

Name: _____

Date: _____

Learning Goal 5.2

Use exponent laws to evaluate expression with positive and negative rational exponents.

Evaluate the following expressions **without a calculator**. Leave your answers as fractions.

$$\begin{aligned} \text{a. } 3^{-2} &= \frac{1}{3^2} \\ &= \frac{1}{9} \end{aligned}$$

$$\begin{aligned} \text{b. } 2^{-4} &= \frac{1}{2^4} \\ &= \frac{1}{16} \end{aligned}$$

$$\begin{aligned} \text{c. } (0.3)^{-4} &= \left(\frac{3}{10}\right)^{-4} \\ &= \left(\frac{10}{3}\right)^4 \\ &= \frac{10000}{81} \end{aligned}$$

$$\begin{aligned} \text{d. } \left(\frac{1}{3}\right)^{-3} &= \left(\frac{3}{1}\right)^3 \\ &= 3^3 \\ &= 27 \end{aligned}$$

$$\begin{aligned} \text{e. } \left(-\frac{2}{3}\right)^{-2} &= \left(-\frac{3}{2}\right)^2 \\ &= \frac{9}{4} \end{aligned}$$

$$\begin{aligned} \text{f. } \frac{1}{5^{-3}} &= 5^3 \\ &= 125 \end{aligned}$$

Simplify the following expressions to a single power with only positive exponents. Do not evaluate. Show all your work.

$$\begin{aligned} \text{a. } ((11^3 \times 11^{-7})^{-3})^2 & \\ &= ((11^{-4})^{-3})^2 \\ &= (11^{12})^2 \\ &= 11^{24} \end{aligned}$$

$$\begin{aligned} \text{b. } (32^{-2} \times 128)^{-4} & \\ &= ((2^5)^{-2} \times (2^7))^{-4} \\ &= (2^{-10} \times 2^7)^{-4} \\ &= (2^{-3})^{-4} \\ &= 2^{12} \end{aligned}$$

$$\begin{aligned} \text{c. } ((q^{-5} \times q^{-4})^2)^{-4} & \\ &= ((q^{-9})^2)^{-4} \\ &= (q^{-18})^{-4} \\ &= q^{72} \end{aligned}$$

$$\begin{aligned} \text{d. } -\left(\frac{t^{-9}}{t^{-12}}\right)^{-4} &= -\left(\frac{t^{12}}{t^9}\right)^{-4} \\ &= -\left(\frac{t^9}{t^{12}}\right)^4 \\ &= -\left(\frac{1}{t^3}\right)^4 \\ &= -\frac{1}{t^{12}} \end{aligned}$$

$$\begin{aligned} \text{e. } \left(-\left(\frac{w^{-3}}{w^3}\right)^2\right)^{-8} & \\ &= \left(-\left(\frac{1}{w^3 \times w^3}\right)^2\right)^{-8} \\ &= \left(-\left(\frac{1}{w^6}\right)^2\right)^{-8} \\ &= \left(-\frac{1}{w^{12}}\right)^{-8} \\ &= (-w^{12})^8 \\ &= w^{96} \end{aligned}$$

$$\begin{aligned} \text{f. } \left(\frac{-81^2}{27^{-6}}\right)^{-3} & \\ &= \left(\frac{-(3^4)^2}{(3^3)^{-6}}\right)^{-3} \\ &= \left(\frac{-3^8}{3^{-18}}\right)^{-3} \\ &= (-3^8 \times 3^{18})^{-3} \\ &= (-3^{26})^{-3} \\ &= \left(-\frac{1}{3^{26}}\right)^3 \\ &= -\frac{1}{3^{78}} \end{aligned}$$