Your Name

Mrs. Theo

1 / 13 / 21

Notes

Lesson 4.3

Dividing Polynomials using Long Division

Day 6

Objective: to be able to divide polynomial expressions by dividing each term by the monomial, by factoring and canceling, or by long division.

Life Lesson/Math Skill: you need to be able to divide polynomials by monomial and binomial factors using long division in order to find the zeros/solutions/ roots and graph polynomial functions. This is how you solve polynomial equations.

Long Division...Also, Can we do this in 2 different ways?

128 ÷ 4

$$\begin{array}{r} 32 \\ 4\overline{)128} \\ -12\downarrow \\ \hline 08 \\ -8 \\ \hline 0 \end{array}$$

4 went in to 128 evenly
4 is a factor of 128
$4 \cdot 32 = 128$

128 ÷ 5

Denominator

$$\begin{array}{r} 25\tfrac{3}{5} \\ 5\overline{)128} \\ -10\downarrow \\ \hline 28 \\ -25 \\ \hline 3 \end{array}$$

remainder is numerator

$$\frac{128}{5} = 25\tfrac{3}{5}$$

$25 + \frac{3}{5}$

128 ÷ 5

Dividing Polynomials by Binomials

Option 1: First try factoring the first polynomial and cancel the common factors.

$$a^2 + 7a + 12 \div (a - 5)$$

$$\frac{(a+3)(a+4)}{a-5}$$

nothing cancels

Option 2: If nothing cancels, then use long division

Quotient — Answer to a ÷ problem

Dividend — Starting Polynomial under

Divisor — thing doing dividing

$$a-5\overline{)a^2+7a+12}$$

Long Division of Polynomials

1. Set up long division (decending order, every term needs to be accounted for $-4+x^2 \rightarrow x^2+0x^1-4$
2. Focus on the first term only and what you need to multiply it by to get the first term of the polynomial, write that up top
3. Subtract and bring down terms, repeat step 2

* put in ( ) + distribute subtraction

Done

4. When the divisor can no longer go in (its degree is bigger than the remainder polynomial) write the leftovers in a fraction over the divisor.

set it up!

$(-5m + m^2 - 7) \div (m-6) = \boxed{m+1-\frac{1}{m-6}}$

Dividend divisor

$$
\begin{array}{r}
m+1-\frac{1}{m-6} \\
m-6 \,\overline{)\, m^2-5m^1-7} \\
-(m^2-6m) \quad \\
\hline
0m^2+1m-7 \\
-(m-6) \\
\hline
0m\ -1
\end{array}
$$

nothing else to bring down
degree of $-1x^0$: 0
Smaller than degree of $m^1-6 = 1$

Done

Missing Terms

You must write them in
missing x^2 and x^1
So add: $+0x^2$ and $+0x^1$

$(3x^3 + 1) \div (x - 2)$

$$
\begin{array}{r}
3x^2+6x+12+\frac{25}{x-2} \\
x-2 \,\overline{)\, 3x^3+0x^2+0x^1+1} \\
-(3x^3-6x^2) \qquad\qquad \\
\hline
6x^2+0x+1 \\
-(6x^2-12x) \quad \\
\hline
12x+1 \\
-(12x-24) \\
\hline
25
\end{array}
$$

$2\frac{1}{2}$

$2+\frac{1}{2}$

Assignment:

Worksheet #6, 8, and 10

4. $\dfrac{2m^3n^2 + 56mn - 4m^2n^3}{8m^3n}$

5. $(x^2 - 3x - 40) \div (x + 5)$

6. $(3m^2 - 20m + 12) \div (m - 6)$

7. $(a^2 + 5a + 20) \div (a - 3)$

8. $(x^2 - 3x - 2) \div (x + 7)$

9. $(t^2 + 9t + 28) \div (t + 3)$

10. $(s^2 - 9s + 25) \div (s - 4)$

11. $\dfrac{6r^2 - 5r - 56}{3r + 8}$

12. $\dfrac{20w^2 + 39w + 18}{5w + 6}$

Homework Key

5. $(x^2 - 3x - 40) \div (x + 5)$

$x - 8$

6. $(3m^2 - 20m + 12) \div (m - 6)$

$3m - 2$

7. $(a^2 + 5a + 20) \div (a - 3)$

$a + 8 + \dfrac{44}{a - 3}$

8. $(x^2 - 3x - 2) \div (x + 7)$

$x - 10 + \dfrac{68}{x + 7}$

9. $(t^2 + 9t + 28) \div (t + 3)$

$t + 6 + \dfrac{10}{t + 3}$

10. $(s^2 - 9s + 25) \div (s - 4)$

$s - 5 + \dfrac{5}{s - 4}$

Leading coefficients

$$\frac{6a^2 + 7a + 5}{2a + 5}$$

$$3a - 4 + \frac{25}{2a+5}$$

$$
\begin{array}{r}
2a+5 \,\big)\, 6a^2 + 7a + 5 \\
-(6a^2 + 15a) \\
\hline
-8a + 5 \\
-(-8a - 20) \\
\hline
25
\end{array}
$$

