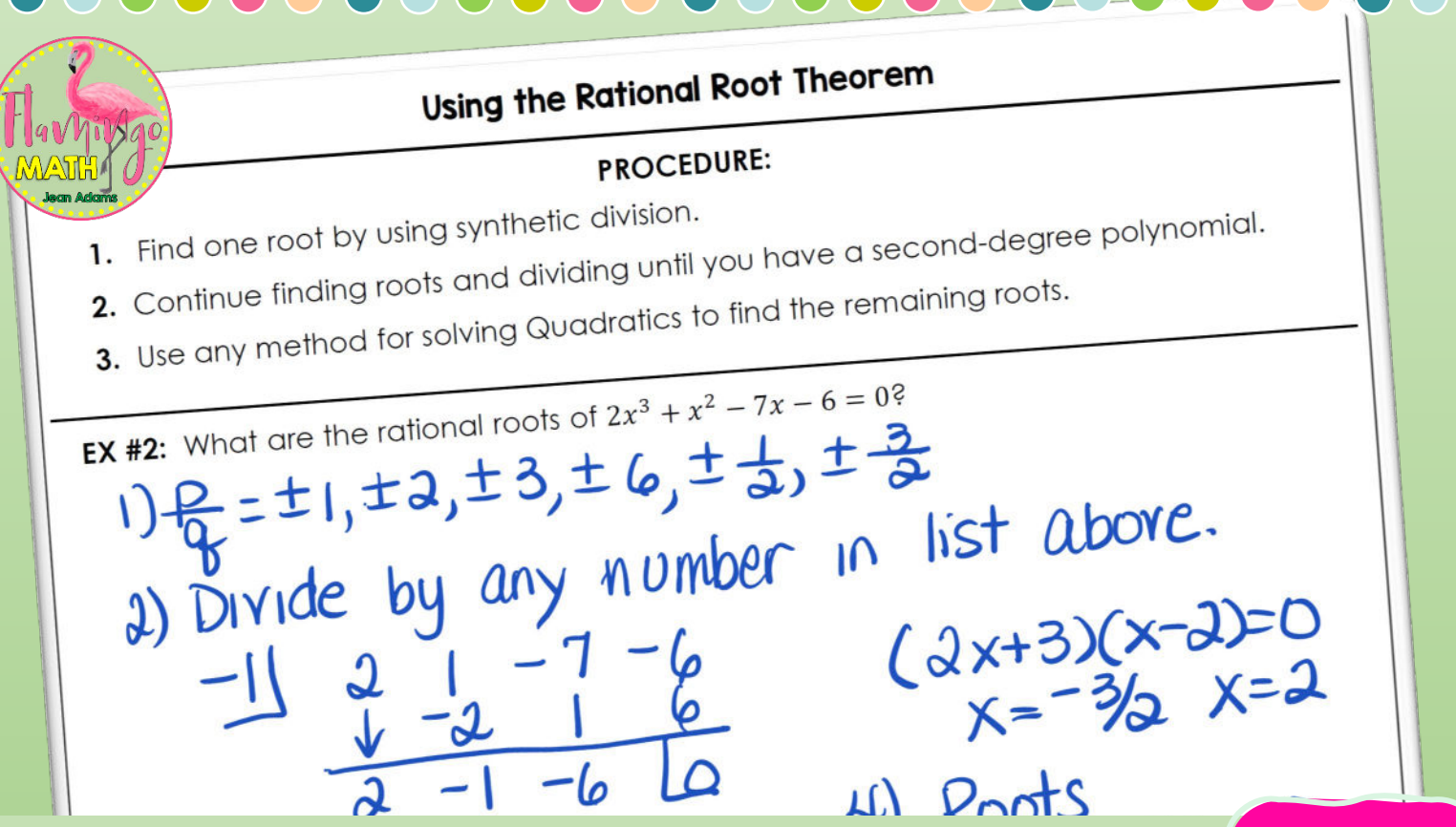
Algebra 2 Honors

Roots of Polynomial Equations



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5.5

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 $P(x) = x^5 - 3x^4 - 28x^3 + 5x + 20$

NOTES

Name _____ Date_____

5.4

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 $x^3 - kx^2 + 6x + 12k$ 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 zeros for the po $P(x) = x^3 + 5x$

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 $P(a)$.
$P(x) = x^3 + 4x^2 - 8x + 6\,; a = -2$

Grade:

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 $P(a)$.
$P(x) = x^3 - 5x^2 - 8x + 6\,; a = -2$

Grade:

Daily Lesson Quiz