

Algebra 2 Honors

Dividing Polynomials

Using Polynomial Long Division

Use polynomial long division to divide $3x^2 - 29x + 56$ by $(x - 7)$. What is the quotient and remainder?

$$\begin{array}{r} \text{divisor } x-7 \overline{) 3x^2 - 29x + 56} \\ \underline{-(3x^2 - 21x)} \\ -8x + 56 \\ \underline{-(-8x + 56)} \\ 0 \end{array}$$

quotient $3x - 8$
dividend $3x^2 - 29x + 56$
remainder 0

Quotient: $3x - 8$

Completely Editable

5.4

Lesson 5.4: Dividing Polynomials

Division Algorithm for Polynomials

Divide polynomial $P(x)$ by polynomial $D(x)$ to get polynomial quotient $Q(x)$ and polynomial remainder $R(x)$. The result is $P(x) = D(x)Q(x) + R(x)$. If $R(x) = 0$, then $P(x) = D(x)Q(x)$ also $D(x)$ and $Q(x)$ are factors of $P(x)$.

Synthetic Division

The process for dividing a polynomial by a linear expression $x - a$. A polynomial must be in standard form by omitting all variables and exponents.

Remainder Theorem

If you divide a polynomial $P(x)$ of degree $n \geq 1$ by $x - a$, then the remainder is $P(a)$.

Polynomials and Long Division

EX #1: Divide $496 \div 16$.

EX #2: Divide $(4x^2 + 9x + 6) \div (x + 6)$.

Using Polynomial Long Division

EX #3: Use polynomial long division to divide $3x^2 - 29x + 56$ by $(x - 7)$. What is the quotient and remainder?

Checking Factors

EX #4: Is $(x - 2)$ a factor of $x^3 - 9$?

EX #5: Is $(x - 4)$ a factor of $f(x) = 5x^2 - 17x - 12$?
If it is, write $P(x)$ as a product of two factors.

Using Synthetic Division

PROCEDURE:

1. Write polynomial in standard form, include zeros for missing powers of x .
2. Omit all variables and exponents.
3. For the divisor, reverse the sign, use a .
4. Add instead of subtracting throughout.

Using Synthetic Division to Solve a Problem

EX #7: If the polynomial $x^3 + 6x^2 + 11x + 6$ expresses the volume, in cubic inches, of a box, and the width is $(x + 1)$ inches, what are the dimensions of the box?

Evaluating a Polynomial

EX #8: Find $P(-4)$, given that $P(x) = x^5 - 3x^4 - 28x^3 + 5x + 20$

EX #9: Use the Factor Theorem to determine if $(x - 3)$ is a factor of $x^4 - 81$

NOTES

Dividing Polynomials Practice

Problems 1–4, divide using long division, check your answers.

1. $(x^2 - 5x - 36) \div (x + 4)$

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

3. $(3x^3 - x^2 + 7x - 6) \div (x - 2)$

4. $(2x^2 - 5x - 3) \div (2x + 1)$

Problems 5–8, determine whether each binomial is a factor of $x^3 - 3x^2 - 10x + 24$

5. $x - 4$

6. $x + 3$

7. $x + 1$

8. $x - 2$

Problems 9–14, divide using synthetic division.

9. $(x^2 + 15x + 56) \div (x + 7)$

10. $(x^2 - 8x - 16) \div (x + 4)$

11. $(y^3 - 4y^2 + 3y + 5) \div (y - 2)$

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

13. $(x^3 - 5x^2 - 10x + 25) \div (x - 5)$

14. $(m^4 - 3m^2 + 7m - 18) \div (m - 2)$

Problems 15–16, use synthetic division and given factor to completely factor each polynomial.

15. $x^3 - 3x^2 - 10x + 24; (x - 2)$

16. $x^3 + 4x^2 - 11x - 30; (x + 5)$

Problems 17–18, use synthetic division and the Remainder Theorem to find $P(a)$.

17. $P(x) = x^3 + 5x^2 - 12x + 3; a = -4$

18. $P(x) = 2x^3 - 4x^2 - 5x + 7; a = 2$

Problems 19–20, divide.

19. $(x^4 - 9x^2 + 20) \div (x - 2)$

20. $(x^5 - 32) \div (x - 2)$

21. $(2x^4 + 3x^3 - 4x^2 + x - 1) \div (2x - 1)$

22. $(3x^3 - x^2 - 3x + 1) \div (3x - 1)$

Problems 23–26, solve.

23. Find k so that when $x^2 - kx^2 + 6x + 12k$ is divided by $x + 2$ the remainder will be 0.

24. The volume in cubic inches of the enameled box can be expressed as the product of the lengths of its sides is $V(x) = x^3 + x^2 - 12x$. Write linear expressions for the box's length and height, given that the width is $(x - 3)$.

Width = $x - 3$

25. A shipping box has a volume in cubic inches of $V(x) = x^3 - 2x^2 - 11x + 12$. The length is $x + 3$. If the width is greater than the height,

A. Find the linear expressions for the other dimensions.

B. If $x = 9$, what are the dimensions of the shipping box?

Practice Sets

Lesson Warm-Ups

3. Given $P(x) = x^3 + 6x^2 + 10x + 3$ find $P(-3)$ and describe your result in relation to the graph.

4. Use a graphing utility to determine the remaining zeros for the polynomial.
 $P(x) = x^3 + 6x^2 + 10x + 3$

Name _____ Date _____ Period _____

Lesson 5.4: Dividing Polynomials

Warm-Up #2

1. Given $P(x) = x^3 + 5x^2 - x - 14$ find $P(-1)$

2. Divide $\frac{7x^2 + 16x - 15}{x + 3}$

3. Given $P(x) = x^3 + 5x^2 - x - 14$ find $P(-2)$ and describe your result in relation to the graph.

4. Use a graphing utility to determine the remaining zeros for the polynomial.
 $P(x) = x^3 + 5x^2 - x - 14$

5.4 Dividing Polynomials

Form A

Name _____

Date _____ Period _____

1. Divide using long division.
 $(x^2 - 4x - 32) \div (x + 4)$

2. Use synthetic division to find the quotient and remainder.
 $(x^3 - 2x^2 - 8) \div (x + 2)$

3. Use synthetic division and the Remainder Theorem to find $P(a)$.
 $P(x) = x^3 + 4x^2 - 8x + 6; a = -2$

5.4 Dividing Polynomials

Form B

Name _____

Date _____ Period _____

1. Divide using long division.
 $(x^2 + 4x - 45) \div (x - 5)$

2. Use synthetic division to find the quotient and remainder.
 $(x^3 + 5x^2 + 9) \div (x + 3)$

3. Use synthetic division and the Remainder Theorem to find $P(a)$.
 $P(x) = x^3 - 5x^2 - 8x + 6; a = -2$

Daily Lesson Quiz

Grade: _____

Grade: _____