

## §1.2 EXPONENTS &amp; RADICALS

6/6/2016

# 12, 13, 17, 19, 24, 31, 33, 35, 39,

41, 43, 45, 47, 51, 55, 57, 67, 69, 73

$$\underline{12.} \quad \frac{1}{\sqrt{10^3}}$$

$$\underline{13.} \quad 5^{3/5}$$

$$\underline{17.} \quad (a) \quad -2^6 = -(2^6) = \boxed{-64}$$

$$(b) \quad (-2)^6 = (-1)^6 (2)^6 = \boxed{64}$$

$$(c) \quad \left(\frac{1}{5}\right)^2 \cdot (-3)^3 = \frac{1^2}{5^2} \cdot (-1)^3 (3)^3 = \frac{(1)(-1)(27)}{(25)} = \boxed{-\frac{27}{25}}$$

$$\underline{19.} \quad (a) \quad \left(\frac{5}{3}\right)^0 \cdot 2^{-1} = 1 \cdot \frac{1}{2} = \boxed{\frac{1}{2}}$$

$$(b) \quad \frac{2^{-3}}{3^0} = \frac{1}{3^0 \cdot 2^3} = \frac{1}{1 \cdot 8} = \boxed{\frac{1}{8}}$$

$$(c) \quad \left(\frac{2}{3}\right)^{-2} = \left(\frac{3}{2}\right)^2 = \frac{3^2}{2^2} = \boxed{\frac{9}{4}}$$

$$\text{or} \quad \frac{2^{-2}}{3^{-2}} = \frac{3^2}{2^2}$$

24. (a)  $2\sqrt[3]{81} = 2\sqrt[3]{27 \cdot 3} = 2\sqrt[3]{27}\sqrt[3]{3}$   
 $= 2 \cdot 3\sqrt[3]{3} = \boxed{6\sqrt[3]{3}}$

(b)  $\frac{\sqrt{18}}{\sqrt{25}} = \frac{\sqrt{9 \cdot 2}}{5} = \frac{\sqrt{9}\sqrt{2}}{5} = \boxed{\frac{3\sqrt{2}}{5}}$

(c)  $\sqrt{\frac{12}{49}} = \frac{\sqrt{12}}{\sqrt{49}} = \frac{\sqrt{4}\sqrt{3}}{7} = \boxed{\frac{2\sqrt{3}}{7}}$

31. (a)  $x^{-5} \cdot x^3 = x^{-5+3} = x^{-2} = \boxed{\frac{1}{x^2}}$

(b)  $w^{-2} \cdot w^{-4} \cdot w^5 = w^{-2-4+5} = w^{-1} = \boxed{\frac{1}{w}}$

(c)  $\frac{x^{16}}{x^{10}} = x^{16-10} = \boxed{x^6}$

33. (a)  $\frac{a^9 a^{-2}}{a} = a^{9+(-2)-1} = \boxed{a^6}$

(b)  $(a^2 a^4)^3 = (a^{2+4})^3 = (a^6)^3 = \boxed{a^{18}}$

( or  $= (a^2)^3 (a^4)^3 = a^6 a^{12} = a^{6+12} = a^{18}$  )

(c)  $\left(\frac{x}{2}\right)^3 (5x^6) = \frac{x^3 \cdot 5x^6}{2^3} = \boxed{\frac{5x^9}{8}}$

$$\underline{35.} \quad (a) \quad (3x^3y^2)(2y^3) = 2 \cdot 3 x^3 y^2 y^3 = \boxed{6x^3y^5}$$

$$(b) \quad (5w^2z^{-2})^2(z^3) = 5^2(w^2)^2(z^{-2})^2z^3$$

$$= 25w^4z^{-4}z^3$$

$$= 25w^4z^{-1} = \boxed{\frac{25w^4}{z}}$$

$$\underline{39.} \quad \left(\frac{a^2}{b}\right)^5 \left(\frac{a^3b^2}{c^3}\right)^3 = \frac{(a^2)^5 (a^3)^3 (b^2)^3}{b^5 (c^3)^3}$$

$$= \frac{a^{10} a^9 b^6}{b^5 c^9} = \frac{a^{19} b^6}{c^9 b^5} = \boxed{\frac{a^{19} b}{c^9}}$$

$$\frac{(u^{-1}v^2)^2}{(u^3v^{-2})^3} = \frac{(u^{-1})^2 (v^2)^2}{(u^3)^3 (v^{-2})^3} = \frac{u^{-2} v^4}{u^9 v^{-6}} = u^{-2-9} v^{4-(-6)}$$

$$= u^{-11} v^{10} = \boxed{\frac{v^{10}}{u^{11}}}$$

$$\underline{41.} \quad (a) \quad \frac{8a^3b^{-4}}{2a^{-5}b^5} = \frac{2^3 a^3 a^5}{2 b^4 b^5} = \frac{2^2 a^8}{b^9} = \boxed{\frac{4a^8}{b^9}}$$

$$\left( \text{or } \left( \frac{2^{3-1} a^{3-(-5)} b^{-4-5}}{1} = 2^2 a^8 b^{-9} = \right) \right)$$

$$(b) \left( \frac{y}{5x^{-2}} \right)^{-3} = \frac{y^{-3}}{5^{-3} (x^{-2})^{-3}} = \frac{5^3}{x^6 y^3} = \boxed{\frac{125}{x^6 y^3}}$$

