

Section 2.0 - Practice Questions

1. Multiply. Leave answers in exponential form, positive exponents only

a) $2^3 * 2^4$ 2^7 <i>Multiply common base add exponents</i>	b) $3^5 * 3^7$ 3^{12}
c) $4^{-3} * 4^2$ $4^{-1} = \frac{1}{4}$	d) $5^0 * 5^3$ 5^3
e) $a^2 * a^3 * a^{-5}$ $a^0 = 1$	f) $y^{-3} * y^2 * y$ $y^0 = 1$
g) $8^0 * 8^1 * 8^2$ 8^3	h) $\left(\frac{2}{3}\right)^3 * \left(\frac{2}{3}\right)^4$ $\left(\frac{2}{3}\right)^7$
i) $(-3)^4 * (-3)^3 * (-3)^2$ $(-3)^7 * (-3)^2 = 3^9$	j) $\left(-\frac{1}{2}\right)^5 * \left(-\frac{1}{2}\right)^{-3} * \left(-\frac{1}{2}\right)^6$ $\left(-\frac{1}{2}\right)^8$

2. Divide. Leave answers in exponential form, positive exponents only

I. $\frac{5^6}{5^3}$ 5^3 <i>Divide common base subtract exponents</i>	II. $\frac{4^8}{4^4}$ 4^4
III. $\frac{2^8}{2^2}$ 2^6	IV. $\frac{3^9}{3^3}$ 3^6
V. $\frac{t^6}{t^2}$ t^4	VI. $\frac{x^6}{x^6}$ $x^0 = 1$
VII. $\frac{(-6)^4}{(-6)^{-3}}$ $(-6)^7$	VIII. $\frac{(-9)^{-3}}{(-9)^{-6}}$ $(-9)^3$
IX. $\frac{(-2x)^3}{(-2x)^{-4}}$ $(-2x)^7$	X. $\frac{z^{-2}}{z^{-6}}$ z^4

3. Simplify. Express without brackets or negative exponents.

a) $(2^4)^2$ 2^8	b) $(5^3)^{-2}$ $5^{-6} = \frac{1}{5^6}$
c) $(3^{-4})^{-2}$ 3^8	d) $(-3x^{-2})^0$ 1
e) $(2x)^3$ $2^3 x^3 = 8x^3$	f) $(3x^{-4})^2$ $3^2 x^{-8} = \frac{9}{x^8}$
g) $(2a^{-4})^3$ $8a^{-12} = \frac{8}{a^{12}}$	h) $(3x^4y^{-2})^4$ $3^4 x^{16} y^{-8} = \frac{81x^{16}}{y^8}$
i) $(-4a^{-3}b^{-2})^2$ $(-4)^2 a^{-6} b^{-4} = \frac{16}{a^6 b^4}$	j) $(-2^{-3}x^{-2}y)^3$ $(-2)^{-9} x^{-6} y^3 = -\frac{y^3}{512x^6}$

4. Simplify. Express without brackets or negative exponents.

a) $\frac{3^4 \cdot 3^7}{3^5}$ $\frac{3^{11}}{3^5} = 3^6$	b) $\frac{2^5}{2^4 \cdot 2^3}$ $\frac{2^5}{2^7} = \frac{1}{2^2}$
c) $\frac{4^{-3} \cdot 4^1}{4^{-1}}$ $\frac{4^{-2}}{4^{-1}} = \frac{4}{4^2} = \frac{1}{4}$	d) $\frac{5^4 \cdot 5^{-2}}{5^3 \cdot 5^{-1}}$ $\frac{5^2}{5^2} = 1$
e) $\frac{7^0 \cdot 7^{-3}}{7^2 \cdot 7^{-2}}$ $\frac{7^{-3}}{7^0} = \frac{1}{7^3}$	f) $\frac{11^2 \cdot 11^3}{11^{-1}}$ $\frac{11^5}{11^{-1}} = 11^6$
g) $\frac{3(x^3)^2}{x^{-2}}$ $\frac{3x^6}{x^{-2}} = 3x^8$	h) $\frac{(3x^2)^{-3}}{x^3}$ $\frac{(3)^{-3} x^{-6}}{x^3} = \frac{1}{27x^9}$
i) $\frac{(2a^2b^{-4}c^{-5})^3}{2^2}$ $\frac{8a^6 b^{-12} c^{-15}}{2^2} = \frac{2a^6}{b^{12} c^{15}}$	j) $\left(\frac{2a^2}{3b^4}\right)^{-3}$ $\frac{(2)^{-3} a^{-6}}{(3)^{-3} b^{-12}} = \frac{27b^{12}}{8a^6}$

