Learning Goals

1. To understand how the location of a negative sign affects the value of powers with rational bases.

2. To understand how to follow BEDMAS with rational numbers.

3. To understand how to plug in a rational number in place of a variable.

1.6 - Powers of Rational Numbers

Key Ideas

1. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

For example, $\left(\frac{2}{3}\right)^3 = \frac{2^3}{3^3} = \frac{8}{27}$

2. $-\left(\frac{a}{b}\right)^n = -\left(\frac{a}{b}\right)\left(\frac{a}{b}\right)\cdots$

For example, $-\left(\frac{2}{3}\right)^3 = -1\times\left(\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\right)$

$= -1\left(\frac{8}{27}\right)$

$= \frac{-8}{27}$

3. $\left(-\frac{a}{b}\right)^n = \left(\frac{-a}{b}\right)\left(\frac{-a}{b}\right)\cdots$

For example, $\left(\frac{-2}{3}\right)^3 = \left(\frac{-2}{3}\right)\times\left(\frac{-2}{3}\right)\times\left(\frac{-2}{3}\right)$

$= \frac{-8}{27}$

Remember to follow order of operations (BEDMAS) when solving an equation.

Example One

Calculate. $(-3.2)^2 - 2(-6.5)^3$

$= 10.24 - 2(-274.625)$

$= 10.24 + 549.25$ or $10.24 - (-549.25)$

$= 559.49$

Example Two

Solve. $-2\frac{2}{3} + (-1\frac{3}{4} - \frac{5}{6})^2$

1. Solve for brackets.

$$\left(\frac{-7\times6}{4\times6} - \frac{5\times4}{6\times4}\right)$$

$$= \frac{-42}{24} - \frac{20}{24}$$

$$= \frac{-62}{24}$$

2. Apply the exponent.

$$\left(\frac{-62}{24}\right)^2 = \frac{3844}{576}$$

3. Add

$$-2\frac{2}{3} + \frac{3844}{576}$$

$$= -\frac{8\times192}{3\times192} + \frac{3844}{576}$$

$$= -\frac{1536}{576} + \frac{3844}{576}$$

$$= \frac{2308}{576}$$

4. Report as a mixed number.

$$4\frac{4}{576} = 4\frac{1}{144}$$

When plugging a fraction into an equation with existing whole numbers, put a number one under any whole number to make it look like a fraction and then proceed by multiplying/dividing or finding a common denominator to add/subtract.

Example Three

Evaluate the following expression: $x^2 + x - 3$, where $x = 4\frac{3}{5}$.

1. Plug in $4\frac{3}{5}$ for x.

$$\left(4\frac{3}{5}\right)^2 + \left(4\frac{3}{5}\right) - 3$$

2. Change all fractions to improper.

$$\left(\frac{23}{5}\right)^2 + \left(\frac{23}{5}\right) - 3$$

3. Make all whole numbers look like a fraction by putting a one underneath it.

$$\left(\frac{23}{5}\right)^2 + \left(\frac{23}{5}\right) - \frac{3}{1}$$

4. Follow BEDMAS and solve.

$$\frac{529}{25} + \frac{23 \times 5}{5 \times 5} - \frac{3 \times 25}{1 \times 25}$$

$$= \frac{529}{25} + \frac{115}{25} - \frac{75}{25}$$

$$= \frac{569}{25}$$

5. Report as a mixed number.

$$22\frac{19}{25}$$

Complete: p. 63 – 64 #5, 6ace, 13ad.