

Assignment

1. Write each expression without brackets and with positive exponents.

$$\text{a) } 4xy^{-3} = \frac{4x}{y^3}$$

$$\text{b) } \frac{15y^{-3}}{5y} = 3y^{-4} = \frac{3}{y^4}$$

$$\text{c) } (3x^3y)(5x^{-2}y^4) = 15xy^5$$

$$\text{d) } \frac{24p^{-8}}{16p^{-3}} = \frac{3p^{-5}}{2} = \frac{3}{2p^5}$$

$$\text{e) } \frac{2}{a^{-\frac{1}{3}}} = 2a^{\frac{1}{3}}$$

$$\text{f) } (2x^{-2})^3 = 8x^{-6} = \frac{8}{x^6}$$

2. Simplify the following. Write the answers with positive exponents.

$$\text{a) } \frac{x^5y^{-1}}{x^2y^{-4}} = x^3y^3$$

$$\text{b) } \left(\frac{5x^3}{2y^4}\right)^{-3} = \left(\frac{2y^4}{5x^3}\right)^3 = \frac{8y^{12}}{125x^9}$$

$$\text{c) } (4m^2n)^{-1} \times 2mn^5 = \frac{2mn^5}{4m^2n} = \frac{n^4}{2m}$$

$$\text{d) } \frac{3x^2y^0z^{-4}}{(2xyz)^3} = \frac{3x^2z^{-4}}{8x^3y^3z^3} = \frac{3}{8x^4y^3z^7}$$

3. Without using a calculator, determine exact the value of the following. Verify with a calculator.

$$\text{a) } 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

$$\text{b) } 27^{\frac{4}{3}} = \sqrt[3]{27^4} = 3^4 = 81$$

$$\text{c) } \left(\frac{4}{9}\right)^{-\frac{3}{2}} = \left(\frac{9}{4}\right)^{\frac{3}{2}} = \left(\frac{3}{2}\right)^3 = \frac{27}{8}$$

$$\text{d) } 125^{\frac{1}{3}} - 10^0(64)^{\frac{2}{3}} = \sqrt[3]{125} - 1(\sqrt[3]{64})^2 = 5 - 4^2 = 5 - 16 = -11$$

$$\text{e) } \left(\frac{1}{4}\right)^{-2} = 4^2 = 16$$

4. Convert each of the following to the base indicated.

a) 32^x to base 2

$$(2^5)^x = 2^{5x}$$

b) 81^{x-2} to base 3

$$(3^4)^{x-2} = 3^{4x-8}$$

c) $\frac{1}{64^{2x}}$ to base 4

$$\frac{1}{(4^3)^{2x}} = \frac{1}{4^{6x}} = 4^{-6x}$$

d) $\left(\frac{1}{16}\right)^{x+1}$ to base 2

$$\left(\frac{1}{2^4}\right)^{x+1} = (2^{-4})^{x+1} = 2^{-4x-4}$$

e) $\left(\frac{25}{49}\right)^{3x}$ to base $\frac{5}{7}$

$$\left(\frac{5^2}{7^2}\right)^{3x} = \left(\frac{5}{7}\right)^{6x}$$

f) $\left(\frac{27}{64}\right)^{x+2}$ to base $\frac{4}{3}$

$$\left(\frac{3}{4}\right)^{x+2} = \left(\frac{4}{3}\right)^{-3x-6}$$

5. Convert each of the following to the base indicated.

a) $2 \cdot 4^x$ to base 2

$$2^1 \cdot 2^{2x} = 2^{2x+1}$$

b) $9 \cdot 27^{x-1}$ to base 3

$$3^2 \cdot (3^3)^{x-1} = 3^1 \cdot 3^{3x-3} = 3^{3x-1}$$

c) $\frac{1}{4} \cdot \left(\frac{1}{16}\right)^{4-x}$ to base 4

$$\frac{1}{4} \cdot \left(\frac{1}{4^2}\right)^{4-x} = 4^{-1} \cdot (4^{-2})^{4-x} = 4^{-1} \cdot 4^{-8+2x} = 4^{2x-9}$$

6. Solve for x.

a) $x^{\frac{1}{2}} = 5$

$$(x^{\frac{1}{2}})^2 = 5^2$$

$$x = 25$$

b) $x^{-\frac{1}{2}} = 5$

$$(x^{-\frac{1}{2}})^{-2} = 5^{-2}$$

$$= \frac{1}{5^{-2}}$$

$$= \frac{1}{25}$$

c) $x^{\frac{1}{3}} = -5$

$$(x^{\frac{1}{3}})^3 = (-5)^3$$

$$x = -125$$

d) $4x^{-\frac{2}{3}} = 16$

$$(4x^{-\frac{2}{3}})^{-3/2} = 16^{-3/2}$$

$$4x = \frac{1}{(\sqrt{16})^3}$$

$$4x = \frac{1}{64} \div 4$$

$$x = \frac{1}{8}$$

Multiple Choice

7. $(4x^{-3}y^5)^2$ is equal to

A. $\frac{16y^{10}}{x^6}$

B. $\frac{4y^{10}}{x^6}$

C. $\frac{16y^{10}}{x^3}$

D. $\frac{16x^6}{y^{10}}$

$16x^{-6}y^{10}$
 $= \frac{16y^{10}}{x^6}$

8. $(36x^{-4})^{-\frac{1}{2}}$ is equal to

A. $\frac{6}{x^2}$

B. $-18x^2$

C. $\frac{x^2}{6}$

D. $\frac{x^{-4.5}}{6}$

$\frac{1}{(36x^{-4})^{\frac{1}{2}}}$
 $= \frac{1}{6x^{-2}}$
 $= \frac{x^2}{6}$

9. When $16(8)^{x-1}$ is converted to base 2, the exponent is

A. $3x + 1$

B. $3x + 3$

C. $7x - 7$

D. $12x - 12$

$2^4 \cdot (2^3)^{x-1}$
 $2^4 \cdot 2^{3x-3}$
 2^{3x+1}

Answer Key

1. a) $\frac{4x}{y^3}$ b) $\frac{3}{y^4}$ c) $15xy^5$ d) $\frac{3}{2p^5}$ e) $2a^{\frac{1}{3}}$ f) $\frac{8}{x^6}$

2. a) x^3y^3 b) $\frac{8y^{12}}{125x^9}$ c) $\frac{n^4}{2m}$ d) $\frac{3}{8xy^3z^7}$

3. a) $\frac{1}{25}$ b) 81 c) $\frac{27}{8}$ d) -11 e) 16

4. a) 2^{5x} b) 3^{4x-8} c) 4^{-6x} d) 2^{-4x-4} e) $\left(\frac{5}{7}\right)^{6x}$ f) $\left(\frac{4}{3}\right)^{-3x-6}$

5. a) 2^{2x+1} b) 3^{3x-1} c) 4^{2x-9}

6. a) $x = 25$ b) $x = \frac{1}{25}$ c) $x = -125$ d) $x = \frac{1}{8}$

7. A 8. C 9. A