5. Solve.

I. 3^2 $3 \cdot 3 = \boxed{9}$

II. 3^{-2} $\frac{1}{3 \cdot 3} = \boxed{\frac{1}{9}}$

III. $\left(\frac{1}{3}\right)^2$ $\frac{1^2}{3^2} = \boxed{\frac{1}{9}}$

IV. $\left(\frac{1}{3}\right)^{-2}$ $\frac{1^{-2}}{3^{-2}} = \frac{3^2}{1^2} = \frac{9}{1} = \boxed{9}$

V. -3^2 $(-1)3^2 = (-1)9 = \boxed{-9}$

VI. $(-3)^2$ $(-3)(-3) = \boxed{9}$

VII. $-(-\frac{1}{3})^2$ $(-1)(-\frac{1}{3})(-\frac{1}{3}) = \boxed{-\frac{1}{9}}$

VIII. $(-\frac{1}{3})^2$ $(-\frac{1}{3})(-\frac{1}{3}) = \boxed{\frac{1}{9}}$

IX. $(-\frac{1}{3})^{-2}$ $(-\frac{3}{1})^2 = \boxed{9}$

X. $-(-\frac{1}{3})^{-2}$ $(-1)(-\frac{3}{1})^2 = \boxed{-9}$

XI. -2^3 $(-1)2^3 = \boxed{-8}$

XII. $-(-2)^3$ $(-1)(-2)(-2)(-2) = (-1)(-8) = \boxed{8}$

6. Simplify. Express without brackets or negative exponents.

a) $\frac{(2a^2b^3)^{-2}(4ab^{-1})^3}{(a^3b)^{-4}}$

$$\frac{(2)^{-2} a^{-4} b^{-6} (4)^3 a^3 b^{-3}}{a^{-12} b^{-4}}$$

$$\frac{64 a^{-4} b^{-9}}{4 a^{-12} b^{-4}}$$

$$16 a^{11} b^{-5} \rightarrow \boxed{\frac{16a^{11}}{b^5}}$$

b) $\frac{(x^5y^2)^{-2}(x^2y^{-2})^3}{x^{-1}y^{-2}}$

$$\frac{x^{-10} y^{-4} x^6 y^{-6}}{x^{-1} y^{-2}} = \frac{x^{-4} y^{-10}}{x^{-1} y^{-2}}$$

$$x^{-3} y^{-8} = \boxed{\frac{1}{x^3 y^8}}$$

or work it out first

c) $\frac{(5m^{-1}n^2)^2(2m^{-2}n^{-3})^3}{(2m^3n^2)^{-1}}$ this goes positive on top

$$\frac{(5m^{-1}n^2)^2(2m^{-2}n^{-3})^3(2m^3n^2)^1}{(5^2m^{-2}n^4)(2^3m^{-6}n^{-9})(2m^3n^2)}$$

$$25 \cdot 8 \cdot 2 \cdot m^6 n^6 = \boxed{\frac{400}{m^6 n^6}}$$

d) $\frac{(3a^{-2}b^3)^2(3a^{-1}b^{-4})^{-1}}{(3a^2b^{-2})^{-3}}$

$$\frac{3^2 a^{-4} b^6 \cdot 3^{-1} a^1 b^4}{3^{-3} a^{-6} b^6} = \frac{3^1 a^{-3} b^{10}}{3^{-3} a^{-6} b^6}$$

$$3^4 a^3 b^4 = \boxed{81 a^3 b^4}$$

e) $\frac{(3^{-1}x^{-2}y)^{-1}(5x^2y^4)^{-2}}{(4x^{-2}y^{-3})^2}$

$$\frac{3^1 x^2 y^{-1} \cdot 5^{-2} x^{-4} y^{-8}}{4^2 x^{-4} y^{-6}} = \frac{3x^2 y}{16 \cdot 25 x^{-4} y^{-6}}$$

$$\boxed{\frac{3x^2}{400y^3}}$$

f) $\frac{(3^{-1}a^{-1}b^{-2})^{-2}(4a^{-3}b^4)^{-2}}{(3a^{-3}b^{-4})^2}$

$$\frac{3^2 a^2 b^4 \cdot 4^{-2} a^6 b^{-8}}{3^2 a^{-6} b^8} = \frac{a^8 b^{-4}}{4^2 a^{-6} b^8}$$

$$\boxed{\frac{a^{14} b^4}{16}}$$

g) $\left(\frac{4^{-2}x^2y^{-3}}{x^{-2}y}\right)^3 \left(\frac{8^{-1}x^{-3}y}{x^3y^{-1}}\right)^{-2}$ Flip this term exponent positive.

