Index Laws 3 and the zero power

Year 9
Mathematics

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- Understand how to use Index Law 3
- Review and use the zero power

RECAP

We are storming through the work on indices! We are now half way through the laws … and they seem pretty great so far.

Remember that when we are dealing with anything to the power of **zero** what we are really doing is dividing a number by itself. And, we know, when we divide a number by itself, it equals 1.

The zero power

Remember:

$$x^3 \div x^3$$

Can be done in two ways.

This means we can use the two ways to prove that anything to the power of zero is 1.

Method 1: Anything divided by itself is 1.

$$x^3 \div x^3 = 1$$

Method 2: Subtract the powers

$$x^3 \div x^3 = x^0$$

So $x^0 = 1$

$$x^3 \div x^3 = \underline{\underline{x^0}}$$

$$= 1$$

$$=$$

$$x^0 = \underline{\underline{1}}$$

$$7^3 \div 7^3 = \underline{\underline{7^0}}$$

$$= 1$$

$$7^0 = 1$$

$$a^0 = 1$$

$$b^0 = 1$$

$$2 \div 2 = 1$$

$$3 \div 3 = 1$$

$$x^3 \div x^3 = 1$$

Tricks they try and employ

There are lots of tricks they can employ, but it really comes down to if you understand **who the power belong to**.

There is a big difference between

$$xy^0$$

$$x\boxed{y^0} = x \times 1 = x$$

And

$$(xy)^0$$

$$(xy)^0 = 1$$

And

$$2\times 7^0$$

$$2 \times \overset{1}{\cancel{7^0}} = 2 \times 1 = 2$$

And

$$(-3)^0$$

$$\cancel{(-3)^0} = 1$$

$$27^0$$

Rule 3

Let's look at the "formal way" of writing the rule and then look at what it means:

$$\boxed{(a^n)^m = a^{nm}}$$

So, in English, when we raise a power to a power you multiply the powers!

Awesome.

Let's look at some examples:

$$(x^2)^3$$

$$= (x^2)^3 = x^2 \times x^2 \times x^2$$

$$= x^4 \times x^2$$

$$= x^6$$

$$(a^n)^m = a^{nm}$$

Rule 3: Examples

Simplify each of the following by applying the various index laws:

$$(x^2)^3 \times (x^3)^5$$

$= (x^2)^3 \times (x^3)^5$

$= x^6 \times x^{15}$

$= x^{21}$

$(a^4)^3 = a^4 \times a^4 \times a^4$

$= a^{12}$

Rule 3: Examples

Simplify each of the following by applying the various index laws:

$$\frac{(m^3)^4}{m^7}$$

$$= \frac{(m^3)^4}{m^7} = \frac{m^{\cancel{12}\,5}}{\cancel{m^7}\,1} = \frac{m^5}{1} = \underline{\underline{m^5}}$$

Rule 3: Examples

Simplify each of the following by applying the various index laws:

$$\frac{4x^2 \times 3x^3}{6x^5}$$

$$= \frac{4 \times 3 \times x^2 \times x^3}{6 \times x^5}$$

$$= \frac{\cancel{12}^{\,2} \times \cancel{x^5}^{\,1}}{\cancel{6}_{\,1} \times \cancel{x^5}_{\,1}}$$

$$= \frac{2}{1} = \underline{\underline{2}}$$

Harder examples

Simplify each of the following using various index laws

$$\frac{4(d^4)^3 \times (e^4)^2}{8(d^2)^5 \times e^7}$$

$$= \frac{\cancel{4}^{\,1} \times d^{\cancel{12}\;2} \times e^{\cancel{8}\;1}}{\underset{2}{\cancel{8}} \times \underset{1}{\cancel{d^{10}}} \times \underset{1}{\cancel{e^{7}}}}$$

$$= \frac{1 \times d^2 \times e^1}{2} = \frac{d^2 e}{2}$$

Work to complete for this topic

The questions I am asking you to complete from this section of the course is shown
asked to answer all parts of each question.

They are quick to complete, but it's important you master the Indices component of

Exercise 6C
2aceg, 3acefiklno, 4adfhk, 5aceg, 6ace, 7, 8, 9, 10