9.23)

(a) $\sqrt{(27)(12)} = \sqrt{3^3 \cdot 3^1 \cdot 4} = \sqrt{9^2 \cdot 4} = 9 \cdot 2 = 18$

(b) $\sqrt{2 \cdot 18 \cdot 40 \cdot 10} = \sqrt{2^2 \cdot 2^2 \cdot 3^2 \cdot 10^2}$

$2 \cdot 9 \cdot 2 \cdot 2^2 \cdot 10 \cdot 10 = 2 \cdot 2 \cdot 3 \cdot 10$

$= 120$

(c) $\sqrt{7 \cdot 2} \cdot \sqrt{2^3 \cdot 7^3} = \sqrt{4^2 \cdot 49^2} = 4 \cdot 49 = 196$

$7 \cdot 2 \cdot 2^3 \cdot 7^3 = 2^4 \cdot 7^4$

$= 4^2 \cdot 49^2$

(d) $\sqrt{24} \cdot 2\sqrt{54} = 2\sqrt{24 \cdot 54} = 2\sqrt{9^2 \cdot 4^2} = 2 \cdot 9 \cdot 4$

$= 72$

$3 \cdot 2^2 \cdot 2 \cdot 2 \cdot 3^3 = 3^4 \cdot 2^4$

$= 9^2 \cdot 4^2$

(e) $\sqrt{3} \cdot \sqrt{5} \cdot \sqrt{15} = \sqrt{3^2 \cdot 5^2} = 3 \cdot 5 = 15$

(f) $\sqrt{24} \cdot \sqrt{18} \cdot \sqrt{12} = \sqrt{8^2 \cdot 9^2} = 8 \cdot 9 = 72$

$\underset{2^2}{4} \cdot 3 \cdot 2 \cdot \underset{3^2}{9} \cdot 2 \cdot \underset{2^2}{4} \cdot 3 = 2^6 \cdot 3^4$

$= 8^2 \cdot 9^2$

(g) $\sqrt{5\frac{4}{9}} = \sqrt{\frac{45}{9} + \frac{4}{9}} = \sqrt{\frac{49}{9}} = \frac{7}{3} = 2\frac{1}{3}$

(h) $\sqrt{12\frac{1}{4}} = \sqrt{\frac{48}{4} + \frac{1}{4}} = \sqrt{\frac{49}{4}} = \frac{7}{2} = 3\frac{1}{2}$

(i) $\sqrt{2.89} = \sqrt{289 \cdot \frac{1}{100}} = 17 \cdot \frac{1}{10} = 1.7$

(j) $\frac{\sqrt{24}}{\sqrt{30}} \div \frac{\sqrt{20}}{3\sqrt{25}} = \frac{\sqrt{24} \cdot 3\sqrt{25}}{\sqrt{30} \cdot \sqrt{20}} = \frac{3\sqrt{5^2 \cdot 2^2 \cdot 2 \cdot 3}}{\sqrt{5^2 \cdot 2^2 \cdot 2 \cdot 3}}$

$= \frac{3 \cdot 8 \cdot \cancel{2} \sqrt{6}}{\cancel{8} \cdot \cancel{2} \sqrt{\cancel{6}}} = 3$

$3 \cdot 4 \cdot 2 \cdot 5^2 = 5^2 \cdot 2^2 \cdot 2 \cdot 3$

$5 \cdot 2 \cdot 3 \cdot 2 \cdot 5 \cdot 2 = 5^2 \cdot 2^2 \cdot 2 \cdot 3$

(k) $\sqrt{3^5 + 3^5 + 3^5} = \sqrt{3^5 (3)} = \sqrt{27^2} = 27$

(l) $\sqrt{5^5 + 5^5 + 5^5 + 5^5 + 5^5} = \sqrt{5^5 (5)}$

$= \sqrt{5^6} = \sqrt{125^2} = 125$

9.24)

