Objectives

The student will be able to:

1. divide monomials.
2. simplify negative exponents.

SOL: A.10, A.11

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A Zero Exponent

Okay this one is easy!

Anything with a zero exponent is equal to 1!!!!!!

Examples

$4^0 = 1$

$1432^0 = 1$

$x^0 = 1$

$(\frac{2}{3})^0 = 1$

- Do you get the point!

An 1 as an Exponent

Okay this one is easy as well!

Anything with an one as a exponent is equal to that number!!!!!!

Examples

$4^1 = 4$

$1432^1 = 1432$

$x^1 = x$

$(\frac{2}{3})^1 = \frac{2}{3}$

- Do you get this point!

Dividing Monomials

When dividing monomials, subtract the exponents.

1. $\dfrac{b^5}{b^2} = \dfrac{b \cdot b \cdot b \cdot b \cdot b}{b \cdot b} = b^{5-2} = b^3$

2. $\dfrac{m^7 n^5}{mn^2} = m^{7-1} n^{5-2} = m^6 n^3$

3. $\dfrac{x^3y^7}{x^2y^6}$

$$\frac{x^3y^7}{x^2y^6} = x^{3-2}y^{7-1} = xy$$

4. $\dfrac{81a^8b^3}{9a^5b}$

$$\frac{81a^8b^3}{9a^5b} = 9a^{8-5}b^{3-1} = 9a^3b^2$$

Simplify $\frac{64g^2h^7}{16gh^5}$

- $48g^2h^2$
- $48gh^2$
- $4g^2h^2$
- ✓ $4gh^2$

Here's a tricky one!

5. $\dfrac{3m^3n^3}{3m^3n^2} = 1m^0n = n$

What happened to the m?

$$\frac{3m^3n^3}{3m^3n^2} = \frac{3mmmnnnmmmnnnmmmnnn}{3mmmnnnmmmnnn}$$

They canceled out! $\dfrac{m^3}{m^3} = 1$

There are no m's left over!

This leads us to our next rule…

Simplify.

6. $x^{-4}\, y^{0}$

You can not have negative or zero exponents in your answer.

$$x^{-4} = \frac{1}{x^{4}} \quad \text{and} \quad y^{0} = 1$$

$$\frac{1}{x^{4}} \cdot 1 = \frac{1}{x^{4}}$$

Simplify $\frac{p^{-7}}{p^{-5}}$

- p^2
- p^{12}
- ✓ $\frac{1}{p^2}$
- $\frac{1}{p^{12}}$

Simplify.

7. $\dfrac{3r^4s^2}{18r^3s^4} = \dfrac{1}{6}r^{4-3}s^{2-4} = \dfrac{1}{6}rs^{-2} = \dfrac{r}{6s^2}$

You can't leave the negative exponent!

There is another way of doing this without negative exponents.

If you don't want to see it, skip the next slide!!!

Simplify (alternate version).

7. $\dfrac{3r^4s^2}{18r^3s^4}$

Look and see (visualize) where you have the larger exponent and leave the variable in that location. Subtract the smaller exponent from the larger one.

In this problem, r is larger in the numerator and s is larger in the denominator.

$$\frac{3r^4s^2}{18r^3s^4} = \frac{1r^{4-3}}{6s^{4-2}} = \frac{r}{6s^2}$$

Notice that you did not have to work with negative exponents! This method is quicker!

Simplify.

8. $\dfrac{x^{-3}}{x^{4}}$ Get rid of the negative exponent.

$$\frac{x^{-3}}{x^{4}} = \frac{1}{x^{3}x^{4}} = \frac{1}{x^{7}}$$

Simplify.

9. $\dfrac{r^{-5}s^{-2}}{r^{3}s^{-3}}$

Get rid of the negative exponents.

$$\frac{r^{-5}s^{-2}}{r^{3}s^{-3}} = \frac{s^{3}}{r^{5}r^{3}s^{2}} = \frac{s}{r^{8}}$$

Simplify.

