac{p^2}{1}\cdot\frac{g^1}{1} \to \frac{p^2g}{4}$$
Method 2:
$$\frac{3p^{12}g^{40}}{12p^{10}g^{39}} \to \frac{3}{12}\cdot\frac{p^{12}}{p^{10}}\cdot\frac{g^{40}}{g^{39}} \to \frac{1}{4}\cdot\frac{p^{12-10}}{1}\cdot\frac{g^{40-39}}{1} \to \frac{1}{4}\cdot\frac{p^2}{1}\cdot\frac{g^1}{1} \to \frac{p^2g}{4}$$

41b.
$$\frac{16a^X}{18a^Y} \to \frac{16}{18}\cdot\frac{a^X}{a^Y} \to \frac{2}{2}\cdot\frac{8}{9}\cdot\frac{a^{X-Y}}{1} \to 1\cdot\frac{8}{9}\cdot\frac{a^{X-Y}}{1} \to \frac{8a^{X-Y}}{9} \quad \text{or} \quad \frac{8}{9}a^{X-Y}$$

42a.
$$\frac{x^6}{x} \to \frac{x^6}{x^1} \to x^{6-1} \to x^5$$

42b.
Method 2:
$\frac{4a^9b^{13}}{9b^8a^9} \rightarrow \frac{4}{9}\cdot\frac{a^9}{a^9}\cdot\frac{b^{13}}{b^8} \rightarrow \frac{4}{9}\cdot 1\cdot\frac{b^{13-8}}{1} \rightarrow \frac{4}{9}\cdot\frac{b^5}{1} \rightarrow \frac{4b^5}{9}$

42c.
Method 2:
$\frac{16x^5y^8z^3}{12xy^3z^3} \rightarrow \frac{16}{12}\cdot\frac{x^5}{x}\cdot\frac{y^8}{y^3}\cdot\frac{z^3}{z^3} \rightarrow \frac{4}{3}\cdot\frac{x^{5-1}}{1}\cdot\frac{y^{8-3}}{1}\cdot 1 \rightarrow \frac{4}{3}\cdot\frac{x^4}{1}\cdot\frac{y^5}{1} \rightarrow \frac{4x^4y^5}{3}$

43a.
$\frac{5(2y)^6}{16y^5} \rightarrow \frac{5\cdot 2^6\cdot y^6}{16y^5} \rightarrow \frac{5\cdot 64\cdot y^6}{16y^5} \rightarrow \frac{320y^6}{16y^5} \rightarrow \frac{320}{16}\cdot\frac{y^6}{y^5} \rightarrow \frac{20}{1}\cdot\frac{y^{6-5}}{1} \rightarrow \frac{20y^1}{1} \rightarrow 20y$

50a.
$(-x)^3 \rightarrow (-x)\cdot(-x)\cdot(-x) \rightarrow (-1x)\cdot(-1x)\cdot(-1x) \rightarrow -1\cdot -1\cdot -1\cdot x\cdot x\cdot x \rightarrow -1\cdot x^3 \rightarrow -x^3$

50b.
$(-3y)^3 \rightarrow (-3y)\cdot(-3y)\cdot(-3y) \rightarrow (-3)\cdot(-3)\cdot(-3)\cdot y\cdot y\cdot y \rightarrow -27\cdot y^3 \rightarrow -27y^3$

50c.
$\left(\frac{z^4}{2}\right)^5 \rightarrow \left(\frac{z^4}{2}\right)\cdot\left(\frac{z^4}{2}\right)\cdot\left(\frac{z^4}{2}\right)\cdot\left(\frac{z^4}{2}\right)\cdot\left(\frac{z^4}{2}\right) \rightarrow \frac{z^4\cdot z^4\cdot z^4\cdot z^4\cdot z^4}{2^5} \rightarrow \frac{z^{4+4+4+4+4}}{2\cdot 2\cdot 2\cdot 2\cdot 2} \rightarrow \frac{z^{20}}{32}$

51a.
$(3x^5)^3 \rightarrow (3x^5)\cdot(3x^5)\cdot(3x^5) \rightarrow 3\cdot 3\cdot 3\cdot x^5\cdot x^5\cdot x^5 \rightarrow 27\cdot x^{5+5+5} \rightarrow 27x^{15}$

51b.
$\left(-y^3\right)^5 \rightarrow \left(-y^3\right)\cdot\left(-y^3\right)\cdot\left(-y^3\right)\cdot\left(-y^3\right)\cdot\left(-y^3\right) \rightarrow -1\cdot -1\cdot -1\cdot -1\cdot -1\cdot y^3\cdot y^3\cdot y^3\cdot y^3\cdot y^3 \rightarrow -1\cdot y^{3+3+3+3+3} \rightarrow -y^{15}$

51c.
$\left(-10x^3y\right)^2 \rightarrow \left(-10x^3y\right)\cdot\left(-10x^3y\right) \rightarrow -10\cdot -10\cdot x^3\cdot x^3\cdot y\cdot y \rightarrow 100\cdot x^{3+3}\cdot y^{1+1} \rightarrow 100x^6y^2$

52a.
$\left(-\frac{x}{2}\right)^3 \rightarrow \left(-\frac{x}{2}\right)\cdot\left(-\frac{x}{2}\right)\cdot\left(-\frac{x}{2}\right) \rightarrow -1\cdot -1\cdot -1\cdot\frac{x}{2}\cdot\frac{x}{2}\cdot\frac{x}{2} \rightarrow -1\cdot\frac{x\cdot x\cdot x}{2\cdot 2\cdot 2} \rightarrow -\frac{x^3}{8}$

