

Chapter

5

Chapter 5

REVIEW

Assignment

Complete pgs. 304 - 305

**Questions 1-7, 10,11,13,14
16,18,19abc and 21**

Solutions

SOLUTIONS => Chapter 5 Review

1.

$$\begin{aligned} \text{a) } & 8\sqrt{5} \\ &= \sqrt{(8)^2(5)} \\ &= \sqrt{(64)(5)} \\ &= \sqrt{320} \end{aligned}$$

$$\begin{aligned} \text{b) } & -2\sqrt[5]{3} \\ &= \sqrt[5]{(-2)^5(3)} \\ &= \sqrt[5]{(-32)(3)} \\ &= \sqrt[5]{-96} \end{aligned}$$

$$\begin{aligned} \text{c) } & 3y^3\sqrt{7} \\ &= \sqrt{(3)^2(y^3)^2(7)} \\ &= \sqrt{(9)(y^6)(7)} \\ &= \sqrt{63y^6} \end{aligned}$$

$$\begin{aligned} \text{d) } & -3z\sqrt[3]{4z} \\ &= \sqrt[3]{(-3)^3(z)^3(4z)} \\ &= \sqrt[3]{(-27)(z^3)(4z)} \\ &= \sqrt[3]{-108z^4} \end{aligned}$$

2.

$$\begin{aligned} \text{a) } & \sqrt{72} \\ &= \sqrt{(2)(2)(2)(3)(3)} \\ &= (2)(3)\sqrt{2} \\ &= 6\sqrt{2} \end{aligned}$$

$$\begin{aligned} \text{b) } & 3\sqrt{40} \\ &= 3\sqrt{(2)(2)(2)(5)} \\ &= 3(2)\sqrt{(2)(5)} \\ &= 6\sqrt{10} \end{aligned}$$

$$\begin{aligned} \text{c) } & \sqrt{27m^2} \\ &= \sqrt{(3)(3)(3)(m)(m)} \\ &= 3m\sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{d) } & \sqrt[3]{80x^5y^6} \\ &= \sqrt[3]{(2)(2)(2)(2)(5)(x)(x)(x)(x)(x)(y)(y)(y)(y)(y)(y)} \\ &= 2xy^2\sqrt[3]{(2)(5)(x)(x)} \\ &= 2xy^2\sqrt[3]{10x^2} \end{aligned}$$

3

$$\begin{aligned} \text{a) } & -\sqrt{13} + 2\sqrt{13} \\ &= 1\sqrt{13} \end{aligned}$$

$$\begin{aligned} \text{b) } & 4\sqrt{7} - 2\sqrt{112} \\ &= 4\sqrt{7} - 2\sqrt{(2)(2)(2)(2)(7)} \\ &= 4\sqrt{7} - 2(2)(2)\sqrt{7} \\ &= 4\sqrt{7} - 8\sqrt{7} \\ &= -4\sqrt{7} \end{aligned}$$

$$\begin{aligned} \text{c) } & -\sqrt[3]{3} + \sqrt[3]{24} \\ &= -\sqrt[3]{3} + \sqrt[3]{(2)(2)(2)(3)} \\ &= -\sqrt[3]{3} + 2\sqrt[3]{3} \\ &= 1\sqrt[3]{3} \end{aligned}$$

Solutions

$$\begin{aligned}
 4a) & 4\sqrt{45x^3} - \sqrt{27x} + 17\sqrt{3x} - 9\sqrt{125x^3} \\
 & = 4\sqrt{(3)(3)(5)(x)(x)(x)} - \sqrt{(3)(3)(3)(x)} + 17\sqrt{3x} - 9\sqrt{(5)(5)(5)(x)(x)(x)} \\
 & = 4(3)(x)\sqrt{5x} - 3\sqrt{3x} + 17\sqrt{3x} - 9(5)(x)\sqrt{5x} \\
 & = 12x\sqrt{5x} - 3\sqrt{3x} + 17\sqrt{3x} - 45x\sqrt{5x} \\
 & = -33x\sqrt{5x} + 14\sqrt{3x}, \quad x \geq 0
 \end{aligned}$$