$$\left(\frac{4^{-6} x^6 y^{-9}}{x^{-6} y^3}\right) \left(\frac{x^3 y^{-1}}{8^{-1-3}}\right)^2$$

$$\left(\frac{x^{12}}{4^6 y^{12}}\right) \left(\frac{x^6 y^{-2}}{8^{-2-6}}\right) \rightarrow \frac{x^{18}}{4096 y^{12}} \cdot \frac{64 x^{12}}{y^4} = \boxed{\frac{x^{30}}{64 y^{16}}}$$

h) $\left(\frac{9ab^{-1}}{8a^{-2}b^2}\right)^{-2} \left(\frac{3a^{-2}b^2}{2a^2b^{-1}}\right)^3$

$$\left(\frac{8a^{-2}b^2}{9ab^{-1}}\right)^2 \left(\frac{3^3 a^{-6} b^6}{2^3 a^6 b^{-3}}\right)^3 = \left(\frac{8^2 a^{-4} b^4}{9^2 a^2 b^{-2}}\right) \left(\frac{27^3 b^9}{8 a^{18}}\right)$$

$$\left(\frac{64 b^6}{81 a^6}\right) \left(\frac{27 b^9}{18 a^{12}}\right) = \boxed{\frac{8 b^{15}}{3 a^{18}}}$$

i) $\frac{(2x^{-1}y^2)(4x^2y^{-3})^{-2}}{(12x^2y^2)}$

$$\frac{2x^{-1}y^2}{(12x^2y^2)(4x^2y^{-3})^2} \rightarrow \frac{2x^{-1}y^2}{12x^2y^2 \cdot 16x^4y^{-6}}$$

$$\frac{2x^{-1}y^2}{12 \cdot 16 x^6 y^{-4}} \rightarrow \frac{1x^{-1}y^2}{6 \cdot 16 x^6 y^{-4}}$$

$$= \boxed{\frac{y^6}{96x^7}}$$

j) $\left[\frac{(5x^{-3}y^4)^{-2}(6x^2y^{-5})^{-2}}{15x^2y^{-4}}\right]^{-2}$ Flip the whole thing then positive

Do inside first

$$\left[\frac{15x^2y^{-4}}{(5x^{-3}y^4)^{-2}(6x^2y^{-5})^{-2}}\right]^2$$

$$\left[\frac{15x^2y^{-4}}{5^{-2}x^6y^{-8} \cdot 6x^2y^{-5}}\right]^2 \rightarrow \left[\frac{25 \cdot 15 y^9}{6x^8}\right]^2 \rightarrow \left[\frac{25 \cdot 5 y^9}{2x^6}\right]^2$$

$$= \left[\frac{125 y^9}{2x^6}\right]^2 = \boxed{\frac{15625 y^{18}}{4x^{12}}}$$

7. Solve.

a) $16^{\frac{3}{4}}$ $\sqrt[4]{16^3} = 2^3 = \boxed{8}$

b) $16^{-\frac{3}{4}}$ $\frac{1}{\sqrt[4]{16^3}} = \boxed{\frac{1}{8}}$

c) $8^{\frac{2}{3}}$ $\sqrt[3]{8^2} = 2^2 = \boxed{4}$

d) $8^{-\frac{2}{3}}$ $\frac{1}{4}$ (all work from previous, but negative exponent)

e) $27^{\frac{4}{3}}$ $\sqrt[3]{27^4} = 3^4 = \boxed{81}$

f) $27^{-\frac{4}{3}}$ $\frac{1}{81}$

g) $-16^{\frac{5}{4}}$ $-\sqrt[4]{16^5} = -2^5 = \boxed{-32}$

h) $-16^{-\frac{5}{4}}$ $-\frac{1}{32}$

i) $-32^{\frac{4}{5}}$ $-\sqrt[5]{32^4} = -2^4 = \boxed{-16}$

j) $-32^{-\frac{4}{5}}$ $-\frac{1}{16}$

k) $216^{\frac{2}{3}}$ $\sqrt[3]{216^2} = 6^2 = \boxed{36}$

l) $216^{-\frac{2}{3}}$ $\frac{1}{36}$

m) $-125^{\frac{4}{3}}$ $-\sqrt[3]{125^4} = -5^4 = \boxed{-625}$

n) $-125^{-\frac{4}{3}}$ $-\frac{1}{625}$

o) $64^{\frac{7}{6}}$ $64^{\frac{5}{6}} \cdot 64^{\frac{1}{6}}$ $\sqrt[6]{64} = 2$
 $64 \cdot 2 = \boxed{128}$

