5.1 Working With Radicals Pg 279

1. $4\sqrt{7} = \sqrt{16}\cdot\sqrt{7} = \boxed{\sqrt{112}}$

   $5\sqrt{2} = \sqrt{25}\sqrt{2} = \sqrt{50}$

   $-11\sqrt{8} = -\sqrt{121}\cdot\sqrt{8} = -\sqrt{968}$

   $-10\sqrt{2} = -\sqrt{100}\cdot\sqrt{2} = -\sqrt{200}$

2. a) $\sqrt{56} = \sqrt{4}\cdot\sqrt{14} = 2\sqrt{14}$

   b) $3\sqrt{75} = 3\cdot\sqrt{25}\cdot\sqrt{3} = 3\cdot 5\cdot\sqrt{3} = \underline{15\sqrt{3}}$

   c) $\sqrt[3]{24} = \sqrt[3]{8}\cdot\sqrt[3]{3} = \underline{2\sqrt[3]{3}}$

   d) $\sqrt{c^3d^2} = \sqrt{c^2}\cdot\sqrt{c}\cdot\sqrt{d^2} = \underline{cd\sqrt{c}}$

3. a) $3\sqrt{8m^4} = 3\cdot\sqrt{4}\cdot\sqrt{2}\cdot\sqrt{m^4} = 3\cdot 2\cdot\sqrt{2}\cdot m^2$

   $= 6m^2\sqrt{2}$

   $m \in \mathbb{R}$

   b) $\sqrt[3]{24q^5} = \sqrt[3]{8}\cdot\sqrt[3]{3}\cdot\sqrt[3]{q^3}\cdot\sqrt[3]{q^2}$

   $= 2\cdot\sqrt[3]{3}\cdot q\cdot\sqrt[3]{q^2}$

   $= 2q\sqrt[3]{3q^2} \quad q \in \mathbb{R}$

   c) $-2\sqrt[5]{160s^5t^6} = -2\sqrt[5]{32}\cdot\sqrt[5]{5}\cdot\sqrt[5]{s^5}\cdot\sqrt[5]{t^5}\cdot\sqrt[5]{t}$

   $= -2\cdot 2\cdot\sqrt[5]{5}\cdot s\cdot t\cdot\sqrt[5]{t}$

   $= -4st\sqrt[5]{5t} \quad s,t \in \mathbb{R}$

4. a) $3n\sqrt{5} = \sqrt{9} \cdot \sqrt{n^2} \cdot \sqrt{5} = \sqrt{45n^2}$ $n \in \mathbb{R}$

b) $\sqrt[3]{-432} = \sqrt[3]{-216} \cdot \sqrt[3]{2} = -6\sqrt[3]{2}$

c) $\frac{1}{2a}\sqrt[3]{7a} = \sqrt[3]{\frac{1}{8}} \cdot \sqrt[3]{\frac{1}{a^3}} \cdot \sqrt[3]{7a} = \sqrt[3]{\frac{7a}{8a^3}} = \sqrt[3]{\frac{7}{8a^2}}$

$a \neq 0$

d) $\sqrt[3]{128x^4} = \sqrt[3]{64} \cdot \sqrt[3]{2} \cdot \sqrt[3]{x^3} \cdot \sqrt[3]{x}$

$= 4\sqrt[3]{2} \cdot x \cdot \sqrt[3]{x}$

$= 4x\sqrt[3]{2x}$ $x \in \mathbb{R}$

5. a) $15\sqrt{5}$ and $8\sqrt{125}$

$\rightarrow 8 \cdot \sqrt{25} \cdot \sqrt{5} = 8 \cdot 5 \cdot \sqrt{5}$
$= 40\sqrt{5}$

$15\sqrt{5}$ and $40\sqrt{5}$ are like radicals

b) $8\sqrt{112z^8}$ and $48\sqrt{7z^4}$

$8 \cdot \sqrt{16 \cdot 7} \cdot \sqrt{z^8}$ $48\sqrt{7} \cdot \sqrt{z^4}$

$8 \cdot 4 \cdot \sqrt{7} \cdot z^4$ $48 \cdot z^2\sqrt{7}$

$32z^4\sqrt{7}$ and $48z^2\sqrt{7}$

Radicals are now the same but they are NOT like terms since there are different powers of z

c) $-35\sqrt[4]{w^2}$ and $3\sqrt[4]{81w^{10}}$

$3\sqrt[4]{81} \cdot \sqrt[4]{w^8} \cdot \sqrt[4]{w^2}$

$= 3 \cdot 3 \cdot w^2 \cdot \sqrt[4]{w^2} = 9w^2\sqrt[4]{w^2}$

$-35\sqrt[4]{w^2}$ and $9w^2\sqrt[4]{w^2}$

d) $6\sqrt[3]{2}$ and $6\sqrt[3]{54}$

$6\sqrt[3]{27} \cdot \sqrt[3]{2}$

$6 \cdot 3 \cdot \sqrt[3]{2}$

$6\sqrt[3]{2}$ and $18\sqrt[3]{2}$

6. a) $3\sqrt{6} = \sqrt{9} \cdot \sqrt{6} = \sqrt{54}$ 1 or $3\sqrt{6}, 7\sqrt{2}, 10$