$$\begin{aligned}
 b) & \frac{2}{5}\sqrt{44a} + \sqrt{144a^3} - \frac{\sqrt{11a}}{2} \\
 & = \frac{2}{5}\sqrt{(2)(2)(11)a} + \sqrt{(2)(2)(2)(2)(3)(3)(a)(a)(a)} - \frac{1}{2}\sqrt{11a} \\
 & = \frac{2}{5}(2)\sqrt{11a} + (2)(2)(3)(a)\sqrt{a} - \frac{1}{2}\sqrt{11a} \\
 & = \frac{4}{5}\sqrt{11a} + 12a\sqrt{a} - \frac{1}{2}\sqrt{11a} \\
 & = \frac{4}{5}\sqrt{11a} - \frac{1}{2}\sqrt{11a} + 12a\sqrt{a} \\
 & = \frac{8}{10}\sqrt{11a} - \frac{5}{10}\sqrt{11a} + 12a\sqrt{a} \\
 & = \frac{3}{10}\sqrt{11a} + 12a\sqrt{a}, \quad a \geq 0
 \end{aligned}$$

5. $\boxed{8\sqrt{7}}$

$$\begin{aligned}
 \hookrightarrow & \frac{2\sqrt{112}}{2\sqrt{(2)(2)(2)(2)(7)}} \\
 & = 2(2)(2)\sqrt{7} \\
 & = 8\sqrt{7} \quad \text{EQUIVALENT!}
 \end{aligned}$$

$$\begin{aligned}
 \hookrightarrow & 3\sqrt{42} \\
 & \text{NOT EQUIVALENT!}
 \end{aligned}$$

$$\begin{aligned}
 \hookrightarrow & \frac{\sqrt{448}}{\sqrt{(2)(2)(2)(2)(2)(2)(7)}} \\
 & = (2)(2)(2)\sqrt{7} \\
 & = 8\sqrt{7} \quad \text{EQUIVALENT!}
 \end{aligned}$$

$$\begin{aligned}
 \hookrightarrow & 4\sqrt{28} \\
 & = 4\sqrt{(2)(2)(7)} \\
 & = 4(2)\sqrt{7} \\
 & = 8\sqrt{7} \quad \text{EQUIVALENT!}
 \end{aligned}$$

Solutions

6. Order the following numbers from least to greatest: $3\sqrt{7}$, $\sqrt{65}$, $2\sqrt{17}$, 8.

$$\begin{aligned}
 &= \frac{3\sqrt{7}}{\sqrt{(3)^2(7)}} & \sqrt{65} & & \frac{2\sqrt{17}}{\sqrt{(2)^2(17)}} & & \frac{8}{\sqrt{64}} \\
 &= \frac{\sqrt{(9)(7)}}{\sqrt{63}} & & & = \frac{\sqrt{(4)(17)}}{\sqrt{68}} & & \\
 &= \sqrt{63} & & & = \sqrt{68} & &
 \end{aligned}$$

From least to greatest: $3\sqrt{7}$, 8, $\sqrt{65}$, $2\sqrt{17}$

7. The speed, v , in kilometers per hour, of a car before a collision can be approximated from the length, d , in meters, of the skid mark left by the tire. On a dry day, one formula that approximates this speed is $v = \sqrt{169d}$, $d \geq 0$.

a) Rewrite the formula as a mixed radical.

$$\begin{aligned}
 v &= \sqrt{(13)(13)(d)} \\
 v &= 13\sqrt{d}
 \end{aligned}$$

b) What is the approximate speed of a car if the skid mark measures 13.4 m? Express your answer to the nearest kilometer per hour.

