1.4 Working with Radicals – Worksheet

MCR3U
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SOLUTIONS

1) Simplify

a) $3(4\sqrt{5})$

$= 12\sqrt{5}$

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

$= -2\sqrt{35}$

c) $2\sqrt{3}(3\sqrt{2})$

$= 6\sqrt{6}$

2) Express each as a mixed radical in simplest form

a) $\sqrt{12}$

$= \sqrt{4} \times \sqrt{3}$

$= 2\sqrt{3}$

b) $\sqrt{147}$

$= \sqrt{49 \times 3}$

$= \sqrt{49} \times \sqrt{3}$

$= 7\sqrt{3}$

c) $\sqrt{252}$

$= \sqrt{36 \times 7}$

$= \sqrt{36} \times \sqrt{7}$

$= 6\sqrt{7}$

3) Simplify

a) $2\sqrt{3} - 5\sqrt{3} + 4\sqrt{3}$

$= 1\sqrt{3}$

b) $11\sqrt{5} - 4\sqrt{5} - 5\sqrt{5} - 6\sqrt{5}$

$= -4\sqrt{5}$

c) $\sqrt{6} - 4\sqrt{2} + 3\sqrt{6} - \sqrt{2}$

$= 4\sqrt{6} - 5\sqrt{2}$

d) $2\sqrt{10} - \sqrt{10} - 4\sqrt{10} + \sqrt{5}$

$= -3\sqrt{10} + \sqrt{5}$

4) Add or subtract as indicated

a) $8\sqrt{2} - 4\sqrt{8} + \sqrt{32}$

$= 8\sqrt{2} - 4(\sqrt{4})(\sqrt{2}) + (\sqrt{16})(\sqrt{2})$

$= 8\sqrt{2} - 8\sqrt{2} + 4\sqrt{2}$

$= 4\sqrt{2}$

b) $\sqrt{20} - 4\sqrt{12} - \sqrt{125} + 2\sqrt{3}$

$= (\sqrt{4})(\sqrt{5}) - 4(\sqrt{4})(\sqrt{3}) - (\sqrt{5})(\sqrt{25}) + 2\sqrt{3}$

$= 2\sqrt{5} - 8\sqrt{3} - 5\sqrt{5} + 2\sqrt{3}$

$= -3\sqrt{5} - 6\sqrt{3}$

c) $5\sqrt{3} - \sqrt{72} + \sqrt{243} + \sqrt{8}$

$= 5\sqrt{3} - (\sqrt{36})(\sqrt{2}) + (\sqrt{81})(\sqrt{3}) + (\sqrt{4})(\sqrt{2})$

$= 5\sqrt{3} - 6\sqrt{2} + 9\sqrt{3} + 2\sqrt{2}$

$= 14\sqrt{3} - 4\sqrt{2}$

d) $\sqrt{44} + \sqrt{88} + \sqrt{99} + \sqrt{198}$

$= (\sqrt{4})(\sqrt{11}) + (\sqrt{4})(\sqrt{22}) + (\sqrt{9})(\sqrt{11}) + (\sqrt{9})(\sqrt{22})$

$= 2\sqrt{11} + 2\sqrt{22} + 3\sqrt{11} + 3\sqrt{22}$

$= 5\sqrt{11} + 5\sqrt{22}$

5) Expand and simplify

a) $5\sqrt{6}(2\sqrt{3})$

$= 10\sqrt{18}$

$= 10(\sqrt{9})(\sqrt{2})$

$= 30\sqrt{2}$

b) $8\sqrt{5}(\sqrt{10})$

$= 8\sqrt{50}$

$= 8(\sqrt{25})(\sqrt{2})$

$= 40\sqrt{2}$

c) $11\sqrt{2}(5\sqrt{3})$

$= 55\sqrt{6}$

6) Expand and simplify where possible

a) $3(8 - \sqrt{5})$

$= 24 - 3\sqrt{5}$

b) $\sqrt{3}(\sqrt{6} - \sqrt{3})$

$= \sqrt{18} - \sqrt{9}$

$= (\sqrt{9})(\sqrt{2}) - \sqrt{9}$

$= 3\sqrt{2} - 3$

c) $8\sqrt{2}(2\sqrt{8} + 3\sqrt{12})$

$= 16\sqrt{16} + 24\sqrt{24}$

$= 64 + 24(\sqrt{4})(\sqrt{6})$

$= 64 + 48\sqrt{6}$

7) Expand and simplify where possible

a) $(\sqrt{2} + 5)(\sqrt{2} + 5)$

$= \sqrt{4} + 5\sqrt{2} + 5\sqrt{2} + 25$

$= 2 + 10\sqrt{2} + 25$

$= 27 + 10\sqrt{2}$

b) $(\sqrt{3} + 2\sqrt{2})(5 + 5\sqrt{2})$

$= 5\sqrt{3} + 5\sqrt{6} + 10\sqrt{2} + 10\sqrt{4}$

$= 5\sqrt{3} + 5\sqrt{6} + 10\sqrt{2} + 20$

c) $(1 + \sqrt{5})(1 - \sqrt{5})$ D.O.S.