$\sqrt{x^3 - 2^y}$ $\quad x = 5$, $y = 2$

$\sqrt{5^3 - 2^2}$

$\sqrt{125 - 4} = \sqrt{121} = 11$

9.25) $\sqrt{28 + \sqrt{1296}} = \sqrt{28 + 36}$

$= \sqrt{64} = 8$

9.26)

$1^3, 2^3, \cdots 4^3, 0^3 = 0$

$\sqrt{1} = 1 \quad \sqrt{(2^3)^2} = 8 \quad \sqrt{0} = 0$ **3**

9.27)

$x^2 = 16 \qquad -4 + 4 = 0$

9.28)

$\sqrt{n} = \sqrt{81} - \sqrt{16}$

$\sqrt{n} = 9 - 4$

$\sqrt{n} = 5 \qquad n = 25$

9.29)

(a) $\sqrt{9+4y} = 11 \qquad 11^2 = 9+4y$

$121 - 9 = 4y$

$\frac{112}{4} = y = 28$

(b) $6 - \sqrt{z+1} = 9$

$-3 = \sqrt{z+1}$ No tiene solución porque la expresión $\sqrt{z+1}$ debe ser no-negativa.

9.30)

$-\sqrt{23} \qquad 4 < \sqrt{23} < 5$

$\sqrt{23}$ está más cerca a 5. por lo que $-\sqrt{23}$ se aproxima a -5.

$4.5 < \sqrt{23} < 5$

9.31)

(a) $10 - \sqrt{101} \qquad \sqrt{100} < \sqrt{101}$

Negativa $\qquad 10 < \sqrt{101}$

(b) $10 - 3\sqrt{11} \qquad \sqrt{11} < 3.33$

Positivo

$$(3\sqrt{11})^2 = 9 \cdot 11 = 99$$

$$3\sqrt{11} < 10$$

$$\begin{array}{r} 3.33 \\ \times \quad 3 \\ \hline 9.99 \end{array}$$

$$3\sqrt{11} < 3 \cdot 3.33$$

(c)

$$4\sqrt{33} - 5\sqrt{21}$$

$$(4\sqrt{33})^2 = 16 \cdot 33 \qquad (5\sqrt{21})^2 = 25 \cdot 21$$

$$\begin{array}{r} 1 \\ 1 \\ 16 \\ \times 33 \\ \hline 48 \\ 48 \\ \hline 528 \end{array}$$

$$\begin{array}{r} 1 \\ 25 \\ \times 21 \\ \hline 25 \\ 50 \\ \hline 525 \end{array}$$

$$4\sqrt{33} > 5\sqrt{21}$$

Positivo

9.32)

$$\sqrt{37} \quad y \quad 5\sqrt{11}$$

$$\sqrt{37} < 7 \qquad 5\sqrt{11} < 17$$

$\sqrt{37}$ se encuentra entre 6 y 7

$5\sqrt{11}$ se encuentra entre 16 y 17

de 7 y 16 hay 10 enteros.

9.33)

