# Algebraic Expressions with Exponents on the ISEE

**Upper Level**

LESSON GOAL: Learn to multiply and divide algebraic expressions with exponents on the ISEE.

***ISEE Question:***

Simplify the expression: $\dfrac{a^{-7}\sqrt{a^4}}{a^8\,a^{-3}}$

A) $a$ B) $\dfrac{1}{a^{10}}$ C) $a^{\frac{1}{10}}$ D) $a^{10}$

Normally, for a question with variables on the ISEE, the fastest solution is to plug in a number. Since we're working with big exponents, however, the only reasonable number to plug in is 1 (even 2 would create extremely big results). 1 raised to any power is always 1, so the entire expression would equal 1, but unfortunately, so would the answer choices. This is a rare instance where plugging in doesn't work.

Let's review the basic rules for exponents:

*1. When **multiplying** the same base, **add** the exponents:* $n^x n^y = n^{(x+y)}$, for example: $3^7 \times 3^2 = 3^9$

*2. When **dividing** the same base, **subtract** the exponents:* $\dfrac{n^x}{n^y} = n^{(x-y)}$, for example: $3^7 \div 3^2 = 3^5$

*3. A **square root** is the same as an **exponent of 1/2**:* $\sqrt{n} = n^{½}$

*4. A **negative exponent reciprocates the number**:* $n^{-x} = \dfrac{1}{n^x}$

***Solution:***

STEP 1: Simplify the square root (rule #3 above).

$$\sqrt{a^4} = a^{\frac{4}{2}} = a^2$$

STEP 2: Flip the variables with negative exponents from numerator to denominator and vice versa to make them positive (rule #4).

$$\frac{a^{-7}\,a^2}{a^8\,a^{-3}} = \frac{a^3\,a^2}{a^8\,a^7}$$

STEP 3: Add the exponents in the numerator, then in the denominator (rule #1).

$$\frac{a^3\,a^2}{a^8\,a^7} = \frac{a^5}{a^{15}}$$

STEP 4: Simplify the fraction by subtracting the exponents (rule #2).

$$\frac{a^5}{a^{15}} = a^{-10}$$

$a^{-10}$ is not in the answer choices, but according to rule #4, we can reciprocate it to answer choice C) $a^{\frac{1}{10}}$

***Helpful Tip:*** All this being said, this problem is both challenging and time-consuming, so it's a good one to skip, at least until you have given all other problems on this ISEE section a fair shot.

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