$$\frac{6m^3 + 11m^2 + 4m + 35}{2m + 5}$$

$$3m^2 - 2m + 7$$

$$
\begin{array}{r}
2m+5 \,\big)\, 6m^3 + 11m^2 + 4m + 35 \\
-(6m^3 + 15m^2) \\
\hline
-4m^2 + 4m + 35 \\
-(-4m^2 - 10m) \\
\hline
14m + 35 \\
-(14m + 35) \\
\hline
0
\end{array}
$$

No remainder! that means $6m^3 + 11m^2 + 4m + 35$ is factorable!

$(2m+5)(3m^2 - 2m + 7)$

Fraction Coefficients Remainder 0

Day 7

$$2x^2 + 7x + 3 \div 4x + 2$$

$$\frac{1}{2}x + \frac{3}{2}$$

$$
\begin{array}{r}
4x+2 \,\big)\, 2x^2 + 7x + 3 \\
-(2x^2 + 1x) \\
\hline
6x + 3 \\
6x + 3 \\
\hline
0
\end{array}
$$

Fraction
Coefficients
remainder not 0

$2x^2 + 7x + 3 \div 4x + 1$

$$\frac{1}{2}x + \frac{13}{8} + \frac{11}{32x+8}$$

$$4x+1 \overline{)\,2x^2 + 7x + 3}$$

$-(2x^2 + \frac{1}{2}x)$

$\frac{13}{2}x + 3$

$-(\frac{13}{2}x + \frac{13}{8})$

$\frac{11}{8}$

Assignment:

Worksheet #12,14,16,18,19,20

10. $(s^2 - 9s + 25) \div (s - 4)$

11. $\frac{6r^2 - 5r - 56}{3r + 8}$

12. $\frac{20w^2 + 39w + 18}{5w + 6}$

13. $(x^3 + 2x^2 - 16) \div (x - 2)$

14. $(s^3 - 11s - 6) \div (s + 3)$

15. $\frac{x^3 + 6x^2 + 3x + 1}{x - 2}$

16. $\frac{6d^3 + d^2 - 2d + 17}{2d + 3}$

17. $\frac{2k^3 + 7k^2 - 7}{2k + 3}$

18. $\frac{9y^3 - y - 1}{3y + 2}$

LANDSCAPING For Exercises 19 and 20, use the following information.
Jocelyn is designing a bed for cactus specimens at a botanical garden. The total area can be modeled by the expression $2x^2 + 7x + 3$, where x is in feet.

19. Suppose in one design the length of the cactus bed is $4x$, and in another, the length is $2x + 1$. What are the widths of the two designs?

20. If $x = 3$ feet, what will be the dimensions of the cactus bed in each of the designs?

Homework Key

10. $(s^2 - 9s + 25) \div (s - 4)$

$s - 5 + \frac{5}{s-4}$

11. $\frac{6r^2 - 5r - 56}{3r + 8}$

$2r - 7$

12. $\frac{20w^2 + 39w + 18}{5w + 6}$

$4w + 3$

13. $(x^3 + 2x^2 - 16) \div (x - 2)$

$x^2 + 4x + 8$

14. $(s^3 - 11s - 6) \div (s + 3)$

$s^2 - 3s - 2$

15. $\frac{x^3 + 6x^2 + 3x + 1}{x - 2}$

$x^2 + 8x + 19 + \frac{39}{x-2}$

16. $\frac{6d^3 + d^2 - 2d + 17}{2d + 3}$

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

17. $\frac{2k^3 + 7k^2 - 7}{2k + 3}$

$k^2 + 2k - 3 + \frac{2}{2k+3}$

18. $\frac{9y^3 - y - 1}{3y + 2}$

$3y^2 - 2y + 1 - \frac{3}{3y+2}$

LANDSCAPING For Exercises 19 and 20, use the following information.

Jocelyn is designing a bed for cactus specimens at a botanical garden. The total area can be modeled by the expression $2x^2 + 7x + 3$, where x is in feet.

19. Suppose in one design the length of the cactus bed is $4x$, and in another, the length is $2x + 1$. What are the widths of the two designs? $\frac{x}{2} + \frac{7}{4} + \frac{3}{4x}$; $x + 3$

20. If $x = 3$ feet, what will be the dimensions of the cactus bed in each of the designs?
12 ft by 3.5 ft; 7 ft by 6 ft