52b.
$\left(\frac{2}{x^3}\right)^4 \rightarrow \left(\frac{2}{x^3}\right)\cdot\left(\frac{2}{x^3}\right)\cdot\left(\frac{2}{x^3}\right)\cdot\left(\frac{2}{x^3}\right) \rightarrow \frac{2\cdot 2\cdot 2\cdot 2}{x^3\cdot x^3\cdot x^3\cdot x^3} \rightarrow \frac{16}{x^{3\cdot 4}} \rightarrow \frac{16}{x^{12}}$

52c.
$\left(\frac{-2a^2}{b^7}\right)^5 \rightarrow \left(\frac{(-2)^5\cdot\left(a^2\right)^5}{\left(b^7\right)^5}\right) \rightarrow \left(\frac{(-2)\cdot(-2)\cdot(-2)\cdot(-2)\cdot(-2)\cdot a^{2\cdot 5}}{b^{7\cdot 5}}\right) \rightarrow \frac{-32a^{10}}{b^{35}}$ or $-\frac{32a^{10}}{b^{35}}$

53a.
$x^4\cdot(3x)^4 \rightarrow x^4\cdot(3x)\cdot(3x)\cdot(3x)\cdot(3x) \rightarrow x^4\cdot 3^4\cdot x^4 \rightarrow x^4\cdot 81\cdot x^4 \rightarrow 81x^{4+4} \rightarrow 81x^8$

53b.
$\left(2x^2\right)^2\cdot(-4x)^2 \rightarrow \left(2x^2\right)\cdot\left(2x^2\right)\cdot(-4x)\cdot(-4x) \rightarrow 2\cdot 2\cdot x^2\cdot x^2\cdot(-4)\cdot(-4)\cdot x\cdot x \rightarrow 4x^4\cdot 16x^2 \rightarrow 4\cdot 16x^{4+2} \rightarrow 64x^6$

53c.
$-2(-5x)^2\cdot(-2x)^3 \rightarrow -2(-5x)\cdot(-5x)\cdot(-2x)\cdot(-2x)\cdot(-2x) \rightarrow -2\cdot 25x^2\cdot\left(-8x^3\right) \rightarrow -50\cdot(-8)x^{2+3} \rightarrow 400x^5$

58a.
$-2y^4\cdot 3y^2\cdot y \rightarrow -2\cdot 3\cdot y^4\cdot y^2\cdot y \rightarrow -6\cdot y^{4+2+1} \rightarrow -6y^7$

58b.
$2^4\cdot 2^2 \rightarrow 2^{4+2} \rightarrow 2^6$

58c.
$\frac{9x^2y^4}{15x^3y} \rightarrow \frac{9}{15}\cdot\frac{x^2}{x^3}\cdot\frac{y^4}{y} \rightarrow \frac{3}{5}\cdot\frac{x^2}{x^2}\cdot\frac{1}{x}\cdot\frac{y^{4-1}}{1} \rightarrow \frac{3}{5}\cdot 1\cdot\frac{1}{x}\cdot\frac{y^3}{1} \rightarrow \frac{3}{5}\cdot\frac{1}{x}\cdot\frac{y^3}{1} \rightarrow \frac{3y^3}{5x}$

59a.
$\left(\frac{-2y^2}{x^3}\right)^3 \rightarrow \frac{(-2)^3\left(y^2\right)^3}{(x^3)^3} \rightarrow \frac{-8y^{2\cdot 3}}{x^{3\cdot 3}} \rightarrow \frac{-8y^6}{x^9}$ or $-\frac{8y^6}{x^9}$

59b.
$\left(x^2\right)^3 + \left(x^3\right)^2 \rightarrow x^{2\cdot 3} + x^{3\cdot 2} \rightarrow x^6 + x^6 \rightarrow 2x^6$

59c.
$-3(-y)^2\cdot(-2y)^3 \rightarrow -3\cdot(-1)^2\cdot y^2\cdot(-2)^3\cdot y^3 \rightarrow -3\cdot 1\cdot y^2\cdot -8\cdot y^3 \rightarrow 24y^{2+3} \rightarrow 24y^5$

62d.
$3x^0 \rightarrow 3\cdot x^0 \rightarrow 3\cdot 1 \rightarrow 3$

62e.
$-2x^0 \rightarrow -2\cdot x^0 \rightarrow -2\cdot 1 \rightarrow -2$

63a.
$7(9)^0 \rightarrow 7\cdot 9^0 \rightarrow 7\cdot 1 \rightarrow 7$

63b.
$-(-8)^0 \rightarrow -1\cdot(-8)^0 \rightarrow -1\cdot 1 \rightarrow -1$

63c.
$-5y^0 \rightarrow -5\cdot y^0 \rightarrow -5\cdot 1 \rightarrow -5$

67c.
The value of 5^2 is 25. The value of 5^{-2} is the reciprocal of 5^2, so $5^{-2} = \frac{1}{25}$.

71a.
$\left(\frac{9}{2}\right)^{-2} \rightarrow \left(\frac{2}{9}\right)^2 \rightarrow \frac{2^2}{9^2} \rightarrow \frac{4}{81}$

71b.
$\left(\frac{3}{10}\right)^{-2} \rightarrow \left(\frac{10}{3}\right)^2 \rightarrow \frac{10^2}{3^2} \rightarrow \frac{100}{9}$

71c.

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

72.

$$0^{-3} \rightarrow \left(\frac{1}{0}\right)^{3} \rightarrow \frac{1^3}{0^3} \rightarrow \frac{1}{0} \rightarrow \frac{1}{0}$$

The value of $\frac{1}{0}$ is called "undefined."

