KEY

Chapter 5 Review

5.1 Working With Radicals, pages 188–198

1. Convert each entire radical to a mixed radical in simplest form. State any restrictions on the variable(s).

a) $\sqrt{288}$ $= 2 \cdot 2 \cdot 3\sqrt{2}$

$= \boxed{12\sqrt{2}}$

2 144

12 12

3 4 3 4

2 2 2 2

b) $\sqrt{128c^2}$ $= c \cdot 2 \cdot 2 \cdot 2\sqrt{2}$

$= \boxed{8c\sqrt{2}}$

2 64

2 32

2 16

2 8

2 4

2 2

c) $\sqrt{24a^4b^3}$ $= \boxed{2a^2b\sqrt{6b},\ b \geq 0}$

2 12

2 6

2 3

d) $\sqrt[3]{250x^3y^5}$ $= \boxed{5xy\sqrt[3]{2y^2}}$

2 125

5 25

5 5

2. Convert each mixed radical to an entire radical. State any restriction on the variable(s).

a) $4\sqrt{6} = \sqrt{(\boxed{4})^2(6)}$

$= \sqrt{\boxed{96}}$

b) $-5m\sqrt{7}$ $= \sqrt{(-5)^2m^2 7}$

$= \boxed{-\sqrt{175m^2}}$

c) $3y\sqrt[3]{2y^2}$ $= \sqrt[3]{3^3y^3 2y^2}$

$= \boxed{\sqrt[3]{54y^5}}$

d) $-2x\sqrt[4]{6xy^3}$ $= -\sqrt[4]{2^4x^4 6xy^3}$

$= \boxed{-\sqrt[4]{96x^5y^3}}$, $x \geq 0$, $y \geq 0$

3. Simplify. State any restrictions on the values for the variables.

a) $3\sqrt{6} - 4\sqrt{6} = \boxed{-1\ \sqrt{6}}$

b) $-\sqrt{45} + 2\sqrt{5} - \sqrt{20}$

5 ^ 9   5 ^ 4

$= -3\sqrt{5} \cancel{+2\sqrt{5}} \cancel{-2\sqrt{5}}$

$= \boxed{-3\sqrt{5}}$

c) $-3\sqrt{18} + 3\sqrt{8x} - \sqrt{32x^3}$

2 ^ 9

32 1
2 ^ 16
2 ^ 8
2 ^ 4
2 ^ 2

$= \boxed{-9\sqrt{2} + 6\sqrt{2x} - 4x\sqrt{2x}}$

$x \geq 0$

d) $2\sqrt[3]{6x^2y} - \sqrt[3]{48x^2y}$

48
2 ^ 24
2 ^ 12
2 ^ 6
2 ^ 3

$= 2\sqrt[3]{6x^2y} - 2\sqrt[3]{6x^2y}$

$= \boxed{0}$

4. Put the following values in ascending order: $3\sqrt{30}$, $\sqrt{250}$, 16, $4\sqrt{15}$.

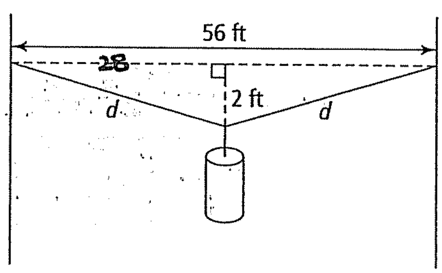
$3\sqrt{30} = \sqrt{3 \cdot 3 \cdot 30} = \sqrt{270}$

$16 = \sqrt{16 \cdot 16} = \sqrt{256}$

$4\sqrt{15} = \sqrt{4 \cdot 4 \cdot 15} = \sqrt{240}$

$\boxed{4\sqrt{15},\ \sqrt{250},\ 16,\ 3\sqrt{30}}$

5. A wire is pulled taut between two posts. A weight is placed in the middle of the wire, which pulls the wire down at its centre by 2 ft. How long is the wire after the weight is place on it? Write the answer in simplest radical form.