$$\begin{aligned}
 v &= 13\sqrt{13.4\text{m}} \\
 v &= 48 \text{ km/h}
 \end{aligned}$$

Solutions

10.

$$\begin{aligned} \text{a) } & \sqrt{2}(\sqrt{6}) \\ &= \sqrt{12} \\ &= \sqrt{(2)(2)(3)} \\ &= 2\sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{b) } & (-3f\sqrt{15})(2f^3\sqrt{5}) \\ &= -6f^4\sqrt{75} \\ &= -6f^4\sqrt{(5)(5)(3)} \\ &= -6f^4(5)\sqrt{3} \\ &= -30f^4\sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{c) } & (\sqrt[4]{8})(\sqrt[3]{18}) \\ &= 3\sqrt[4]{144} \\ &= 3\sqrt[4]{(2)(2)(2)(2)(3)(3)} \\ &= 3(2)\sqrt[4]{9} \\ &= 6\sqrt[4]{9} \end{aligned}$$

11.

$$\begin{aligned} \text{a) } & (2-\sqrt{5})(2+\sqrt{5}) \\ &= 4+2\sqrt{5}-2\sqrt{5}-5 \\ &= 4-5 \\ &= -1 \end{aligned}$$

$$\begin{aligned} \text{b) } & (5\sqrt{3}-\sqrt{8})^2 \\ &= (25)(3)-2(5\sqrt{24})+8 \\ &= 75-10\sqrt{24}+8 \\ &= 83-10\sqrt{24} \\ &= 83-10\sqrt{(2)(2)(2)(3)} \\ &= 83-10(2)\sqrt{6} \\ &= 83-20\sqrt{6} \end{aligned}$$

$$\begin{aligned} \text{c) } & (a+3\sqrt{a})(a+7\sqrt{4a}) \\ &= a^2+7a\sqrt{4a}+3a\sqrt{a}+21\sqrt{4a^2} \\ &= a^2+7a(2)\sqrt{a}+3a\sqrt{a}+21(2a) \\ &= a^2+14a\sqrt{a}+3a\sqrt{a}+42a \\ &= a^2+17a\sqrt{a}+42a, a \geq 0 \end{aligned}$$

Solutions

13.

$$\begin{aligned}
 \text{a) } & \frac{\sqrt{6}}{\sqrt{12}} \\
 &= \frac{\sqrt{6} \cdot \sqrt{12}}{\sqrt{12} \cdot \sqrt{12}} \\
 &= \frac{\sqrt{72}}{12} \\
 &= \frac{\sqrt{(2)(2)(2)(3)(3)}}{12} \\
 &= \frac{(2)(3)\sqrt{2}}{12} \\
 &= \frac{6\sqrt{2}}{12} \\
 &= \frac{\sqrt{2}}{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } & \frac{-1}{\sqrt[3]{25}} \\
 &= \frac{-1}{\sqrt[3]{25}} \cdot \frac{(\sqrt[3]{25})^2}{(\sqrt[3]{25})^2} \\
 &= \frac{-(\sqrt[3]{25})^2}{25}
 \end{aligned}$$

$$\begin{aligned}
 \text{c) } & -4 \sqrt{\frac{2a^2}{9}}, a \geq 0 \\
 &= -4 \frac{\sqrt{2a^2}}{\sqrt{9}} \\
 &= -4 \frac{a\sqrt{2}}{3}
 \end{aligned}$$

14.

$$\begin{aligned}
 \text{a) } & \frac{-2}{4-\sqrt{3}} \\
 &= \frac{-2}{4-\sqrt{3}} \cdot \frac{(4+\sqrt{3})}{(4+\sqrt{3})} \\
 &= \frac{-8-2\sqrt{3}}{16-3} \\
 &= \frac{-8-2\sqrt{3}}{13}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } & \frac{\sqrt{7}}{2\sqrt{5}-\sqrt{7}} \\
 &= \frac{\sqrt{7}}{2\sqrt{5}-\sqrt{7}} \cdot \frac{(2\sqrt{5}+\sqrt{7})}{(2\sqrt{5}+\sqrt{7})} \\
 &= \frac{2\sqrt{35}+7}{(4)(5)-7} \\
 &= \frac{2\sqrt{35}+7}{20-7} \\
 &= \frac{2\sqrt{35}+7}{13}
 \end{aligned}$$

