Math 10 Lecture Videos

Section 5.5:
Dividing Polynomials

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OBJECTIVES:

1. Use the quotient rule for exponents.
2. Use the zero-exponent rule.
3. Use the quotients-to-powers rule.
4. Divide monomials
5. Check polynomial division.
6. Divide a polynomial by a monomial.

Objective 1:
Use the quotient rule for exponents.

THE QUOTIENT RULE

$$\frac{b^m}{b^n} = b^{m-n}, \ b \neq 0$$

When dividing exponential expressions with the same nonzero base, **subtract the exponent in the denominator from the exponent in the numerator**. Use this difference as the exponent on the common base.

Objective 1:
Use the quotient rule for exponents.

Examples:

1. Divide the expression using the quotient rule: $\dfrac{5^{12}}{5^4}$

$$\frac{5^{12}}{5^4} = 5^{12-4} = 5^8$$

2. Divide the expression using the quotient rule: $\dfrac{x^9}{x^2}$

$$\frac{x^9}{x^2} = x^{9-2} = x^7$$

Objective 2:
Use the zero-exponent rule.

If b is any real number other than 0, $b^0 = 1$.

Objective 2:
Use the zero-exponent rule.

Simplify:

$$5^0 = 1$$ 5 is raised to the 0 power.

$$(2xy)^0 = 1$$ 2xy is raised to the 0 power.

$$2xy^0 = 2x$$ Only y is raised to the 0 power.

$$-2^0 = -1$$ Only 2 is raised to the 0 power.

Objective 2:
Use the zero-exponent rule.

Simplify:

Use the zero-exponent rule to simplify the expression: -10^0

$$-10^0 = -1 \cdot 10^0$$
$$= -1 \cdot 1$$
$$= -1$$

Simplify:

Use the zero-exponent rule to simplify the expression: $20x^0$

$$20x^0 = 20 \cdot 1$$
$$= 20$$

Objective 3:
Use the quotients-to-powers rule.

If *a* and *b* are real numbers and *b* is nonzero, then

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

When a quotient is raised to a power, raise the numerator to the power and divide by the denominator raised to the power.

Objective 3:
Use the quotients-to-powers rule.

$$\left(\frac{2}{x}\right)^3 = \frac{2^3}{x^3} = \frac{8}{x^3}$$

Cube the numerator and denominator.

$$\left(\frac{a^3}{b^5}\right)^2 = \frac{(a^3)^2}{(b^5)^2} = \frac{a^6}{b^{10}}$$

Square the numerator and denominator.

Objective 3:
Use the quotients-to-powers rule.

Simplify: $\left(\dfrac{5x^4}{y^2}\right)^3$

$$= \dfrac{(5x^4)^3}{(y^2)^3}$$ Cube the numerator and denominator.

$$= \dfrac{5^3(x^4)^3}{(y^2)^3}$$ Cube each factor in the numerator.

$$= \dfrac{125x^{12}}{y^6}$$ Simplify.

Objective 4: Divide Monomials.

To divide monomials, *divide the coefficients* and then *divide the variables*.

Use the quotient rule for exponents to divide the variable factors: Keep the variable and subtract the exponents.

Objective 4: Divide Monomials.

Divide: $\dfrac{5x^7}{10x^3}$

$= \dfrac{1x^{7-3}}{2}$ Divide the coefficients, then divide the variables by subtracting exponents.

$= \dfrac{x^4}{2}$ Simplify.

Objective 4: **Divide Monomials.**

Divide: $\dfrac{6x^5y^3}{2x^3y}$

$= 3x^{5-3}y^{3-1}$ Divide the coefficients, then divide the variables by subtracting exponents.

$= 3x^2y^2$ Simplify.

Objective 5: Check Polynomial Division

Divide: $\dfrac{9x^6y^5}{3xy^2}$

$$\frac{9x^6y^5}{3xy^2} = \frac{9}{3} \cdot x^{6-1}y^{5-2}$$

$$= 3x^5y^3$$

Check:

$$(3xy^2)(3x^5y^3) = 3 \cdot 3 \cdot x^{1+5} \cdot y^{2+3}$$

$$= 9x^6y^5$$

To check a quotient in a division problem, **multiply the divisor and the quotient.** If this **product is the dividend, the quotient is correct**.

Objective 6:
Divide a polynomial by a monomial.

Dividing a Polynomial That Is Not a Monomial by a Monomial
To divide a polynomial by a monomial, divide each term of the polynomial by the monomial.

Objective 6:
Divide a polynomial by a monomial.

Divide: $\left(40x^4y^3 - 20x^3y^2 - 50x^2y\right) \div \left(10x^3y^3\right).$

$$\frac{40x^4y^3 - 20x^3y^2 - 50x^2y}{10x^3y^3}$$

$$= \frac{40x^4y^3}{10x^3y^3} - \frac{20x^3y^2}{10x^3y^3} - \frac{50x^2y}{10x^3y^3}$$

Divide each term of the polynomial by the monomial. Note the 3 separate quotients.

$$= 4x - \frac{2}{y} - \frac{5}{xy^2}$$

Simplify each quotient.

Objective 6:
Divide a polynomial by a monomial.

Divide: $\dfrac{5x^6 + 2x^4 - 10x^2}{10x}$

$= \dfrac{5x^6}{10x} + \dfrac{2x^4}{10x} - \dfrac{10x^2}{10x}$ Divide each term of the polynomial by the monomial.

$= \dfrac{1x^{6-1}}{2} + \dfrac{1x^{4-1}}{5} - \dfrac{x^{2-1}}{1}$ Divide the coefficients, then divide the variables by subtracting exponents.

$= \dfrac{x^5}{2} + \dfrac{x^3}{5} - x$ Simplify.

Objective 6:
Divide a polynomial by a monomial.

Divide: $\dfrac{-15x^9 + 6x^5 - 9x^3}{3x^2}$

$$\dfrac{-15x^9 + 6x^5 - 9x^3}{3x^2} = \dfrac{-15x^9}{3x^2} + \dfrac{6x^5}{3x^2} - \dfrac{9x^3}{3x^2}$$

$$= -5x^7 + 2x^3 - 3x$$

OBJECTIVES:

1. Use the quotient rule for exponents. ✓
2. Use the zero-exponent rule. ✓
3. Use the quotients-to-powers rule. ✓
4. Divide monomials ✓
5. Check polynomial division. ✓
6. Divide a polynomial by a monomial. ✓