$2^2 + 28^2 = d^2$

$4 + 784 = d^2$

$788 = d^2$

$\sqrt{788} = d$

788
2 ^ 394
2 ^ 197

$2d = 2\sqrt{788}$

$= \boxed{4\sqrt{197}\ \text{ft}}$

5.2 Multiplying and Dividing Radical Expressions, pages 199–209

6. Multiply. Express each product in simplest form. State any restrictions on the values for the variables.

a) $(\sqrt{6})(\sqrt{14}) = \sqrt{6 \cdot 14}$

$= \sqrt{84}$

$= \boxed{2\sqrt{21}}$

84
2 ^ 42
2 ^ 21
3 ^ 7

b) $(\sqrt{3x^2})(2\sqrt{3x^4})$

$= 2 \cdot 3 \cdot x \cdot x^2 \sqrt{(\cancel{3}x^2)(\cancel{3}x^{\cancel{4}})}$

$= 6x^3$, $x \geq 0$

c) $(-10y\sqrt{5})(4\sqrt{50}) = -40y\sqrt{250}$

$= -40y \cdot 5\sqrt{10}$

$= \boxed{-200y\sqrt{10}}$

250
2 ^ 125
5 ^ 25
5 ^ 5

d) $(5 - 4\sqrt{3})(3 + 3\sqrt{3})$

$= 15 + 15\sqrt{3} - 12\sqrt{3} - 12\sqrt{9}$

$= 15 + 3\sqrt{3} - 12 \cdot 3$

$= 15 + 3\sqrt{3} - 36 = \boxed{-21 + 3\sqrt{3}}$

e) $(\sqrt{2} - 3\sqrt{5r})^2 = (\sqrt{2} - 3\sqrt{5r})(\sqrt{2} - 3\sqrt{5r})$

$= \sqrt{4} - 3\sqrt{10r} - 3\sqrt{10r} + 9\sqrt{25r^2}$

$= 2 - 6\sqrt{10r} + 9 \cdot 5r$

$= \boxed{2 - 6\sqrt{10r} + 45r, \ r \geq 0}$

f) $(3 - \sqrt{2x})(3 + \sqrt{2x})$

$= 9 + 3\sqrt{2x} - 3\sqrt{2x} - \sqrt{4x^2}$

$= \boxed{9 - 2x, \ x \geq 0}$

7. Rationalize each denominator. State any restrictions on the values for the variable(s).

a) $\frac{4}{\sqrt{5}} = \left(\frac{4}{\sqrt{5}}\right)\left(\frac{\sqrt{5}}{\sqrt{5}}\right)$

$= \frac{4\sqrt{5}}{5}$

b) $\frac{-\sqrt{2}}{8\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{-\sqrt{6}}{24}}$

c) $\frac{3}{\sqrt{5} + 4} \times \frac{\sqrt{5} - 4}{\sqrt{5} - 4}$

$= \frac{3\sqrt{5} - 12}{5 - 16}$

$= \boxed{\frac{3\sqrt{5} - 12}{-11}}$

d) $\frac{3 + 4\sqrt{3}}{\sqrt{2} + 2\sqrt{5}} \times \frac{\sqrt{2} - 2\sqrt{5}}{\sqrt{2} - 2\sqrt{5}}$

$= \frac{3\sqrt{2} - 6\sqrt{5} + 4\sqrt{6} - 8\sqrt{15}}{2 - 4 \cdot 5}$

$= \boxed{\frac{3\sqrt{2} - 6\sqrt{5} + 4\sqrt{6} - 8\sqrt{15}}{-18}}$

e) $\frac{\sqrt{\cancel{18}^{3}\cancel{x}y}}{\sqrt{\cancel{12}_{2}\cancel{x}y^{\cancel{3}}}} = \sqrt{\frac{3}{2y^2}} = \frac{\sqrt{3}}{y\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$

$= \boxed{\frac{\sqrt{6}}{2y}, \ x > 0, y > 0}$

f) $\frac{3n^2 + \sqrt{2n^2}}{\sqrt{10n}} \times \frac{\sqrt{10n}}{\sqrt{10n}} = \frac{3n^2\sqrt{10n} + \sqrt{20n^3}}{10n}$