75.

$$2x^{-4} \rightarrow 2{\cdot}x^{-4} \rightarrow 2{\cdot}\frac{1}{x^4} \rightarrow \frac{2}{1}\cdot\frac{1}{x^4} \rightarrow \frac{2}{x^4}$$

77a.

$$9y^{-2} \rightarrow 9{\cdot}y^{-2} \rightarrow 9{\cdot}\frac{1}{y^2} \rightarrow \frac{9}{1}\cdot\frac{1}{y^2} \rightarrow \frac{9}{y^2}$$

77b.

$$2^{-4}x^4 \rightarrow \frac{1}{2^4}{\cdot}x^4 \rightarrow \frac{1}{16}\cdot\frac{x^4}{1} \rightarrow \frac{x^4}{16}$$

77c.

$$x^{-5}y^2 \rightarrow \frac{1}{x^5}{\cdot}y^2 \rightarrow \frac{1}{x^5}\cdot\frac{y^2}{1} \rightarrow \frac{y^2}{x^5}$$

77d.

$$\frac{1}{x^{-1}} \rightarrow \frac{1}{\frac{1}{x}} \rightarrow 1\div\frac{1}{x} \rightarrow 1{\cdot}\frac{x}{1} \rightarrow \frac{x}{1} \rightarrow x$$

77e.

$$\frac{x}{y^{-1}} \rightarrow \frac{x}{\frac{1}{y}} \rightarrow x\div\frac{1}{y} \rightarrow x{\cdot}\frac{y}{1} \rightarrow \frac{x}{1}\cdot\frac{y}{1} \rightarrow \frac{xy}{1} \rightarrow xy$$

78a.

Method 1: When multiplying like bases, you can add the exponents.

$$y^{-3}{\cdot}y^{-1} \rightarrow y^{-3\,+\,-1} \rightarrow y^{-4} \rightarrow \frac{1}{y^4}$$

Method 2: Make each negative exponent positive by switching each expression to its reciprocal.

$$\frac{1}{y^3}\cdot\frac{1}{y^1} \rightarrow \frac{1}{y^3{\cdot}y^1} \rightarrow \frac{1}{y^{3\,+\,1}} \rightarrow \frac{1}{y^4}$$

78b.

Method 1: Make the negative exponent positive by moving z^{-5} down to the denominator.

$$2z^{-5} \rightarrow \frac{2z^{-5}}{1} \rightarrow 2\cdot\frac{1}{z^5} \rightarrow \frac{2}{1}\cdot\frac{1}{z^5} \rightarrow \frac{2}{z^5}$$

Method 2: Make the negative exponent positive by writing z^{-5} as $\frac{1}{z^5}$.

$$2z^{-5} \rightarrow 2\cdot z^{-5} \rightarrow 2\cdot\frac{1}{z^5} \rightarrow \frac{2}{1}\cdot\frac{1}{z^5} \rightarrow \frac{2}{z^5}$$

78c.

Method 1: Make the negative exponent positive by moving x^{-4} up to the numerator.

$$\frac{6x^2}{x^{-4}} \rightarrow \frac{6x^2\cdot x^4}{1} \rightarrow \frac{6x^{2+4}}{1} \rightarrow \frac{6x^6}{1} \rightarrow 6x^6$$

Method 2: Make the negative exponent positive by writing x^{-4} as $\frac{1}{x^4}$.

$$\frac{6x^2}{x^{-4}} \rightarrow \frac{6x^2}{\frac{1}{x^4}} \rightarrow 6x^2 \div \frac{1}{x^4} \rightarrow 6x^2\cdot\frac{x^4}{1} \rightarrow 6x^2\cdot x^4 \rightarrow 6x^{2+4} \rightarrow 6x^6$$

79a.

Method 1:

$$\left(3^{-1}\right)^2 \rightarrow 3^{-1\cdot 2} \rightarrow 3^{-2} \rightarrow \frac{1}{3^2} \rightarrow \frac{1}{9}$$

Method 2:

$$\left(3^{-1}\right)^2 \rightarrow \left(\frac{1}{3}\right)^2 \rightarrow \frac{1}{3}\cdot\frac{1}{3} \rightarrow \frac{1}{9}$$

79b.

$$\left(f^8\right)^{-2} \rightarrow f^{8\cdot -2} \rightarrow f^{-16} \rightarrow \frac{1}{f^{16}}$$

79c.

$$(10g)^{-2} \rightarrow \frac{1}{(10g)^2} \rightarrow \frac{1}{100g^2}$$

82a.

Method 1:

$$(-5x^{-1})^2 \rightarrow (-5\cdot x^{-1})^2 \rightarrow \left(\frac{-5}{1}\cdot\frac{1}{x}\right)^2 \rightarrow \left(\frac{-5}{x}\right)^2 \rightarrow \frac{(-5)^2}{(x)^2} \rightarrow \frac{25}{x^2}$$

Method 2:

$$(-5x^{-1})^2 \rightarrow (-5)^2\cdot(x^{-1})^2 \rightarrow 25x^{-1\cdot 2} \rightarrow 25x^{-2} \rightarrow 25\cdot x^{-2} \rightarrow 25\cdot\frac{1}{x^2} \rightarrow \frac{25}{1}\cdot\frac{1}{x^2} \rightarrow \frac{25}{x^2}$$

82b.
Method 1:

$$\left(-\frac{y}{4}\right)^{-2} \rightarrow \left(-\frac{4}{y}\right)^{2} \rightarrow \left(-\frac{4}{y}\right)^{2} \rightarrow \frac{16}{y^2}$$

Method 2:

$$\left(-\frac{y}{4}\right)^{-2} \rightarrow \frac{1}{\left(-\frac{y}{4}\right)^{2}} \rightarrow \frac{1}{\frac{y^2}{16}} \rightarrow 1 \div \frac{y^2}{16} \rightarrow 1 \cdot \frac{16}{y^2} \rightarrow \frac{16}{y^2}$$

