

Name: Key

Math 20-2

Radicals Worksheet

$$3 \times 3 \times 3 \times 3 = 81$$

Show your work!!!

1. Write each of the following as an entire radical. (1 mark each)

$$\begin{aligned} a) 3\sqrt{2} &= \sqrt{9}\sqrt{2} \\ &= \sqrt{18} \end{aligned}$$

$$\begin{aligned} b) 4\sqrt[3]{7} &= \sqrt[3]{64}\sqrt[3]{7} \\ &= \sqrt[3]{448} \end{aligned}$$

$$\begin{aligned} c) 3\sqrt[4]{7} &= \sqrt[4]{81}\sqrt[4]{7} \\ &= \sqrt[4]{567} \end{aligned}$$

2. Write as a mixed radical. (1 mark each)

$$\begin{aligned} a) \sqrt{32} &= \sqrt{16}\sqrt{2} \\ &= 4\sqrt{2} \end{aligned}$$

$$\begin{aligned} b) 7\sqrt{48} &= 7\sqrt{16}\sqrt{3} \\ &= 7(4)\sqrt{3} \\ &= 28\sqrt{3} \end{aligned}$$

$$\begin{aligned} c) -\sqrt{27} &= -(3) \\ &= -3 \end{aligned}$$

$$\begin{aligned} d) 2\sqrt[3]{128} &= 2\sqrt[3]{64}\sqrt[3]{2} \\ &= 2(4)\sqrt[3]{2} \\ &= 8\sqrt[3]{2} \end{aligned}$$

3. Determine an equivalent form for each expression. (2 marks each)

$$\begin{aligned} a) \sqrt{24} + \sqrt{48} \\ &= \sqrt{4}\sqrt{6} + \sqrt{16}\sqrt{3} \\ &= 2\sqrt{6} + 4\sqrt{3} \end{aligned}$$

$$\begin{aligned} b) 5\sqrt{80} + \sqrt{162} - 2\sqrt{45} + 3\sqrt{5} \\ &= 5\sqrt{16}\sqrt{5} + \sqrt{81}\sqrt{2} - 2\sqrt{9}\sqrt{5} + 3\sqrt{5} \\ &= 5(4)\sqrt{5} + 9\sqrt{2} - 2(3)\sqrt{5} + 3\sqrt{5} \\ &= 20\sqrt{5} + 9\sqrt{2} - 6\sqrt{5} + 3\sqrt{5} \\ &= 17\sqrt{5} + 9\sqrt{2} \end{aligned}$$

$$\begin{aligned} c) \sqrt[3]{162} + \sqrt[3]{48} - \sqrt[3]{16} \\ &= \sqrt[3]{27}\sqrt[3]{6} + \sqrt[3]{8}\sqrt[3]{6} - \sqrt[3]{8}\sqrt[3]{2} \\ &= 3\sqrt[3]{6} + 2\sqrt[3]{6} - 2\sqrt[3]{2} \\ &= 5\sqrt[3]{6} - 2\sqrt[3]{2} \end{aligned}$$

$$\begin{aligned} d) -\sqrt[3]{27} + \sqrt[3]{72} &= -(3) + \sqrt[3]{8}\sqrt[3]{9} \\ &= -3 + 2\sqrt[3]{9} \end{aligned}$$

4. Multiply or Divide. Simplify wherever possible. (2 mark each)

$$\begin{aligned} \text{a. } 3\sqrt{5} \times 4\sqrt{8} &= 12\sqrt{40} \\ &= 12\sqrt{4}\sqrt{10} \\ &= 12(2)\sqrt{10} \\ &= 24\sqrt{10} \end{aligned}$$

$$\begin{aligned} \text{b. } (5\sqrt{2}-2\sqrt{6})(5\sqrt{2}-2\sqrt{6}) & \\ &= 25\sqrt{4}-10\sqrt{12}-10\sqrt{12}+4\sqrt{36} \\ &= 25(2)-20\sqrt{12}+2(6) \\ &= 50-20\sqrt{4}\sqrt{3}+12 \\ &= 50-20(2)\sqrt{3}+12 \\ &= 62-40\sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{c. } (\sqrt{2}+\sqrt{5})(3\sqrt{6}-2\sqrt{10}) & \\ &= 3\sqrt{12}-2\sqrt{20}+3\sqrt{30}-2\sqrt{50} \\ &= 3\sqrt{4}\sqrt{3}-2\sqrt{4}\sqrt{5}+3\sqrt{30}-2\sqrt{25}\sqrt{2} \\ &= 3(2)\sqrt{3}-2(2)\sqrt{5}+3\sqrt{30}-2(5)\sqrt{2} \\ &= 6\sqrt{3}-4\sqrt{5}+3\sqrt{30}-10\sqrt{2} \end{aligned}$$