$= \frac{3n^{\cancel{2}}\sqrt{10n} + 2\cancel{n}\sqrt{5n}}{10\cancel{n}}$

$= \boxed{\frac{3n\sqrt{10n} + 2\sqrt{5n}}{10}, \ n > 0}$

8. Write the conjugate of each expression.

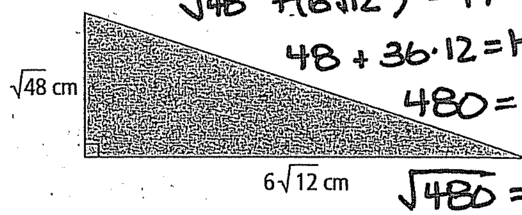
a) $\sqrt{3k} - 5$

$\sqrt{3k} + 5$

b) $-3\sqrt{2} - 4\sqrt{7}$

$-3\sqrt{2} + 4\sqrt{7}$

9. For the given right triangle, express the following in simplest radical form.



$\sqrt{48}^2 + (6\sqrt{12})^2 = h^2$

$48 + 36 \cdot 12 = h^2$

$480 = h^2$

$\sqrt{480} = h$

48: 2, 24; 2, 12; 2, 6; 2, 3

12: 2, 6; 2, 3

480: 48, 10; 2, 24; 2, 5; 2, 12; 2, 6; 2, 3

a) the perimeter

$P = \sqrt{48} + 6\sqrt{12} + \sqrt{480}$

$= 4\sqrt{3} + 12\sqrt{3} + 4\sqrt{30}$

$= \boxed{16\sqrt{3} + 4\sqrt{30}\text{ cm}}$

b) the area

$A = \sqrt{48} \times 6\sqrt{12} \div 2$

$= 4\sqrt{3} \times 12\sqrt{3} \div 2$

$= 48\sqrt{9} \div 2 = 48 \times 3 \div 2 = \boxed{72\text{ cm}^2}$

5.3 Radical Equations, pages 211–222

10. Solve each radical equation. State any restrictions on the values for the variable(s).

a) $-8 + \sqrt{5a - 5} = -3$, $a \geq$ 1

$5a - 5 \geq 0$

$5a \geq 5$

$a \geq 1$

$+8 \qquad +8$

$\sqrt{5a - 5} =$ 5

$(\sqrt{5a - 5})^2 = (5)^2$

$5a - 5 = 25$

$+5 \qquad +5$

$\frac{5a}{5} = \frac{30}{5}$

$\boxed{a = 6}$

b) $\sqrt{2n - 88}^2 = \sqrt{\frac{n}{6}}^2$ $\boxed{n \geq 44}$

$(2n - 88 = \frac{n}{6}) \times 6$

$12n - 528 = n$

$-n \qquad -n$

$11n - 528 = 0$

$+528 \qquad +528$

$\frac{11n}{11} = \frac{528}{11} \rightarrow \boxed{n = 48}$

c) $(b - 6)^2 = \sqrt{18 - 3b}^2$, $b \geq 6$

$b^2 - 12b + 36 = 18 - 3b$

$b^2 - 9b + 18 = 0$

$(b - 6)(b - 3) = 0$

$\boxed{b = 6}$ $\cancel{b = 3}$

d) $\sqrt{x + 4} - \sqrt{x - 4} = 2$, $\boxed{x \geq 4}$

$(\sqrt{x+4})^2 = (2 + \sqrt{x-4})^2$

$\cancel{x} + 4 = \cancel{4} + 4\sqrt{x - 4} + \cancel{x} - \cancel{4}$

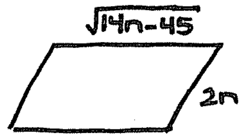
$\frac{4}{4} = \frac{4\sqrt{x-4}}{4}$

$1^2 = \sqrt{x - 4}^2$

$1 = x - 4$

$\boxed{5 = x}$

11. Two adjacent sides of a parallelogram have the measures $\sqrt{14n - 45}$ cm and $2n$ cm. Determine the actual lengths of the two sides if the perimeter of the parallelogram is 54 cm.



$$\frac{2(2n) + 2(\sqrt{14n-45}) = 54}{2}$$

$$2n + \sqrt{14n-45} = 27$$

$$\sqrt{14n-45}^{\,2} = (-2n+27)^2$$

$$14n - 45 = 4n^2 - 108n + 729$$

$$0 = 4n^2 - 122n + 774$$

$$0 = 2n^2 - 61n + 387$$

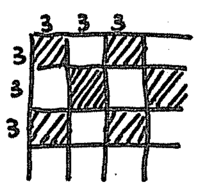
$$n = \frac{-(-61) \pm \sqrt{(-61)^2 - 4(2)(387)}}{2(2)} = \frac{61 \pm \sqrt{625}}{4} = \frac{61 \pm 25}{4}$$

$n = 21.5, 9$

$\sqrt{14(21.5)-45} = \cancel{16 \times 43 \text{ cm}}$ too big

$\sqrt{14(9)-45} = \boxed{9 \times 18 \text{ cm}}$

12. The Japanese game called Chu Shogi uses a square board. The board is covered with smaller squares that are alternating black and white. Each of these squares is 3 cm by 3 cm. If the diagonal of the square playing board is $\sqrt{2592}$ cm, how many small squares are on the board?



Let n = the number of squares on each side.

Then $(3n)^2 + (3n)^2 = \sqrt{2592}^{\,2}$

$$9n^2 + 9n^2$$

$$18n^2 = 2592$$

$$n^2 = 144$$

$$n = 12$$

There are 12 squares on each side of the board.

There are 144 squares on the board.

Chapter 5 Skills Organizer B

Complete the organizer for the concepts in Section 5.3, Radical Equations.