82c.

$$\left(-\frac{7}{p^5}\right)^{-3} \rightarrow \left(-\frac{p^5}{7}\right)^{3} \rightarrow -\frac{p^{5\cdot 3}}{7^3} \rightarrow -\frac{p^{15}}{343}$$

82d.

$$\left(-9x^6y^{-1}\right)^{-2} \rightarrow \left(\frac{-9x^6}{y^1}\right)^{-2} \rightarrow \left(\frac{y^1}{-9x^6}\right)^{2} \rightarrow \frac{y^{1\cdot 2}}{(-9)^2 \cdot x^{6\cdot 2}} \rightarrow \frac{y^2}{81 \cdot x^{12}} \rightarrow \frac{y^2}{81x^{12}}$$

83.

$$\left(\frac{8^{-2}x^3}{y^{-7}}\right)^{-3} \rightarrow \left(\frac{x^3y^7}{8^2}\right)^{-3} \rightarrow \left(\frac{8^2}{x^3y^7}\right)^{3} \rightarrow \frac{8^6}{x^9y^{21}}$$

84a.

$$\frac{5f^4}{25f^7} \rightarrow \frac{5}{25}\cdot\frac{f^4}{f^7} \rightarrow \frac{1}{5}\cdot\frac{f^{4-7}}{1} \rightarrow \frac{1}{5}\cdot\frac{f^{-3}}{1} \rightarrow \frac{1}{5}\cdot\frac{1}{f^3} \rightarrow \frac{1}{5f^3}$$

84b.

$$\frac{18x^2y}{12x^2y^5} \rightarrow \frac{18}{12}\cdot\frac{x^2}{x^2}\cdot\frac{y}{y^5} \rightarrow \frac{3}{2}\cdot 1\cdot\frac{y^{1-5}}{1} \rightarrow \frac{3}{2}\cdot 1\cdot\frac{y^{1-5}}{1} \rightarrow \frac{3}{2}\cdot\frac{y^{-4}}{1} \rightarrow \frac{3}{2}\cdot\frac{1}{y^4} \rightarrow \frac{3}{2y^4}$$

84c.

$$\frac{12p^{10}g^{39}}{3p^{12}g^{40}} \rightarrow \frac{12}{3}\cdot\frac{p^{10}}{p^{12}}\cdot\frac{g^{39}}{g^{40}} \rightarrow \frac{4}{1}\cdot\frac{p^{10-12}}{1}\cdot\frac{g^{39-40}}{1} \rightarrow \frac{4}{1}\cdot\frac{p^{-2}}{1}\cdot\frac{g^{-1}}{1} \rightarrow \frac{4}{1}\cdot\frac{1}{p^2}\cdot\frac{1}{g^1} \rightarrow \frac{4}{p^2g}$$

86a.

$$\frac{x}{x^6} \rightarrow \frac{x^{1-6}}{1} \rightarrow \frac{x^{-5}}{1} \rightarrow \frac{1}{x^5}$$

86b.

$$\frac{9a^8b^9}{4b^9a^{13}} \rightarrow \frac{9a^8b^9}{4a^{13}b^9} \rightarrow \frac{9}{4}\cdot\frac{a^8}{a^{13}}\cdot\frac{b^9}{b^9} \rightarrow \frac{9}{4}\cdot\frac{a^{8-13}}{1}\cdot 1 \rightarrow \frac{9}{4}\cdot\frac{a^{-5}}{1} \rightarrow \frac{9}{4}\cdot\frac{1}{a^5} \rightarrow \frac{9}{4a^5}$$

86c.

$$\frac{12xy^3z^3}{16x^5y^8z^3} \rightarrow \frac{12}{16}\cdot\frac{x}{x^5}\cdot\frac{y^3}{y^8}\cdot\frac{z^3}{z^3} \rightarrow \frac{3}{4}\cdot\frac{x^{1-5}}{1}\cdot\frac{y^{3-8}}{1}\cdot 1 \rightarrow \frac{3}{4}\cdot\frac{x^{-4}}{1}\cdot\frac{y^{-5}}{1} \rightarrow \frac{3}{4}\cdot\frac{1}{x^4}\cdot\frac{1}{y^5} \rightarrow \frac{3}{3x^4y^5}$$

89b.
$\dfrac{9f^{11}m^{-2}}{27f^{5}m^{-7}} \rightarrow \dfrac{9}{27}\cdot\dfrac{f^{11}}{f^{5}}\cdot\dfrac{m^{-2}}{m^{-7}} \rightarrow \dfrac{1}{3}\cdot\dfrac{f^{11-5}}{1}\cdot\dfrac{m^{-2-(-7)}}{1} \rightarrow \dfrac{1}{3}\cdot\dfrac{f^{6}}{1}\cdot\dfrac{m^{5}}{1} \rightarrow \dfrac{f^{6}m^{5}}{3}$

90a.
$-2(1)^2 \rightarrow -2\cdot1 \rightarrow -2$

90b.
$-2(-1)^2 \rightarrow -2\cdot1 \rightarrow -2$

90c.
$-(1)^2 \rightarrow -1\cdot1^2 \rightarrow -1\cdot1 \rightarrow -1$

90d.
$-(-1)^2 \rightarrow -1\cdot(-1)^2 \rightarrow -1\cdot1 \rightarrow -1$

91a.
$-2(-3) \rightarrow 6$

91b.
$3(-3)^2 \rightarrow 3\cdot(-3)^2 \rightarrow 3\cdot9 \rightarrow 27$

91c.
$-4(-3)^3 \rightarrow -4\cdot(-3)^3 \rightarrow -4\cdot-27 \rightarrow 108$

92a.
$(-H)^4 \rightarrow \big(-(-10)\big)^4 \rightarrow (10)^4 \rightarrow 10{,}000$