$$d = \sqrt{1.5n}$$

$$d = \sqrt{1.5.1250}$$

$$d = \sqrt{15 \cdot 125}$$

$$\begin{array}{r} 1 \\ 625 \\ \times \quad 3 \\ \hline 1875 \end{array}$$

$= \sqrt{5^3 \cdot 5^1 \cdot 3} = \sqrt{25^2 \cdot 3} = 25\sqrt{3}$

$= 625 \cdot 3 = 1875$

$43 < 25\sqrt{3} < 43.5$

43 millas

9.34) $\sqrt{80} + \sqrt{120}$

$\sqrt{81} + \sqrt{121} = 9 + 11 = 20.$ 19

$\sqrt{80} + \sqrt{120} < 20$

$8.5 < \sqrt{80}$

$10.5 < \sqrt{121}$

$8.5 + 10.5 < \sqrt{80} + \sqrt{121}$

$19 < \sqrt{80} + \sqrt{121}$

9.35) $15,\ 4\sqrt{14},\ 3\sqrt{26},\ 6\sqrt{6}$ 15

$(4\sqrt{14})^2 = 16 \cdot 14 = 224$

$(3\sqrt{26})^2 = 9 \cdot 26 = 234$

$(6\sqrt{6})^2 = 36 \cdot 6 = 216$

$15^2 = 225$

$6\sqrt{6} < 4\sqrt{14} < 15 < 3\sqrt{26}$

9.36) $\sqrt{42.3}$ $\quad 6 < \sqrt{42.3} < 7$

$6.5 < \sqrt{42.3} < 7$

$$\begin{array}{r} 6.5 \\ \times 6.5 \\ \hline 1\,3\,2\,5 \\ 3\,9\,0 \\ \hline 4\,2.2\,5 \end{array}$$

7

9.37)

$$3\sqrt{3} = \frac{x}{100}\left(12\sqrt{12}\right)$$

$$\frac{3 \cdot 100\sqrt{3}}{12\sqrt{12}} = x$$

(3 and 12 cancelled to 1 and 4; 100 and 4 cancelled to 25 and 1)

$$x = \frac{25\sqrt{3}}{\sqrt{12}} = 25\sqrt{\tfrac{1}{4}}$$

$$= 25 \cdot \tfrac{1}{2} = 12.5$$

12.5 %

9.38)

(a) $\sqrt{360} =$

$36 \cdot 10$

$9 \cdot 2 \cdot 2 \cdot 2 \cdot 5$

$\sqrt{9 \cdot 2^2 \cdot 2 \cdot 5} = 3 \cdot 2\sqrt{10}$

$6\sqrt{10}$

(b) $\sqrt{936}$

$$\begin{array}{r|l} 936 & 9 \\ \hline 9 & 104 \\ 036 & \end{array}$$

$9 \cdot 104$

$$\begin{array}{r|l} 104 & 4 \\ \hline 8 & 26 \\ 24 & \end{array}$$

$\sqrt{9 \cdot 4 \cdot 26}$

$3 \cdot 2\sqrt{26} =$ **$6\sqrt{26}$**

(c) $\sqrt{10164} = \sqrt{4 \cdot 121 \cdot 21}$

$$\begin{array}{r|l} 10164 & 4 \\ \hline 8 & 2541 \\ 21 & \\ 20 & \\ 16 & \\ 16 & \\ 04 & \end{array}$$

$= 2 \cdot 11\sqrt{21}$

$$\begin{array}{r|l} 363 & 7 \\ \hline 35 & 5 \\ 13 & \end{array}$$

$=$ **$22\sqrt{21}$**

$10164 = 4 \cdot 7 \cdot 363$

$= 4 \cdot 7 \cdot 121 \cdot 3$

9.39)

$\sqrt{98} - \sqrt{50}$

$9.8 < \sqrt{98} < 10$

$7 < \sqrt{50} < 7.2$

$\sqrt{98} - \sqrt{50} < 3$

$\sqrt{98} - \sqrt{50} > 2.6$

$2.6 < \sqrt{98} - \sqrt{50} < 3$

$\sqrt{98} - \sqrt{50}$ está más cerca de 3.

9.40)

$k\sqrt{5}$

$(k\sqrt{5})^2 = k^2 \cdot 5 = 5k^2$

$5k^2 < 100$

1, 2, 3, 4. **4**

9.41)

$4\sqrt{60} - 2\sqrt{135}$

$135 \; \overline{|3}$ 27

10

$\overline{35}$

$3^2 \cdot 3 \cdot 5$

$8\sqrt{15} - 6\sqrt{15}$

$2\sqrt{15}$

9.42)

$(\sqrt{3} - \sqrt{27} + \sqrt{75})^2$

$(\sqrt{3} - 3\sqrt{3} + 5\sqrt{3})^2 = (3\sqrt{3})^2 = 9 \cdot 3 = 27$