$10 = \sqrt{100}$ 3

$7\sqrt{2} = \sqrt{49} \cdot \sqrt{2} = \sqrt{98}$ 2

b) $-2\sqrt{3} = -\sqrt{12}$ 1

$-4 = -\sqrt{16}$ 3

$-3\sqrt{2} = -\sqrt{18}$ 4

$-2\sqrt{\frac{7}{2}} = -\sqrt{\frac{28}{2}} = -\sqrt{14}$ 2

so: $-2\sqrt{3}, -2\sqrt{\frac{7}{2}}, -4, -3\sqrt{2}$

c) $\sqrt[3]{21} = \sqrt[3]{21}$ 1

$3\sqrt[3]{2} = \sqrt[3]{27} \cdot \sqrt[3]{2} = \sqrt[3]{54}$ 4

$2.8 = \sqrt[3]{21.952}$ 2

$2\sqrt[3]{5} = \sqrt[3]{8} \cdot \sqrt[3]{5} = \sqrt[3]{40}$ 3

so: $\sqrt[3]{21}, 2.8, 3\sqrt[3]{2}, 2\sqrt[3]{5}$

8. a) $-1\sqrt{5} + 9\sqrt{5} - 4\sqrt{5} = 4\sqrt{5}$

b) $1.4\sqrt{2} + 9\sqrt{2} - 7 = 10.4\sqrt{2} - 7$

c) $14 - 4\sqrt[4]{11}$ or $-4\sqrt[4]{11} + 14$

d) $-\frac{2}{3}\sqrt{6} + 2\sqrt{10}$

9. a) $3\sqrt{75} - \sqrt{27}$

$3\sqrt{25}\cdot\sqrt{3} - \sqrt{9}\cdot\sqrt{3}$

$3\cdot 5\sqrt{3} - 3\sqrt{3}$

$15\sqrt{3} - 3\sqrt{3} = \underline{\underline{12\sqrt{3}}}$

b) $2\sqrt{18} + 9\sqrt{7} - \sqrt{63}$

$2\cdot\sqrt{9}\cdot\sqrt{2} + 9\sqrt{7} - \sqrt{9}\cdot\sqrt{7}$

$2\cdot 3\cdot\sqrt{2} + 9\sqrt{7} - 3\sqrt{7}$

$= \underline{\underline{6\sqrt{2} + 6\sqrt{7}}}$

c) $-8\sqrt{45} + 5.1 - \sqrt{80} + 17.4$

$-8\sqrt{9}\cdot\sqrt{5} + 5.1 - \sqrt{16}\sqrt{5} + 17.4$

$-8\cdot 3\sqrt{5} - 4\sqrt{5} + 22.5$

$-24\sqrt{5} - 4\sqrt{5} + 22.5$

$\underline{\underline{-28\sqrt{5} + 22.5}}$

d) $\frac{2}{3}\sqrt[3]{81} + \frac{1}{4}\sqrt[3]{375} - 4\sqrt{99} + 5\sqrt{11}$

$\frac{2}{3}\sqrt[3]{27}\cdot\sqrt[3]{3} + \frac{1}{4}\sqrt[3]{125}\cdot\sqrt[3]{3} - 4\sqrt{9}\cdot\sqrt{11} + 5\sqrt{11}$

$\frac{2}{\cancel{3}}\cdot\cancel{3}\sqrt[3]{3} + \frac{1}{4}\cdot 5\cdot\sqrt[3]{3} - 4\cdot 3\sqrt{11} + 5\sqrt{11}$

$2\sqrt[3]{3} + \frac{5}{4}\sqrt[3]{3} - 12\sqrt{11} + 5\sqrt{11}$

$\frac{13}{4}\sqrt[3]{3} \quad -7\sqrt{11}$

10 a) $2a\sqrt{a} + 6a\sqrt{a}$ $a \geq 0$
$= 8a\sqrt{a}$

b) $3\sqrt{2x} + 6\sqrt{2x} - \sqrt{x}$
$= 9\sqrt{2x} - \sqrt{x}$ $x \geq 0$

c) $-4 \cdot 5\sqrt[3]{5r} + 2r\sqrt[3]{5r}$

$= -20\sqrt[3]{5r} + 2r\sqrt[3]{5r}$. $r \in \mathbb{R}$.

~~Factor out a 2: 2(-10∛5r +~~

Factor out a $2\sqrt[3]{5r}$ then:

$-20\sqrt[3]{5r} + 2r\sqrt[3]{5r} = 2\sqrt[3]{5r}(-10 + r)$

$3x^2 \times 6x$

$3x(x+2)$

d) $\frac{w}{5} \cdot -4 + \frac{8w}{5} - \frac{2}{5} \cdot 5\sqrt{2w} - 4\sqrt{2w}$
$= -\frac{4}{5}w + \frac{8}{5}w - 6\sqrt{2w}$
$= \frac{4}{5}w - 6\sqrt{2w}$ $w \geq 0$.

15. $A = \pi r^2$ so $\frac{\pi r^2}{\pi} = \frac{38\pi m}{\pi}$

$\sqrt{r^2} = \sqrt{38m}$

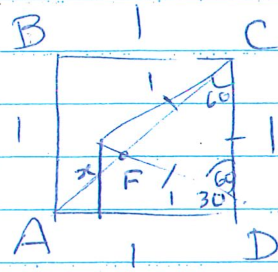
$\underline{\underline{r = \sqrt{38m}}}$

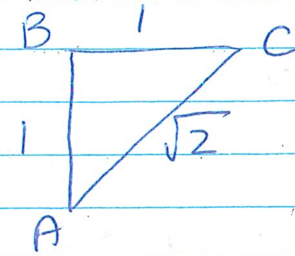
$d = 2\sqrt{38m}$ b/c $2r = d$

Challenge

#21 □ABCD   Perimeter = 4 m

so each side = 1m





(Pythagoras

$x\sqrt{2} =$

$$\left(1-\frac{\sqrt{3}}{2}\right)\sqrt{2} = \frac{2\sqrt{2}-\sqrt{6}}{2}$$

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