92b.
$\dfrac{1}{100}H^5 \rightarrow \dfrac{1}{100}(-10)^5 \rightarrow \dfrac{1}{100}(-100{,}000) \rightarrow -1{,}000$

93a.
$\dfrac{y^2}{x^7} \rightarrow \dfrac{(-4)^2}{(-1)^7} \rightarrow \dfrac{16}{-1} \rightarrow -16$

93b.
$-x^4+7x^3-2x^2 \rightarrow -(-1)^4+7(-1)^3-2(-1)^2 \rightarrow -1\cdot1+7\cdot-1-2\cdot1 \rightarrow -1+-7-2 \rightarrow -8-2 \rightarrow -10$

93c.
$-\dfrac{3}{4}y^3+\dfrac{1}{8}y^2 \rightarrow -\dfrac{3}{4}(-4)^3+\dfrac{1}{8}(-4)^2 \rightarrow -\dfrac{3}{4}\cdot-64+\dfrac{1}{8}\cdot16 \rightarrow 48+2 \rightarrow 50$

94a.
$\dfrac{x^5}{y^2} \rightarrow \dfrac{(1.5)^5}{(2.5)^2} \rightarrow \dfrac{7.59375}{6.25} \rightarrow 1.215$

94b.

$-1.5y^3 + 3.9y^2 - 2.1y \;\rightarrow\; -1.5(2.5)^3 + 3.9(2.5)^2 - 2.1(2.5) \;\rightarrow\; -1.5(15.625) + 3.9(6.25) - 5.25$

$\rightarrow\; -23.4375 + 24.375 - 5.25 \;\rightarrow\; 0.9375 - 5.25 \;\rightarrow\; -4.3125$

-4.3125 is written as -4.313 when you round it to 3 decimal places.

94c.

$4.7x^2 + 9.2x \;\rightarrow\; 4.7(1.5)^2 + 9.2(1.5) \;\rightarrow\; 4.7(2.25) + 13.8 \;\rightarrow\; 10.575 + 13.8 \;\rightarrow\; 24.375$

95.

$x^{-1} + x^{-2} \;\rightarrow\; (-2)^{-1} + (-2)^{-2} \;\rightarrow\; \dfrac{1}{(-2)^1} + \dfrac{1}{(-2)^2} \;\rightarrow\; \dfrac{1}{-2} + \dfrac{1}{4} \;\rightarrow\; -\dfrac{1}{2} + \dfrac{1}{4} \;\rightarrow\; -\dfrac{2}{4} + \dfrac{1}{4} \;\rightarrow\; -\dfrac{1}{4}$

96.

$x^{-1} + x^{-2} + x^{-3} \;\rightarrow\; \left(-\dfrac{1}{2}\right)^{-1} + \left(-\dfrac{1}{2}\right)^{-2} + \left(-\dfrac{1}{2}\right)^{-3} \;\rightarrow\; \left(-\dfrac{2}{1}\right)^{1} + \left(-\dfrac{2}{1}\right)^{2} + \left(-\dfrac{2}{1}\right)^{3}$

$\rightarrow\; (-2)^1 + (-2)^2 + (-2)^3 \;\rightarrow -2 + 4 + -8 \;\rightarrow\; 2 - 8 \;\rightarrow -6$

103a.

$x - 0.5 = 7.8 \;\rightarrow$ add 0.5 on both sides

$x = 8.3$

103b.

$\frac{x}{3} = 1.5 \;\rightarrow$ multiply by 3 on both sides

$3 \cdot \dfrac{x}{3} = 1.5 \cdot 3$

$x = 4.5$

103c.

$\frac{2}{3}x = 8 \;\rightarrow$ multiply by $\frac{3}{2}$ on both sides

$\frac{3}{2} \cdot \frac{2}{3}x = 8 \cdot \frac{3}{2} \;\rightarrow$ simplify

$x = \dfrac{8}{1} \cdot \dfrac{3}{2} \;\rightarrow\; x = \dfrac{24}{2} \;\rightarrow\; x = 12$

104a.

$0.4a + a = 28 \;\rightarrow$ combine like terms: $0.4a + 1a = 1.4a$

$1.4a = 28 \;\rightarrow$ divide by 1.4 on both sides

$a = \frac{28}{1.4}$

$a = 20$

104b.

$4 - \frac{1}{3}b = 9 \;\rightarrow$ subtract 4 on both sides

$-\frac{1}{3}b = 5 \;\rightarrow$ divide both sides by $-\frac{1}{3}$ or multiply by the reciprocal of $-\frac{1}{3}$, which is -3

$-3 \cdot \left(-\frac{1}{3}b\right) = 5 \cdot -3$

$b = -15$

105a.
$-4x + 5 = 17 - 2x \rightarrow$ add $4x$ on both sides
$5 = 17 + 2x \rightarrow$ subtract 17 on both sides
$-12 = 2x \rightarrow$ divide by 2 on both sides
$\frac{-12}{2} = \frac{2x}{2}$
$-6 = x$

105b.
$\frac{60 + 45 + c}{3} = 40 \rightarrow$ in the numerator of the fraction, combine 60 and 45
$\frac{105 + c}{3} = 40 \rightarrow$ multiply both sides by 3
$3 \cdot \left(\frac{105 + c}{3}\right) = 40 \cdot 3 \rightarrow$ simplify
$105 + c = 120 \rightarrow$ subtract 105 on both sides
$c = 15$

108a.
40% of x is 20
$0.4x = 20 \rightarrow$ divide by 0.4 on both sides
$x = \frac{20}{0.4}$
$x = 50$