Solutions

$$\begin{aligned}
 \text{c) } & \frac{18}{6+\sqrt{27m}} \\
 &= \frac{18}{6+\sqrt{27m}} \cdot \frac{(6-\sqrt{27m})}{(6-\sqrt{27m})} \\
 &= \frac{108-18\sqrt{27m}}{36-27m} \\
 &= \frac{108-18\sqrt{(3)(3)(3)m}}{36-27m} \\
 &= \frac{108-18(3)\sqrt{3m}}{36-27m} \\
 &= \frac{108-54\sqrt{3m}}{36-27m} \\
 &= \frac{12-6\sqrt{3m}}{4-3m} \\
 & m \geq 0 \text{ and } m \neq \frac{4}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{d) } & \frac{a+\sqrt{b}}{a-\sqrt{b}} \\
 &= \frac{a+\sqrt{b}}{a-\sqrt{b}} \cdot \frac{(a+\sqrt{b})}{(a+\sqrt{b})} \\
 &= \frac{a^2+2a\sqrt{b}+b}{a^2-b} \\
 & b \geq 0 \text{ and } b \neq a^2
 \end{aligned}$$

16.

$$\begin{aligned}
 \text{a) } & \left(\frac{-5\sqrt{3}}{\sqrt{6}} \right) \left(\frac{-\sqrt{7}}{3\sqrt{21}} \right) \\
 &= \frac{5\sqrt{21}}{3\sqrt{126}} \\
 &= \frac{5\sqrt{21}}{3\sqrt{(2)(3)(3)(7)}} \\
 &= \frac{5\sqrt{21}}{3(3)\sqrt{14}} \\
 &= \frac{5\sqrt{21} \cdot \sqrt{14}}{9\sqrt{14} \cdot \sqrt{14}} \\
 &= \frac{5\sqrt{294}}{9(14)} \\
 &= \frac{5\sqrt{(2)(3)(7)(7)}}{126} \\
 &= \frac{35\sqrt{6}}{126} = \frac{5\sqrt{6}}{18}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } & \left(\frac{2a\sqrt{a^3}}{9} \right) \left(\frac{12}{-\sqrt{8a}} \right) \\
 &= \frac{24a\sqrt{a^3}}{-9\sqrt{8a}} \\
 &= \frac{24a^2\sqrt{a} \cdot \sqrt{8a}}{-9\sqrt{8a} \cdot \sqrt{8a}} \\
 &= \frac{24a^2\sqrt{8a^2}}{-9(8a)} \\
 &= \frac{24a^2\sqrt{(2)(2)(2)(a)(a)}}{-9(8a)} \\
 &= \frac{24a^2(2)(a)\sqrt{2}}{-72a} \\
 &= \frac{48a^3\sqrt{2}}{-72a} \\
 &= -\frac{2a^2\sqrt{2}}{3}
 \end{aligned}$$

Solutions

18.

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

$$x \geq 0$$

$$(-\sqrt{x})^2 = (-7)^2$$

$$x = 49$$

$$\text{b) } \sqrt{4-x} = -2$$

$$4-x \geq 0$$

$$\frac{-x \geq -4}{-1 \quad -1}$$

$$x \leq 4$$

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

NO SOLUTION!

