

Pre-algebra
Skill-Builder # F – 6
Performing Exponentiation on Signed Fractions

Simply use the fact that exponentiation is repeated multiplication. The same rules for signs apply. Thus, for a nonzero integer b ,

$$\left(\frac{a}{b}\right)^n = \underbrace{\frac{a}{b} \cdot \frac{a}{b} \cdot \dots \cdot \frac{a}{b}}_{n \text{ factors}}$$

Examples

1) $\left(\frac{2}{5}\right)^3 = \frac{2}{5} \cdot \frac{2}{5} \cdot \frac{2}{5} = \frac{8}{125}$

2)

$$\begin{aligned} \left(-\frac{1}{2}\right)^4 &= \left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right) \\ &= \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} && \text{four negative factors give a positive product} \\ &= \frac{1}{16} \end{aligned}$$

3)

$$\begin{aligned} -\left(\frac{2}{3}\right)^4 &= -\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) && \text{The negative sign is not included in the exponentiation.} \\ &= -\frac{16}{81} \end{aligned}$$

4)

$$\begin{aligned} -\left(-\frac{2}{3}\right)^3 &= -\left(-\frac{2}{3}\right)\left(-\frac{2}{3}\right)\left(-\frac{2}{3}\right) \\ &= -\left(-\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3}\right) && \text{The product of three negative factors is negative.} \\ &= \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} && \text{The opposite of a negative is positive.} \\ &= \frac{8}{27} \end{aligned}$$

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Perform the exponentiation.

1) $\left(\frac{1}{4}\right)^2$

2) $\left(\frac{1}{2}\right)^3$

3) $\left(-\frac{1}{3}\right)^2$

4) $\left(-\frac{1}{6}\right)^2$

5) $-\left(\frac{2}{3}\right)^2$

6) $-\left(\frac{4}{5}\right)^2$

7) $\left(-\frac{1}{4}\right)^3$

8) $\left(-\frac{2}{5}\right)^3$

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

10) $-\left(-\frac{4}{3}\right)^3$

11) $\left(-\frac{5}{3}\right)^3$

12) $-\left(-\frac{3}{5}\right)^4$

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Answer Key:

1) $\frac{1}{16}$

2) $\frac{1}{8}$

3) $\frac{1}{9}$

4) $\frac{1}{36}$

5) $-\frac{4}{9}$

6) $-\frac{16}{25}$

7) $-\frac{1}{64}$

8) $-\frac{8}{125}$

9) $-\frac{81}{16}$

10) $\frac{64}{27}$

11) $-\frac{125}{27}$

12) $-\frac{81}{625}$