108b.
113 is 3.1% of x
$113 = 0.031x \rightarrow$ divide by 0.031 on both sides
$x = \frac{113}{0.031}$
$x \approx 3{,}645.2$

109a.
Method 1: Write "what percent" as $\frac{x}{100}$
30 is what percent of 50?
$30 = \frac{x}{100} \cdot 50 \rightarrow 30 = \frac{x}{100} \cdot \frac{50}{1} \rightarrow 30 = \frac{50x}{100} \rightarrow 30 = \frac{50}{100}x \rightarrow 30 = \frac{1}{2}x \rightarrow 2 \cdot 30 = \left(\frac{1}{2}x\right) \cdot 2 \rightarrow 60 = x$
30 is 60% of 50

Method 2: Write "what percent" as x
30 is what percent of 50?
$30 = x \cdot 50 \rightarrow 30 = 50x \rightarrow \frac{30}{50} = x \rightarrow \frac{3}{5} = x \rightarrow 0.6 = x$
0.6 is the decimal form of 60%
30 is 60% of 50

109b.
Method 1: Write "what percent" as $\frac{x}{100}$
What percent of 16 is 54?
$\frac{x}{100} \cdot 16 = 54 \rightarrow \frac{x}{100} \cdot \frac{16}{1} = 54 \rightarrow \frac{16x}{100} = 54 \rightarrow \frac{4}{25}x = 54 \rightarrow \frac{25}{4} \cdot \left(\frac{4}{25}x\right) = 54 \cdot \frac{25}{4}$
$\rightarrow x = \frac{1350}{4} \rightarrow x = 337.5$
337.5% of 16 is 54.

Method 2: Write "what percent" as x
What percent of 16 is 54?
$x \cdot 16 = 54 \rightarrow 16x = 54 \rightarrow \frac{16x}{16} = \frac{54}{16} \rightarrow x = 3.375$
3.375 is the decimal form of 337.5%
337.5% of 16 is 54.

113.
You end with $1,000, but you do not know the original amount of money.
After the original amount increases by 5%, it is worth $1,000.
Let x represent the original amount.
x plus 5% of x is 1,000
$x + 0.05x = 1{,}000$
$1.05x = 1{,}000$
$x = \dfrac{1{,}000}{1.05} \rightarrow x = 952.3809...$
You originally had $952.38 in the account.

114a.
The original population decreases by 10% to end at 9,000.
Let x represent the original population.
x minus 10% of x is 9,000
$x - 0.10x = 9{,}000$
$0.90x = 9{,}000$
$x = \dfrac{9{,}000}{0.90} \rightarrow x = 10{,}000$
The original population is 10,000 people.

115.
Sales tax is added to the original price of the TV to get the final bill.
The original price plus the sales tax equals $638.40.
The original price plus 6.4% of the original price equals $638.40.
You do not know the original price, so you can call it x.
x + 6.4% of x = 638.40
$x + 0.064x = 638.40 \rightarrow 1.064x = 638.40 \rightarrow x = 638.40 \div 1.064 \rightarrow x = \$600$

119a.
Since the Monarch is 1200 miles away after 8 days and 900 miles away after 12 days, you can subtract the miles to see that it has flown 300 miles in 4 days.
300 divided by 4 is 75. It is flying 75 miles per day.
If it was 1200 miles away after 8 days and it was flying 75 miles per day, you can find out how far it flew in 8 days.
75x8 = 600. It flew 600 miles in 8 days.
If it is 1200 miles away from its destination after 8 days, and it has flown 600 miles in those first 8 days, then it start 1200 + 600 = 1800 miles away from its destination. When it finishes its trip, it will have flown 1800 miles.

119b.
After 12 days, it is 900 miles away. Find how long it takes to fly 900 miles at a rate of 75 miles per day.
900 divided by 75 is 12. It will take 12 days to fly 900 miles.
12 days plus 12 days is 24 days.
It will reach its destination after flying a total of 24 days.

121a.

3 kilograms of apples costs $12, while 6 kilograms of apples costs $24. When you buy 3 more kilograms of apples, the total price increases by $12. As a rate the total price increases by $12 per 3 kilograms. If you write this as a unit rate, it is $4 per 1 kilogram.

121b.

To find the total price, multiply the number of kilograms you buy by 4.
The total price, *P*, of the apples is equal to 4 times the number of kilograms, *k*.
$P = 4k$

122.

The two marked points on the line are (−3, 4) and (3, −1). To get from the left point to the right point, you move down 5 and right 6. The rise is −5 and the run is 6. The slope is a ratio that compares the rise and the run. As a fraction, the slope is $\frac{\text{rise}}{\text{run}}$. For this line, the slope is $\frac{-5}{6}$ and that can be written as $-\frac{5}{6}$.
You can also use the slope formula to find the slope:
$\text{m} = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow \text{m} = \frac{-1-4}{3-(-3)} \rightarrow \text{m} = \frac{-5}{6} \rightarrow \text{m} = -\frac{5}{6}$

123.

The two marked points on the line are (−25, 11) and (−10, 6). To get from (−25, 11) to (−10, 6), you move down 5 and right 15. The rise is −5 and the run is 15. The slope is a ratio that compares the rise and the run. As a fraction, the slope is $\frac{\text{rise}}{\text{run}}$. For this line, the slope is $\frac{-5}{15}$ and that can be written as $-\frac{1}{3}$.
You can also use the slope formula to find the slope:
$\text{m} = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow \text{m} = \frac{6-11}{-10-(-25)} \rightarrow \text{m} = \frac{-5}{15} \rightarrow \text{m} = -\frac{1}{3}$

124a.