$$\begin{aligned} \text{d. } \frac{2\sqrt{30}}{\sqrt{8}} &= \frac{2\sqrt{15}}{\sqrt{4}} = \frac{2\sqrt{15}}{2} = \sqrt{15} \\ \text{OR} & \\ \frac{2\sqrt{30}\sqrt{8}}{\sqrt{8}\sqrt{8}} &= \frac{2\sqrt{240}}{\sqrt{64}} = \frac{2\sqrt{16}\sqrt{15}}{8} \\ &= \frac{2(4)\sqrt{15}}{8} \\ &= \frac{8\sqrt{15}}{8} = \sqrt{15} \end{aligned}$$

$$\begin{aligned} \text{e. } \left(\frac{4\sqrt{2}-10\sqrt{6}}{2\sqrt{3}}\right)\frac{\sqrt{3}}{\sqrt{3}} & \\ &= \frac{4\sqrt{6}-10\sqrt{18}}{2\sqrt{9}} = \frac{4\sqrt{6}-10(3)\sqrt{2}}{2(3)} \\ &= \frac{4\sqrt{6}-10(3)\sqrt{2}}{6} = \frac{4\sqrt{6}-30\sqrt{2}}{6} \\ &= \frac{2\sqrt{6}-15\sqrt{2}}{3} \end{aligned}$$

$$\begin{aligned} \text{f. } \left(\frac{12\sqrt{60}-15\sqrt{40}}{3\sqrt{5}}\right)\frac{\sqrt{5}}{\sqrt{5}} &= \frac{12\sqrt{300}-15\sqrt{200}}{3\sqrt{25}} \\ \text{OR} & \\ &= \frac{4\sqrt{12}-5\sqrt{8}}{3(5)} \\ &= \frac{4\sqrt{4}\sqrt{3}-5\sqrt{4}\sqrt{2}}{15} = \frac{100\sqrt{3}-150\sqrt{2}}{15} \\ &= \frac{8\sqrt{3}-10\sqrt{2}}{1} \end{aligned}$$

5. Simplify. (2 marks each)

$$\begin{aligned} a) 2\sqrt{45x^4} &= 2\sqrt{9 \times 5 \times x^2 \times x^2} \\ &= 2(3)(x)(x)\sqrt{5} \\ &= 6x^2\sqrt{5} \end{aligned}$$

$$\begin{aligned} b) 2\sqrt{12x^3} &= 2\sqrt{4 \times 3 \times x^2 \cdot x} \\ &= 2(2)(x)\sqrt{3x} \\ &= 4x\sqrt{3x} \end{aligned}$$

$$\begin{aligned} c) \sqrt{9x^5} + \sqrt{36x^5} \\ &= \sqrt{9x^2 \cdot x^2 \cdot x} + \sqrt{36x^2 \cdot x^2 \cdot x} \\ &= 3xx\sqrt{x} + 6xx\sqrt{x} \\ &= 3x^2\sqrt{x} + 6x^2\sqrt{x} \\ &= 9x^2\sqrt{x} \end{aligned}$$

$$\begin{aligned} d) -3x\sqrt{8x^7} - 4\sqrt{2x^9} \\ &= -3x\sqrt{4 \cdot 2 \cdot x^2 \cdot 2^2 \cdot x^3} - 4\sqrt{2 \cdot x^2 \cdot x^2 \cdot x^2 \cdot x^3} \\ &= -3x(2)(x)(x)\sqrt{2x} - 4(2)(x)(x)(x)\sqrt{2x} \\ &= -6x^4\sqrt{2x} - 4x^4\sqrt{2x} \\ &= -10x^4\sqrt{2x} \end{aligned}$$

$$\begin{aligned} e) (2\sqrt{x})(3\sqrt{x^3}) \\ &= 6\sqrt{x^4} \\ &= 6\sqrt{x^2x^2} \\ &= 6(x)(x) \\ &= 6x^2 \end{aligned}$$

$$\begin{aligned} f) \sqrt{x^3}(2\sqrt{x} - \sqrt{x^5}) \\ &= 2\sqrt{x^4} - \sqrt{x^8} \\ &= 2\sqrt{x^2 \cdot x^2} - \sqrt{x^2 \cdot x^2 \cdot x^2 \cdot x^2} \\ &= 2(x)(x) - (x)(x)(x)(x) \\ &= 2x^2 - x^4 \end{aligned}$$

b. Solve

$$a) \sqrt{x} = 7$$

$$x = 49$$

$$b) \sqrt{2x} + 5 = 13$$

subtract 5

$$\sqrt{2x} = 8$$

square

$$2x = 64$$

$\div 2$

$$x = 32$$

$$c) 5\sqrt{x} = 15$$

$$\sqrt{x} = 3$$

$\div 5$

square

$$x = 9$$

$$d) 2\sqrt{x+3} + 1 = 11$$

isolate radical

$$2\sqrt{x+3} = 10$$

subtract one

divide 2

$$\sqrt{x+3} = 5$$

square

$$x+3 = 25$$

subtract 3

$$x = 22$$