$$\text{c) } 5 - \sqrt{2x} = -1$$

$$\frac{2x \geq 0}{2 \quad 2}$$

$$x \geq 0$$

$$5 - \sqrt{2x} = -1$$

$$5 + 1 = \sqrt{2x}$$

$$6 = \sqrt{2x}$$

$$(6)^2 = (\sqrt{2x})^2$$

$$\frac{36 = 2x}{2 \quad 2}$$

$$18 = x$$

$$\text{d) } 1 + \sqrt{\frac{7x}{3}} = 8$$

$$\frac{7x \geq 0}{3}$$

$$\frac{7x \geq 0}{7} \quad \frac{0}{7}$$

$$x \geq 0$$

$$1 + \sqrt{\frac{7x}{3}} = 8$$

$$\sqrt{\frac{7x}{3}} = 8 - 1$$

$$\sqrt{\frac{7x}{3}} = 7$$

$$\sqrt{\frac{7x}{3}} = 7$$

$$\sqrt{7x} = 7\sqrt{3}$$

$$(\sqrt{7x})^2 = (7\sqrt{3})^2$$

$$7x = (49)(3)$$

$$\frac{7x = 147}{7 \quad 7}$$

$$x = 21$$

Solutions

$$\begin{aligned}
 19a) \quad & \sqrt{5x-3} = \sqrt{7x-12} \\
 & (\sqrt{5x-3})^2 = (\sqrt{7x-12})^2 \\
 & 5x-3 = 7x-12 \\
 & -3+12 = 7x-5x \\
 & \frac{9}{2} = \frac{2x}{2} \\
 & \frac{9}{2} = x
 \end{aligned}$$

Restrictions:

$$\begin{aligned}
 5x-3 &\geq 0 & 7x-12 &\geq 0 \\
 \frac{5x}{5} &\geq \frac{3}{5} & \frac{7x}{7} &\geq \frac{12}{7} \\
 x &\geq \frac{3}{5} & x &\geq \frac{12}{7}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad & \sqrt{y-3} = y-3 \\
 & (\sqrt{y-3})^2 = (y-3)^2 \\
 & y-3 = y^2-6y+9 \\
 & 0 = y^2-6y-y+9+3 \\
 & 0 = y^2-7y+12 \\
 & 0 = (y-4)(y-3) \\
 & 0 = y-4 \quad \text{or} \quad 0 = y-3 \\
 & 4 = y \quad \text{or} \quad 3 = y
 \end{aligned}$$

$$\begin{aligned}
 y-3 &\geq 0 \\
 y &\geq 3
 \end{aligned}$$

$$\begin{aligned}
 c) \quad & \sqrt{7n+25} - n = 1 \\
 & \sqrt{7n+25} = 1+n \\
 & (\sqrt{7n+25})^2 = (1+n)^2 \\
 & 7n+25 = 1+2n+n^2 \\
 & 0 = n^2+2n-7n+1-25 \\
 & 0 = n^2-5n-24 \\
 & 0 = (n+3)(n-8) \\
 & 0 = n+3 \quad \text{or} \quad 0 = n-8 \\
 & -3 = n \quad \text{or} \quad 8 = n
 \end{aligned}$$

$$\begin{aligned}
 7n+25 &\geq 0 \\
 \frac{7n}{7} &\geq \frac{-25}{7} \\
 n &\geq \frac{-25}{7}
 \end{aligned}$$

Extraneous Root!

Solutions

21. On a calm day, the distance, d , in kilometers, that the coast guard crew on the Coast Guard cutter Vakta can see to the horizon depends on their height, h , in meters, above the water. The formula $d = \sqrt{\frac{3h}{2}}$, $h \geq 0$

models this relationship. What is the height of the crew above the water if the distance to the horizon is 7.1 km?

$$d = \sqrt{\frac{3h}{2}}$$

$$7.1 = \sqrt{\frac{3h}{2}}$$

$$(7.1)^2 = \left(\sqrt{\frac{3h}{2}}\right)^2$$

$$50.41 = \frac{3h}{2}$$

$$(50.41)(2) = 3h$$

$$\frac{100.82}{3} = \frac{3h}{3}$$

$$33.6m = h$$