p) $64^{\frac{7}{6}}$ $\frac{1}{128}$

q) $-49^{\frac{3}{2}}$ $-\sqrt{49^3} = -7^3 = \boxed{-343}$

r) $-49^{-\frac{3}{2}}$ $-\frac{1}{343}$

s) $128^{\frac{5}{7}}$ $\sqrt[7]{128^5} = 2^5 = \boxed{32}$

t) $128^{-\frac{5}{7}}$ $\frac{1}{32}$

u) $-243^{\frac{6}{5}}$ $-\sqrt[5]{243^6} = -3^6 = \boxed{-729}$

v) $-243^{-\frac{6}{5}}$ $-\frac{1}{729}$

w) $81^{\frac{5}{4}}$ $\sqrt[4]{81^5} = 3^5 = \boxed{243}$

x) $81^{-\frac{5}{4}}$ $\frac{1}{243}$

8. Simplify. Leave answer with positive exponents.

a) $2^{\frac{1}{4}} * 2^{\frac{5}{4}}$ $2^{\frac{6}{4}} = 2^{\frac{3}{2}}$

b) $3^{\frac{2}{3}} * 3^{\frac{7}{3}}$ $3^{\frac{9}{3}} = 3^3$

c) $4^{\frac{1}{4}} * 4^{-\frac{3}{4}}$ $4^{-\frac{2}{4}} = 4^{-\frac{1}{2}} = \frac{1}{4^{\frac{1}{2}}}$

d) $5^{-\frac{2}{3}} * 5^{-\frac{1}{3}}$ $= 5^{-\frac{3}{3}} = 5^{-1} = \frac{1}{5}$

e) $\frac{6^{\frac{3}{4}}}{6^{\frac{5}{4}}}$ $6^{-\frac{2}{4}} = 6^{-\frac{1}{2}} = \frac{1}{\sqrt{6}}$

f) $\frac{7^{\frac{2}{5}}}{7^{-\frac{1}{5}}}$ $= 7^{\frac{3}{5}}$

g) $\frac{8^{\frac{2}{7}} * 8^{\frac{4}{7}}}{8^{-\frac{3}{7}}}$ $\frac{8^{\frac{6}{7}}}{8^{-\frac{3}{7}}} = 8^{\frac{9}{7}} = (2^3)^{\frac{9}{7}} = 2^{\frac{27}{7}}$

h) $\frac{9^{\frac{3}{5}}}{9^{\frac{2}{5}} * 9^{-\frac{4}{5}}}$ $\frac{9^{\frac{3}{5}}}{9^{-\frac{2}{5}}} = 9^{\frac{5}{5}} = 9$

i) $a^{\frac{3}{4}} * a^{\frac{5}{4}}$ $a^{\frac{8}{4}} = a^2$

j) $b^{\frac{5}{6}} * b^{-\frac{1}{3}}$ $= b^{\frac{5}{6}} * b^{-\frac{2}{6}} = b^{\frac{3}{6}} = b^{\frac{1}{2}}$

k) $\frac{c^{\frac{2}{3}}}{c^{\frac{5}{6}}}$ $c^{\frac{4}{6} - \frac{5}{6}} = c^{-\frac{1}{6}} = \frac{1}{c^{\frac{1}{6}}}$

l) $\frac{d^{\frac{1}{3}}}{d^{-\frac{1}{2}}}$ $\frac{d^{\frac{2}{6}}}{d^{-\frac{3}{6}}} = d^{\frac{5}{6}}$

m) $\left(\frac{9}{4}\right)^{\frac{3}{2}}$ $\left(\sqrt{\frac{9}{4}}\right)^3 = \frac{3^3}{2^3}$

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

o) $\left(\frac{81}{16}\right)^{\frac{3}{4}}$ $\left(\sqrt[4]{\frac{81}{16}}\right)^3 = \frac{3^3}{2^3}$

p) $\left(\frac{81}{16}\right)^{-\frac{3}{4}}$ $\frac{1}{\left(\sqrt[4]{\frac{81}{16}}\right)^3} = \frac{2^3}{3^3}$