The *y*-intercept is (0, −2). The slope of the line is $\frac{3}{4}$ so you can start at the *y*-intercept, move up 3 and right 4, and plot the point (4, 1). You can also start at the *y*-intercept and move down 3 and left 4 to get to the point (−4, −5). Now that you have 3 points plotted, draw a line through the points to show that there are infinitely many more points on this line, including points with coordinates that contain fractions and/or decimals.

124b.

The *y*-intercept is (0, 3). The slope of the line is $-\frac{4}{3}$ so you can start at the *y*-intercept, move down 4 and right 3, and plot the point (3, −1). You can repeat this movement and move down 4 and right 3 again to get to the point (6, −5). You can also start at the *y*-intercept and move up 4 and left 3 to get to the point (−3, 7). After you have at least 3 points plotted, draw a line through the points to show that there are infinitely many more points on this line, including points with coordinates that contain fractions and/or decimals.

125.

Opposite reciprocals are fractions that look like $\frac{A}{B}$ and $-\frac{B}{A}$. If you multiply them together, their product is −1. For example, $\frac{4}{3}$ and $-\frac{3}{4}$ are opposite reciprocals, as well as $\frac{5}{1}$ and $-\frac{1}{5}$.

126.

Pick 2 points on the line. Two points are marked: (−1, 5) and (3, −3). You may also use other points on the line, such as (0, 3) or (2, −1). To write the equation in Slope-Intercept Form, $y = mx + b$, you need the slope and the y-intercept. To find the slope, you need to know the rise and the run. The rise is the difference between the y-values. The run is the difference between the x-values. You can also refer to the slope formula below. If you use the points (−1, 5) and (3, −3), the slope is:

$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{-3 - 5}{3 - (-1)} \rightarrow m = \frac{-8}{4} \rightarrow m = -2$

The slope is −2 , so you can write the equation as $y = -2x + b$. You can see the y-intercept in the graph. It is (0, 3) so you can replace b with 3.

The equation is $y = -2x + 3$.

If you cannot see the y-intercept clearly in the graph, you can pick one of the points on the line, replace x and y with those values and solve for b. If you use the point (3, −3), the equation is:

$-3 = -2(3) + b$

You can multiply −2 and 3 to get −6, which makes the equation $-3 = -6 + b$. Add 6 to both sides of the equation to isolate b, which shows you that b = 3. The y-intercept is 3. In Slope-Intercept Form, the equation is $y = -2x + 3$.

127.

To write the equation in Slope-Intercept Form, $y = mx + b$, you need the slope and the y-intercept. To find the slope, you need to know the rise and the run. The rise is the difference between the y-values. The run is the difference between the x-values. You can also refer to the slope formula below:

$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{-3 - 1}{5 - (-5)} \rightarrow m = \frac{-4}{10} \rightarrow m = -\frac{2}{5}$

The slope is $-\frac{2}{5}$, so you can write the equation as $y = -\frac{2}{5}x + b$. Pick one of the points on the line, replace x and y with those values and solve for b. If you use the point (5, −3), the equation is:

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

You can multiply $-\frac{2}{5}$ and 5 to get −2, which makes the equation $-3 = -2 + b$, so b = −1. Now you know that the y-intercept is −1. In Slope-Intercept Form, the equation is $y = -\frac{2}{5}x - 1$.

128.

To write the equation in Slope-Intercept Form, $y = mx + b$, you need the slope and the y-intercept. To find the slope, you need to know the rise and the run. The rise is the difference between the y-values. The run is the difference between the x-values. You can also refer to the slope formula below:

$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{11 - (-4)}{-6 - (-1)} \rightarrow m = \frac{15}{-5} \rightarrow m = -3$

The slope is −3, so you can write the equation as $y = -3x + b$. Pick one of the points on the line, replace x and y with those values and solve for b. If you use the point (−1, −4), the equation is:

$-4 = -3(-1) + b$

You can multiply −3 and −1 to get 3, which makes the equation $-4 = 3 + b$, so b = −7. Now you know that the y-intercept is −7. In Slope-Intercept Form, the equation is $y = -3x - 7$.

135a.

To find the x-intercept, replace y with 0 and solve for x.

$2x + 5y = -10 \rightarrow 2x + 5(0) = -10 \rightarrow 2x + 0 = -10 \rightarrow 2x = -10 \rightarrow x = -5$

The x-intercept is (−5, 0).

To find the y-intercept, replace x with 0 and solve for y.

$2x + 5y = -10 \rightarrow 2(0) + 5y = -10 \rightarrow 0 + 5y = -10 \rightarrow 5y = -10 \rightarrow y = -2$

The y-intercept is (0, −2).

135b.
To find another point on the line, pick one of the variables in the equation and replace it with a number. Solve the equation to find the value of the other variable.

One example: replace x with 3.
$2x + 5y = -10 \rightarrow 2(3) + 5y = -10 \rightarrow 6 + 5y = -10 \rightarrow 5y = -16 \rightarrow y = -3.2$
When $x = 3$, $y = -3.2$. You can plot the point $(3, -3.2)$.

Another example: replace y with −1.
$2x + 5y = -10 \rightarrow 2x + 5(-1) = -10 \rightarrow 2x - 5 = -10 \rightarrow 2x = -5 \rightarrow x = -2.5$
When $y = -1$, $x = -2.5$. You can plot the point $(-2.5, -1)$.

136a.
If you pick 2 points on a vertical line and calculate the slope, you will get a fraction with zero in the denominator. When a number is divided by 0, it is called "undefined." To use specific numbers, the fractions $\frac{1}{0}$, $\frac{5}{0}$ and $\frac{-3}{0}$ are all undefined. For this reason, the slope of a vertical line is called "undefined."