10. $\dfrac{\left(x^{-3}y^{2}\right)^{2}}{\left(4x^{2}\right)^{3}}$

Get rid of the parentheses.

$$\frac{\left(x^{-3}y^{2}\right)^{2}}{\left(4x^{2}\right)^{3}} = \frac{x^{-6}y^{4}}{4^{3}x^{6}}$$

Get rid of the negative exponents.

$$= \frac{x^{-6}y^{4}}{4^{3}x^{6}} = \frac{y^{4}}{4^{3}x^{6}x^{6}} = \frac{y^{4}}{64x^{12}}$$

Simplify $\dfrac{\left(-3x^2y^{-1}\right)^2}{\left(2xy^3\right)^3}$

- ✓ $\dfrac{9x}{8y^{11}}$
- $\dfrac{-9x}{8y^{11}}$
- $\dfrac{-9x}{8y^{7}}$
- $\dfrac{9x}{8y^{7}}$

When subtracting exponents, you might get a zero or a negative exponent. Thus, remember to use the Zero - Exponential Rule and the Negative Exponential Rule:

if $x \neq 0$

$$x^0 = 1,$$

$$x^{-m} = \frac{1}{x^m}$$

Example 1:

$$\frac{15x^3y^5}{-3x^2y} = \left(\frac{15}{-3}\right)\left(\frac{x^3}{x^2}\right)\left(\frac{y^5}{y}\right)$$

Divide coefficients

Divide factors with the same bases

$$= -5x^{3-2}y^{5-1}$$

$$\boxed{= -5xy^4}$$

x has degree 1;
(1 can be omitted)

Example 2:

$$\frac{-18a^4b^5}{6a^4b^7} = \left(\frac{-18}{6}\right)\left(\frac{a^4}{a^4}\right)\left(\frac{b^5}{b^7}\right)$$

Quotient Rule →

$$= \left(\frac{-18}{6}\right)\left(a^{4-4}\right)\left(b^{5-7}\right)$$

$$= -3\left(a^0\right)\left(b^{-2}\right)$$

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

Simplify

- When Dividing a Polynomial by a monomial, you are **simplifying the expression**.

Simplify, $\dfrac{5x^2 - 10x}{5}$

$= \dfrac{5x^2}{5} - \dfrac{10x}{5}$

Divide each term in the numerator by the term in the denominator.

$= x^2 - 2x$

Simplify

- When Dividing a Polynomial by a monomial, you are **simplifying the expression**.

Simplify, $\dfrac{3b^3 - 6b^2 + 9b}{6b}$

$= \dfrac{3b^3}{6b} - \dfrac{6b^2}{6b} + \dfrac{9b}{6b}$

Divide each term in the numerator by the term in the denominator.

$= \dfrac{b^2}{2} - b + \dfrac{3}{2}$

Remember that you can have a fraction in your answer, just reduce.

For example:

$$\textit{Divide}: \quad \frac{3y^5 + 12y^4 - 18y^2}{3y}$$

Remember to divide $3y$ into every term

$$= \frac{3y^5}{3y} + \frac{12y^4}{3y} - \frac{18y^2}{3y}$$

$$= y^4 + 4y^3 - 6y$$

Simple Division -

dividing a polynomial by a monomial

1. $\dfrac{6r^2s^2 + 3rs^2 - 9r^2s}{3rs}$

$$= \frac{6r^2s^2}{3rs} + \frac{3rs^2}{3rs} - \frac{9r^2s}{3rs}$$

$$= \boxed{2rs + s - 3r}$$

Simplify

2. $$\frac{3a^2b + 6a^3b^2 + 18ab}{3ab}$$

$$= \frac{3a^2b}{3ab} + \frac{6a^3b^2}{3ab} + \frac{18ab}{3ab}$$

$$= \boxed{a + 2a^2b + 6}$$

Simplify

3. $\dfrac{12x^2y - 3x}{3x}$

$$= \frac{12x^2y}{3x} - \frac{3x}{3x}$$

$$= \boxed{4xy - 1}$$

#4 Divide a polynomial by a monomial.

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

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

$$2x^3+3x-\frac{5}{2}$$

#5 Divide a polynomial by a monomial.

$$\frac{2x^3+6x^2+4x}{2x}$$

$$\frac{2x^3}{2x}+\frac{6x^2}{2x}+\frac{4x}{2x}$$

$$x^2+3x+2$$

YOU TRY!

FACTOR COMPLETELY

$$\frac{9x^2 - 6x}{3}$$

$$\frac{12b^3 - 18b^2 + 36b}{6b}$$

YOU TRY!

FACTOR COMPLETELY

$$\frac{15x^3 - 5x^2 + 10x}{5x}$$

$$\frac{2x^3 - 4x^2 + 6x}{4x}$$