$$43. (a) \left( \frac{3a}{b^3} \right)^{-1} = \boxed{\frac{b^3}{3a}}$$

$$(b) \left( \frac{p^{-1} r^{-1} s^{-2}}{r^{-5} s p^{-8}} \right)^{-1} = \frac{(p^{-1})^{-1} (r^{-1})^{-1} (s^{-2})^{-1}}{(r^{-5})^{-1} s^{-1} (p^{-8})^{-1}}$$

$$= \frac{p r s^2}{r^5 s^{-1} p^8} = \boxed{\frac{s^3}{p^7 r^4}}$$

$$45. \sqrt[4]{x^4} = \boxed{x}$$

$$\sqrt[4]{16x^8} = \sqrt[4]{16} \sqrt[4]{x^8} = \boxed{2x^2}$$

$$47. \sqrt[6]{64a^6 b^7} = \sqrt[6]{64a^6 b^6} \cdot \sqrt[6]{b}$$

$$= \boxed{2ab \sqrt[6]{b}}$$

$$\sqrt[3]{a^2 b} \sqrt[3]{64a^4 b} = \sqrt[3]{64a^6} \sqrt[3]{b^2} = \boxed{4a^2 \sqrt[3]{b^2}}$$

$$\begin{aligned} \underline{51.} \quad (a) \quad \sqrt{9a^3} + \sqrt{a} &= \sqrt{9a^2} \sqrt{a} + \sqrt{a} \\ &= 3a\sqrt{a} + \sqrt{a} = \boxed{(3a+1)\sqrt{a}} \end{aligned}$$

$$\begin{aligned} (b) \quad \sqrt{16x} + \sqrt{x^5} &= \sqrt{16} \sqrt{x} + \sqrt{x^4} \sqrt{x} \\ &= 4\sqrt{x} + x^2 \sqrt{x} = \boxed{(4+x^2)\sqrt{x}} \end{aligned}$$

$$\underline{55.} \quad 16^{1/4} = (2^4)^{1/4} = 2$$

$$-8^{1/3} = -(2^3)^{1/3} = -2$$

$$9^{-1/2} = (9^{1/2})^{-1} = 3^{-1} = \frac{1}{3}$$

$$\underline{57.} \quad 32^{2/5} = (32^{1/5})^2 = 2^2 = 4$$

$$\left(\frac{4}{9}\right)^{-1/2} = \left(\frac{9}{4}\right)^{1/2} = \frac{9^{1/2}}{4^{1/2}} = \frac{3}{2}$$

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

$$\underline{67.} \quad \frac{(8s^3t^3)^{2/3}}{(s^4t^{-8})^{1/4}} = \frac{8^{2/3} (s^3)^{2/3} (t^3)^{2/3}}{(s^4)^{1/4} (t^{-8})^{1/4}} = \frac{(8^{1/3})^2 s^2 t^2}{s t^{-2}}$$

$$= \frac{2^2 s^2 t^2}{s t^{-2}} = 4s^{2-1} t^{2-(-2)} = \boxed{4st^4}$$

$$\frac{(32 x^5 y^{-3/2})^{2/5}}{(x^{5/3} y^{2/3})^{3/5}} = \frac{32^{2/5} (x^5)^{2/5} (y^{-3/2})^{2/5}}{(x^{5/3})^{3/5} (y^{2/3})^{3/5}}$$

$$= \frac{2^2 x^2 y^{-3/5}}{x y^{2/5}} = 4 x^{2-1} y^{-3/5-2/5} =$$

$$= 4 x y^{-1} = \boxed{\frac{4x}{y}}$$

69. (a)  $\left(\frac{x^{3/2}}{y^{-1/2}}\right)^4 \left(\frac{x^{-2}}{y^3}\right) = \frac{(x^{3/2})^4 x^{-2}}{(y^{-1/2})^4 y^3}$

$$= \frac{x^6 x^{-2}}{y^{-2} y^3} = \boxed{\frac{x^4}{y}}$$

(b)  $\left(\frac{4y^3 z^{2/3}}{x^{1/2}}\right)^2 \left(\frac{x^{-3} y^6}{8z^4}\right)^{1/3} = \frac{4^2 (y^3)^2 (z^{2/3})^2 (x^{-3})^{1/3} (y^6)^{1/3}}{(x^{1/2})^2 (8z^4)^{1/3}}$

$$= \frac{16 y^6 z^{4/3} x^{-1} y^2}{x \cdot 2 z^{4/3}} = 8 x^{-1-1} y^{6+2} z^{4/3-4/3}$$

$$= \boxed{\frac{8y^8}{x^2}}$$

73.

$$\sqrt[6]{y^5} \sqrt[3]{y^2} = y^{5/6} y^{2/3} = y^{5/6 + 2/3}$$

$$= y^{5/6 + 4/6} = y^{9/6} = \boxed{y^{3/2} \text{ or } \sqrt{y^3}}$$

$$(5\sqrt[3]{x})(2\sqrt[4]{x}) = 10x^{1/3 + 1/4} = 10x^{4/12 + 3/12} = \boxed{10x^{7/12} \text{ or } 10\sqrt[12]{x^7}}$$