136b.
If you pick 2 points on a horizontal line and calculate the slope, you will get a fraction with zero in the numerator. When a fraction is 0 divided by a nonzero number, the value of that fraction is 0. To use specific numbers, the fractions $\frac{0}{1}$, $\frac{0}{5}$ and $\frac{0}{-5}$ are all undefined. For this reason, the slope of a horizontal line is 0.

137a.
$(-10)^3 \rightarrow (-10)\cdot(-10)\cdot(-10) \rightarrow -1{,}000$

137b.
$5 - 1(-3)^3 \rightarrow 5 - 1\cdot(-3)\cdot(-3)\cdot(-3) \rightarrow 5 - 1\cdot(-27) \rightarrow 5 - (-27) \rightarrow 5 + 27 \rightarrow 32$

141a.
$-2y^4\cdot 3y^2\cdot y \rightarrow -2\cdot 3\cdot y^4\cdot y^2\cdot y \rightarrow -6\cdot y^{4+2+1} \rightarrow -6y^7$

141b.
$2^4\cdot 2^2 \rightarrow 2^{4+2} \rightarrow 2^6$ or 64

141c.
$$\frac{9x^2y^4}{15x^3y} \rightarrow \frac{9}{15}\cdot\frac{x^2}{x^3}\cdot\frac{y^4}{y} \rightarrow \frac{3}{5}\cdot\frac{x^2}{x^2}\cdot\frac{1}{x}\cdot\frac{y^{4-1}}{1} \rightarrow \frac{3}{5}\cdot 1\cdot\frac{1}{x}\cdot\frac{y^3}{1} \rightarrow \frac{3}{5}\cdot\frac{1}{x}\cdot\frac{y^3}{1} \rightarrow \frac{3y^3}{5x}$$

142a.
$$\left(\frac{-2y^2}{x^3}\right)^3 \rightarrow \frac{(-2)^3\left(y^2\right)^3}{(x^3)^3} \rightarrow \frac{-8y^{2\cdot 3}}{x^{3\cdot 3}} \rightarrow \frac{-8y^6}{x^9} \text{ or } -\frac{8y^6}{x^9}$$

142b.
$(x^2)^3 + (x^3)^2 \rightarrow x^{2\cdot 3} + x^{3\cdot 2} \rightarrow x^6 + x^6 \rightarrow 2x^6$

142c.
$-3(-y)^2\cdot(-2y)^3 \rightarrow -3\cdot(-1)^2\cdot y^2\cdot(-2)^3\cdot y^3 \rightarrow -3\cdot 1\cdot y^2\cdot -8\cdot y^3 \rightarrow 24y^{2+3} \rightarrow 24y^5$

143a.

$3x^{-2} \rightarrow 3 \cdot x^{-2} \rightarrow 3 \cdot \frac{1}{x^2} \rightarrow \frac{3}{1} \cdot \frac{1}{x^2} \rightarrow \frac{3}{x^2}$

143b.

$3^{-2}x^3 \rightarrow 3^{-2} \cdot x^3 \rightarrow \frac{1}{3^2} \cdot \frac{x^3}{1} \rightarrow \frac{x^3}{9}$

144b.

$\left(x^{-2}\right)^2 \rightarrow x^{-2 \cdot 2} \rightarrow x^{-4} \rightarrow \frac{1}{x^4}$

144c.

$\left(\frac{1}{2}x\right)^{-3} \rightarrow \left(\frac{x}{2}\right)^{-3} \rightarrow \left(\frac{2}{x}\right)^3 \rightarrow \frac{2^3}{x^3} \rightarrow \frac{8}{x^3}$

147.

Two points are marked: (−7, 3) and (−3, 0). To write the equation in Slope-Intercept Form, $y = mx + b$, you need the slope and the y-intercept. To find the slope, you need to know the rise and the run. The rise is the difference between the y-values. The run is the difference between the x-values. You can also refer to the slope formula below. If you use the points (−7, 3) and (−3, 0), the slope is:

$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{0 - 3}{-3 - (-7)} \rightarrow m = \frac{-3}{4} \rightarrow m = -\frac{3}{4}$

The slope is $-\frac{3}{4}$, so you can write the equation as $y = -\frac{3}{4}x + b$.

When you cannot see the y-intercept clearly in the graph, you can pick one of the points on the line, replace x and y with those values and solve for b. If you use the point (−7, 3), the equation is:

$3 = -\frac{3}{4}(-7) + b$

You can multiply $-\frac{3}{4}$ and −7 to get $\frac{21}{4}$, which makes the equation $3 = \frac{21}{4} + b$. Subtract $\frac{21}{4}$ on both sides of the equation to isolate b. To calculate, $3 - \frac{21}{4}$, find a common denominator:

$3 - \frac{21}{4} = b \rightarrow \frac{3}{1} - \frac{21}{4} = b \rightarrow \frac{12}{4} - \frac{21}{4} = b \rightarrow -\frac{9}{4} = b$

Since the value of b is $-\frac{9}{4}$, the y-intercept of the line is $-\frac{9}{4}$. In Slope-Intercept Form, the equation is $y = -\frac{3}{4}x - \frac{9}{4}$. If you write the y-intercept as a mixed number, the equation is $y = -\frac{3}{4}x - 2\frac{1}{4}$.

151.

The money spent decreases by 12.5% from 2012 to 2013.
In the graph, the money spent decreases by 2 horizontal lines from 2012 to 2013.
Each horizontal line represents a change of $5, so 2 lines represents a change of $10.
For this scenario, the $10 decrease is a 12.5% decrease.
100% is 8 times larger than 12.5%. $80 is 8 times larger than $10. If $80 decreases by $10, it decreases by 12.5%. Since the graph shows the amount spent in 2012 decreases by $10 and we know it decreases by 12.5%, then $80 is the amount spent in 2012.
The average amount spent per family in 2012 was $80.

