5.1 Pre-Calculus

page 278 #2,3,5,6,8-10

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

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

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

d) $\sqrt{c^3 d^2}$, $c \geq 0$ $d \geq 0$
$\sqrt{c^2 c d^2}$
$cd\sqrt{c}$

for square root the radicand must be pos.

3. a) $3\sqrt{8m^4}$
$3\sqrt{4 \cdot 2m^4}$
$3 \cdot 2 \cdot m^2\sqrt{2}$
$6m^2\sqrt{2}$
$m \in R$

because m is outside the $\sqrt{}$ sign, it can be any real number

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

for an odd index, the radicand can be neg., pos. or zero

c) $-2\sqrt[5]{160s^5t^6}$
$-2\sqrt[5]{32 \cdot 5s^5t^5t}$
$-2 \cdot 2st\sqrt[5]{5t}$
$-4st\sqrt[5]{5t}$
$t \in R$

the index is odd so t can be neg., pos or zero

5. a) $15\sqrt{5}$, $\sqrt{125}$
$\sqrt{25 \cdot 5}$
$5\sqrt{5}$

b) $8\sqrt{112z^8}$, $4\sqrt{7z^4}$
$8\sqrt{16 \cdot 7z^8}$
$8 \cdot 4z^4\sqrt{7}$
$32z^4\sqrt{7}$

c) $-35\sqrt[4]{w^2}$, $3\sqrt[4]{81w^{10}}$
$3\sqrt[4]{3^4w^8w^2}$
$3 \cdot 3w^2\sqrt{w^2}$
$9w^2\sqrt{w^2}$

d) $6\sqrt[3]{2}$, $6\sqrt[3]{54}$
$6\sqrt[3]{27 \cdot 2}$
$6 \cdot 3\sqrt[3]{2}$
$18\sqrt[3]{2}$

Page 278 cont.

6. a) $3\sqrt{6}$, 10, $7\sqrt{2}$

$\sqrt{3^2 \cdot 6}$ $\quad$ $\sqrt{10^2}$ $\quad$ $\sqrt{7^2 \cdot 2}$

$\sqrt{9 \cdot 6}$ $\quad$ $\sqrt{100}$ $\quad$ $\sqrt{49 \cdot 2}$

$\sqrt{54}$ $\quad$ $\sqrt{98}$

least to greatest: $\sqrt{54}, \sqrt{98}, \sqrt{100}$

$3\sqrt{6}, 7\sqrt{2}, 10$

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

$\sqrt{(-2)^2 \cdot 3}$ $\quad$ $\sqrt{(-4)^2}$ $\quad$ $\sqrt{(-3)^2 \cdot 2}$ $\quad$ $\sqrt{(-2)^2 \cdot \frac{7}{2}}$

$\sqrt{4 \cdot 3}$ $\quad$ $\sqrt{16}$ $\quad$ $\sqrt{9 \cdot 2}$ $\quad$ $\sqrt{4 \cdot \frac{7}{2}}$

$\sqrt{12}$ $\quad$ $\sqrt{18}$ $\quad$ $\sqrt{14}$

$\sqrt{12}, \sqrt{14}, \sqrt{16}, \sqrt{18}$

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

c) $\sqrt[3]{21}$, $3\sqrt[3]{2}$, 2.8, $2\sqrt[3]{5}$

$\sqrt[3]{3^3 \cdot 2}$ $\quad$ $\sqrt[3]{(2.8)^3}$ $\quad$ $\sqrt[3]{2^3 \cdot 5}$

$\sqrt[3]{27 \cdot 2}$ $\quad$ $\sqrt[3]{21.952}$ $\quad$ $\sqrt[3]{8 \cdot 5}$

$\sqrt[3]{54}$ $\quad$ $\sqrt[3]{40}$

$\sqrt[3]{21}, \sqrt[3]{21.952}, \sqrt[3]{40}, \sqrt[3]{54}$

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

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

$4\sqrt{5}$

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

$10.4\sqrt{2} - 7$

c) $\sqrt[4]{11} - 1 - 5\sqrt[4]{11} + 15$

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

d) $-\sqrt{6} + \frac{9}{2}\sqrt{10} - \frac{5}{2}\sqrt{10} + \frac{1}{3}\sqrt{6}$

$-\frac{3}{3}\sqrt{6} + \frac{9}{2}\sqrt{10} - \frac{5}{2}\sqrt{10} + \frac{1}{3}\sqrt{6}$

$-\frac{2}{3}\sqrt{6} + \frac{4}{2}\sqrt{10}$

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

- only "like" radicals can be added or subtracted
- "like" radicals have the same radicand (number inside the $\sqrt{}$)

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

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

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

$15\sqrt{3} - 3\sqrt{3}$

$12\sqrt{3}$

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

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

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

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

page 278 cont.

9. c) $-8\sqrt{145} + 5.1 - \sqrt{180} + 17.4$

$-8\sqrt{9 \cdot 5} - \sqrt{16 \cdot 5} + 22.5$

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

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

$-28\sqrt{5} + 22.5$

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

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

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

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

$\frac{8\sqrt[3]{3}}{4} + \frac{5\sqrt[3]{3}}{4} - 7\sqrt{11}$

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

10. a) $2\sqrt{a^3} + 6\sqrt{a^3}$

$8\sqrt{a^3}$

$8\sqrt{a^2 a}$

$8a\sqrt{a}$

$a \geq 0$ (index is even)

b) $3\sqrt{2x} + 3\sqrt{8x} - \sqrt{x}$

$3\sqrt{2x} + 3\sqrt{4 \cdot 2x} - \sqrt{x}$

$3\sqrt{2x} + 3 \cdot 2\sqrt{2x} - \sqrt{x}$

$3\sqrt{2x} + 6\sqrt{2x} - \sqrt{x}$

$9\sqrt{2x} - \sqrt{x}$

$x \geq 0$ (index is even)

c) $-4\sqrt[3]{625r} + \sqrt[3]{40r^4}$

$-4\sqrt[3]{125 \cdot 5r} + \sqrt[3]{8 \cdot 5r^3 r}$

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

$-20\sqrt[3]{5r} + 2r\sqrt[3]{5r}$

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

$r \in R$ (index is odd)

d) $\frac{w}{5}\sqrt[3]{-64} + \frac{\sqrt[3]{512w^3}}{5} - \frac{2}{5}\sqrt{50w} - 4\sqrt{2w}$

$\frac{w}{5}(-4) + \frac{8w}{5} - \frac{2}{5}\sqrt{25 \cdot 2w} - 4\sqrt{2w}$

$-\frac{4w}{5} + \frac{8w}{5} - \frac{2 \cdot 5\sqrt{2w}}{5} - 4\sqrt{2w}$

$\frac{4w}{5} - 6\sqrt{2w}$

$w \geq 0$ (index is even)