$= (1)^2 - (\sqrt{5})^2$

$= 1 - 5$

$= -4$

d) $(4 - 3\sqrt{7})(\sqrt{7} + 1)$

$= 4\sqrt{7} + 4 - 3\sqrt{49} - 3\sqrt{7}$

$= 1\sqrt{7} + 4 - 21$

$= \sqrt{7} - 17$

8) Simplify

a) $\frac{1}{4}\sqrt{54} - \frac{1}{4}\sqrt{150}$

$= \frac{1}{4}(\sqrt{9})(\sqrt{6}) - \frac{1}{4}(\sqrt{25})(\sqrt{6})$

$= \frac{3}{4}\sqrt{6} - \frac{5}{4}\sqrt{6}$

$= -\frac{1}{2}\sqrt{6}$

b) $\frac{1}{2}\sqrt{8} + \frac{3}{5}\sqrt{50} - \frac{2}{3}\sqrt{18}$

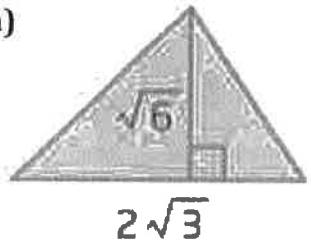
$= \frac{1}{2}(\sqrt{4})(\sqrt{2}) + \frac{3}{5}(\sqrt{25})(\sqrt{2}) - \frac{2}{3}(\sqrt{9})(\sqrt{2})$

$= 1\sqrt{2} + 3\sqrt{2} - 2\sqrt{2}$

$= 2\sqrt{2}$

9) Find a simplified expression for the area of each shape

a)



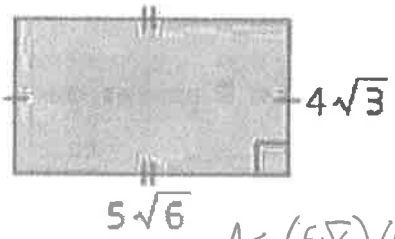
$A = \frac{2\sqrt{3}(\sqrt{6})}{2}$

$= \sqrt{18}$

$= (\sqrt{9})(\sqrt{2})$

$= 3\sqrt{2}$

b)



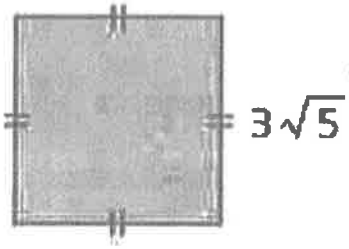
$A = (5\sqrt{6})(4\sqrt{3})$

$= 20\sqrt{18}$

$= 20(\sqrt{9})(\sqrt{2})$

$= 60\sqrt{2}$

c)



$A = (3\sqrt{5})^2$

$= 9(5)$

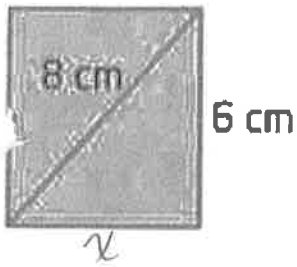
$= 45$

d)

$A = \pi(\sqrt{2})^2$

$= 2\pi$

10) Find the area and perimeter of the rectangle shown. Express your answer in simplified radical form.



$x^2 + 6^2 = 8^2$

$x^2 = 64 - 36$

$x = \sqrt{28}$

$x = 2\sqrt{7}$

$A = (2\sqrt{7})(6)$

$= 12\sqrt{7}\ cm^2$

$P = 2(2\sqrt{7}) + 2(6)$

$= 4\sqrt{7} + 12\ cm$

11) Simplify each of the following

a) $\frac{21-7\sqrt{6}}{7}$

$= \frac{7(3-\sqrt{6})}{7}$

$= 3-\sqrt{6}$

b) $\frac{12-\sqrt{48}}{4}$

$= \frac{12-(\sqrt{16})(\sqrt{3})}{4}$

$= \frac{12-4\sqrt{3}}{4}$

$= \frac{4(3-\sqrt{3})}{4}$

$= 3-\sqrt{3}$

Answers

1) a) $12\sqrt{5}$ **b)** $-2\sqrt{35}$ **c)** $6\sqrt{6}$

2) a) $2\sqrt{3}$ **b)** $7\sqrt{3}$ **c)** $6\sqrt{7}$

3) a) $\sqrt{3}$ **b)** $-4\sqrt{5}$ **c)** $4\sqrt{6}-5\sqrt{2}$ **d)** $-3\sqrt{10}+\sqrt{5}$

4) a) $4\sqrt{2}$ **b)** $-3\sqrt{5}-6\sqrt{3}$ **c)** $14\sqrt{3}-4\sqrt{2}$ **d)** $5\sqrt{11}+5\sqrt{22}$

5) a) $30\sqrt{2}$ **b)** $40\sqrt{2}$ **c)** $55\sqrt{6}$

6) a) $24-3\sqrt{5}$ **b)** $3\sqrt{2}-3$ **c)** $64+48\sqrt{6}$

7) a) $27+10\sqrt{2}$ **b)** $5\sqrt{3}+5\sqrt{6}+10\sqrt{2}+20$ **c)** -4 d) $-17+\sqrt{7}$

8) a) $-\frac{1}{2}\sqrt{6}$ **b)** $2\sqrt{2}$

9) a) $3\sqrt{2}$ **b)** $60\sqrt{2}$ **c)** 45 **d)** 2π

10) area = $12\sqrt{7}$ cm^2; perimeter = $12+4\sqrt{7}$ cm

11) a) $3-\sqrt{6}$ **b)** $3-\sqrt{3}$