

## Review Exercises (Ch. 9)

1) The table values for both functions are the same.

3)  $\sqrt[5]{3} \approx 1.246$

5)

a)  $18^{1/2} = (9 \cdot 2)^{1/2} = 9^{1/2} \cdot 2^{1/2} = (3^2)^{1/2} \cdot 2^{1/2} = 3 \cdot 2^{1/2} = 3\sqrt{2}$

b)  $49^{1/4} = (7^2)^{1/4} = 7^{2/4} = 7^{1/2} = \sqrt{7}$

c)  $\sqrt[3]{\sqrt{2}} = \sqrt[3]{(2^{1/2})} = (2^{1/2})^{1/3} = 2^{1/6} = \sqrt[6]{2}$

d) 
$$\frac{2}{3}^{\frac{4}{3}} = \frac{2^4}{3^4}^{\frac{1}{3}} = \frac{16}{81}^{\frac{1}{3}} = \frac{(8 \cdot 2)^{1/3}}{(27 \cdot 3)^{1/3}} = \frac{8^{1/3} \cdot 2^{1/3}}{27^{1/3} \cdot 3^{1/3}}$$

$$= \frac{2 \cdot 2^{1/3}}{3 \cdot 3^{1/3}} = \frac{2 \cdot 2^{1/3}}{3 \cdot 3^{1/3}} \cdot \frac{3^{1/3} \cdot 3^{1/3}}{3^{1/3} \cdot 3^{1/3}} = \frac{2 \cdot (2 \cdot 3 \cdot 3)^{1/3}}{3 \cdot (3 \cdot 3 \cdot 3)^{1/3}} = \frac{2 \cdot 18^{1/3}}{3 \cdot 3} = \frac{2 \cdot \sqrt[3]{18}}{9}$$

7)

a) 
$$\begin{aligned} & \sqrt{12} + \sqrt{27} \\ &= 12^{1/2} + 27^{1/2} \\ &= (4 \cdot 3)^{1/2} + (9 \cdot 3)^{1/2} \\ &= 4^{1/2} \cdot 3^{1/2} + 9^{1/2} \cdot 3^{1/2} \\ &= 2\sqrt{3} + 3\sqrt{3} \\ &= 5\sqrt{3} \end{aligned}$$

b) 
$$\begin{aligned} & \sqrt{50} - \sqrt{45} \\ &= 50^{1/2} - 45^{1/2} \\ &= (25 \cdot 2)^{1/2} - (9 \cdot 5)^{1/2} \\ &= 25^{1/2} \cdot 2^{1/2} - 9^{1/2} \cdot 5^{1/2} \\ &= 5\sqrt{2} - 3\sqrt{5} \end{aligned}$$

c)  $\sqrt{6} \cdot \sqrt{12} = \sqrt{6 \cdot 12} = \sqrt{72} = 72^{1/2} = (36 \cdot 2)^{1/2} = 36^{1/2} \cdot 2^{1/2} = 6\sqrt{2}$

d) 
$$\frac{\sqrt{8}}{\sqrt{48}} = \frac{8^{1/2}}{48^{1/2}} = \frac{8}{48}^{\frac{1}{2}} = \frac{1}{6}^{\frac{1}{2}} = \frac{1^{1/2}}{6^{1/2}} = \frac{1}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{6}}{6}$$

9)

a) 
$$\begin{aligned} 2x^6 &= 98 \\ x^6 &= 49 \\ x &= \pm \sqrt[6]{49} \\ \sqrt[6]{49} &= 49^{1/6} = (7^2)^{1/6} = 7^{2/6} = 7^{1/3} = \sqrt[3]{7} \end{aligned}$$

$$x = \pm\sqrt[3]{7}$$

b)  $(x - 2)^3 - 5 = 22$   
 $(x - 2)^3 = 27$   
 $x - 2 = 27^{1/3}$   
 $x - 2 = 3$   
 $x = 5$

c) No solution                      See Fact 9.3:  $n$  is even and  $a < 0$

11)

a)  $x^{1/2} = 3$   
 $x = (3)^2$   
 $x = 9$

b)  $x^{1/2} = -3$   
 $x = (-3)^2$   
 $x = 9$                       Extraneous solution

c)  $7x^{1/5} = 11.2$   
 $x^{1/5} = 1.6$   
 $x = (1.6)^5$   
 $x = 10.48576$

d)  $7x^{1/5} = -11.2$   
 $x^{1/5} = -1.6$   
 $x = (-1.6)^5$   
 $x = -10.48576$

13) Recall Definition 9.5:  $Y_1$  and  $Y_2$  are inverses of each other if  $Y_1(Y_2(x)) = x$  for all  $x$  in domain of  $Y_2$  and  $Y_2(Y_1(x)) = x$  for all  $x$  in the domain of  $Y_1$ .

The domain of both  $Y_1$  and  $Y_2$  is all real numbers.

$$Y_1(Y_2(x)) = Y_1(3x + 12) = \frac{1}{3}(3x + 12) - 4 = x + 4 - 4 = x$$

$$Y_2(Y_1(x)) = Y_2\left(\frac{1}{3}x - 4\right) = 3\left(\frac{1}{3}x - 4\right) + 12 = x - 12 + 12 = x$$

15)  $y = 0.407x^{1.5}$

$$y = 0.407(487.4)^{1.5}$$

$$y = 4379 \text{ days} = 4379 \frac{1 \text{ year}}{365 \text{ days}} = 12 \text{ years}$$

$$\begin{aligned}
 17) \quad y &= ax^2 \\
 45 &= a(3)^2 \\
 45 &= 9a \\
 a &= 5
 \end{aligned}$$

19)

$$\begin{aligned}
 \text{a)} \quad y &= ax^{1/2} \\
 (100) &= a(10)^{1/2} \\
 a &= \frac{100}{10^{1/2}} \\
 a &= \frac{10^2}{10^{1/2}} = 10^{2-(1/2)} = 10^{3/2} \quad 31.62
 \end{aligned}$$

$$\begin{aligned}
 \text{b)} \quad y &= 10^{3/2} x^{1/2} \\
 y &= 10^{3/2} (4)^{1/2} \\
 y &= 31.62 (2) \\
 y &= 63.25
 \end{aligned}$$

$$\begin{aligned}
 \text{c)} \quad 64 &= 10^{3/2} x^{1/2} \\
 \frac{64}{10^{3/2}} &= x^{1/2} \\
 x &= \frac{64}{10^{3/2}}^2 \\
 x &= \frac{64^2}{(10^{3/2})^2} \\
 x &= \frac{4096}{10^3} \\
 x &= \frac{4096}{1000} \\
 x &= 4.096
 \end{aligned}$$

21) Let  $p$  be the windmill power generated by a wind speed of  $w$  miles per hour.

$$\begin{aligned}
 p &= aw^3 \\
 (130) &= a(10)^3 && \text{A wind speed of } 10 \frac{\text{mi}}{\text{hr}} \text{ generates 130 watts of power} \\
 130 &= 1000a \\
 a &= 0.13 && \text{Variation constant}
 \end{aligned}$$

$$\begin{aligned}
 p &= 0.13w^3 \\
 p &= 0.13 (25)^3 \\
 p &= 0.13 \quad 15,625
 \end{aligned}$$

$$p = 2031.25 \text{ watts}$$