Same as previous but negative exponent so flip

q) $(a^3 b^{\frac{1}{2}})^{\frac{2}{3}}$ $a^2 b^{\frac{1}{3}}$

r) $(x^4 y^{\frac{1}{2}})^{\frac{4}{3}}$ $x^{\frac{16}{3}} y^{\frac{2}{3}} = x^{\frac{16}{3}} y^{\frac{2}{3}}$

s) $(a^{\frac{2}{3}} b^{\frac{5}{6}} c^{\frac{1}{2}})^{\frac{6}{7}}$ $a^{\frac{4}{7}} b^{\frac{5}{7}} c^{\frac{3}{7}}$

t) $(x^{\frac{4}{3}} y^{\frac{3}{4}} z^{\frac{5}{2}})^{-\frac{12}{5}}$ $\frac{1}{x^{\frac{16}{5}} y^{\frac{9}{5}} z^{\frac{60}{5}}}$

9. Simplify each radical. Assume the variables are positive.

<p>I. $\sqrt[4]{4^1}$ $4^{1/4} = (2^2)^{1/4} = 2^{2/4} = 2^{1/2} = \sqrt{2}$</p>	<p>II. $\sqrt[3]{8^6}$ $8^{6/3} = 8^2 = (2^3)^2 = 2^6 = 64$</p>
<p>III. $\sqrt[6]{16^3}$ $16^{3/6} = (2^4)^{1/2} = 2^{4/2} = 2^2 = 4$</p>	<p>IV. $\sqrt[3]{27^2}$ $27^{2/3} = (3^3)^{2/3} = 3^2 = 9$</p>
<p>V. $\sqrt[3]{9^3}$ $9^{3/3} = 9^1 = (3^2)^1 = 3^2 = 9$</p>	<p>VI. $\sqrt[4]{4^2}$ $4^{2/4} = 4^{1/2} = 2^{2/2} = 2$</p>
<p>VII. $\sqrt[4]{a^2}$ $a^{2/4} = a^{1/2} = \sqrt{a}$</p>	<p>VIII. $\sqrt[3]{b^3}$ $b^{3/3} = b^1 = b$</p>

10. Simplify.

<p>a) $\sqrt{2} * \sqrt[3]{2}$ $2^{1/2} * 2^{1/3} \rightarrow 2^{3/6} * 2^{2/6} = 2^{5/6} = \sqrt[6]{32}$</p>	<p>b) $\sqrt{3} * \sqrt[4]{3}$ $3^{1/2} * 3^{1/4} \rightarrow 3^{2/4} * 3^{1/4} = 3^{3/4} = \sqrt[4]{27}$</p>
<p>c) $\sqrt[3]{2} * \sqrt[4]{2}$ $2^{1/3} * 2^{1/4} \rightarrow 2^{4/12} * 2^{3/12} = 2^{7/12} = \sqrt[12]{128}$</p>	<p>d) $\sqrt[3]{4} / \sqrt[4]{4}$ $4^{1/3} = 4^{4/12} \rightarrow 4^{4/12} / 4^{3/12} = 4^{1/12} = \sqrt[12]{4} = \sqrt[6]{2}$</p>
<p>e) $\frac{\sqrt{27}}{\sqrt[3]{9}}$ $27^{1/2} = 9^{3/2} \rightarrow (3^2)^{3/2} = 3^{3} = 27$ $3^{3/2} / 3^{2/3} \rightarrow 3^{9/6} / 3^{4/6} = 3^{5/6} = \sqrt[6]{243}$</p>	<p>f) $\frac{\sqrt[3]{16}}{\sqrt[4]{8}}$ $2^{4/3} / 2^{3/4} = 2^{16/12} / 2^{9/12} = 2^{7/12} = \sqrt[12]{128}$</p>
<p>g) $\frac{(\frac{1}{2})^x * 8^x}{4^x} \rightarrow \frac{2^{-x} * (2^3)^x}{(2^2)^x} = \frac{2^{-x} * 2^{3x}}{2^{2x}} = \frac{2^{2x}}{2^{2x}} = 1$</p>	<p>h) $\frac{3^x * 27^x}{9^x} = \frac{3^x * 3^{3x}}{3^{2x}} = \frac{3^{4x}}{3^{2x}} = 3^{2x} = 9^x$</p>
<p>i) $\frac{(\frac{1}{3})^x * 81^x}{27^x} \rightarrow \frac{3^{-x} * 3^{4x}}{3^{3x}} = \frac{3^{3x}}{3^{3x}} = 1$</p>	<p>j) $\frac{5^{-x} * 125^{2x}}{25^{3x}} = \frac{5^{-x} * (5^3)^{2x}}{(5^2)^{3x}} = \frac{5^{-x} * 5^{6x}}{5^{6x}} = 5^{-x} = \frac{1}{5^x}$</p>

