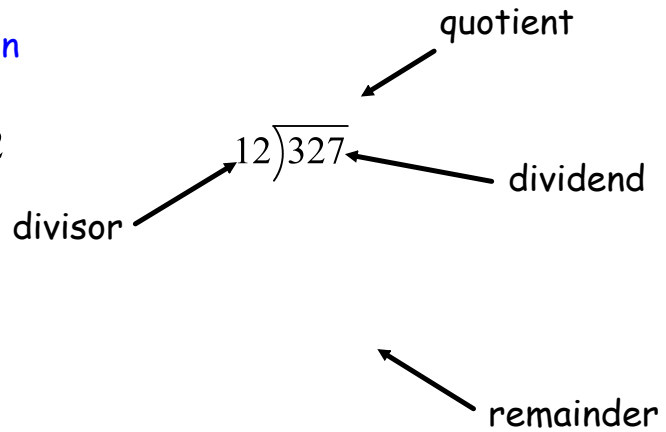


# The Remainder Theorem

Lesson 2

Investigation: Polynomial Division

Recall long division:  $327 \div 12$



We can use the same process to perform polynomial long division.

Divide  $P(x) = x^2 + 7x + 17$  by  $x + 3$

$$x + 3 \overline{)x^2 + 7x + 17}$$

remainder

Substitute -3 into  $P(x)$



Divide  $x^3 + 2x^2 - 5x - 6$  by the following and determine the remainders.

$$x - 3 \overline{) x^3 + 2x^2 - 5x - 6}$$

$$x - 2 \overline{) x^3 + 2x^2 - 5x - 6}$$

$$x - 1 \overline{) x^3 + 2x^2 - 5x - 6}$$

$$x + 1 \overline{) x^3 + 2x^2 - 5x - 6}$$

$$x + 2 \overline{) x^3 + 2x^2 - 5x - 6}$$

What does it mean to have a remainder of zero? Graph and find the zeros.

Predict the remainder when  $2x^3 - 4x^2 + 3x - 6$  is divided by each of the following binomials;

$$x + 1$$

$$x + 3$$

$$x - 2$$

Verify your answer using long division.

Division Statement:

The result of the division of a polynomial in  $x$ ,  $P(x)$ , by a binomial of the form  $x - a$ , is

$$\begin{array}{c} \text{dividend} \longrightarrow \frac{P(x)}{x-a} = Q(x) + \frac{R}{x-a} \longleftarrow \text{remainder} \\ \text{divisor} \nearrow \qquad \qquad \qquad \uparrow \text{quotient} \end{array}$$

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Divide the polynomial  $P(x) = 5x^3 - 13x^2 + 10x - 9$  by  $x - 2$

State the result in a division statement.

Identify any restrictions on the variable.

Example 2: Apply Polynomial Long Division to Solve a Problem

The volume,  $V$ , of a box, in cubic centimeters, is given by  $V(x) = x^3 + 7x^2 + 14x + 8$   
What are the possible dimensions, in terms of  $x$  if the height,  $h$ , is  $x + 1$

Your Turn:

The volume,  $V$ , of a rectangular prism is given by  $V(x) = x^3 + 3x^2 - 36x + 32$

What are the possible dimensions, in terms of  $x$  if the length,  $l$ , is  $x - 4$

Dividing a Polynomial Using Synthetic Division:

Example 3: Divide  $2x^3 + 3x^2 - 4x + 15$  by  $x + 3$

$$2x^3 + 3x^2 - 4x + 15$$

+3	2	3	-4	15
-	↓			
×				

Write the polynomial in descending degree.

Use zero for any missing powers.

Write the coefficients of the dividend.

To the left, write +3, from the binomial.

Try these

Divide  $x^3 + 7x^2 - 3x + 4$  by  $x - 2$

More Synthetic Division:

Divide  $9x + 4x^3 - 12$  by  $x + 2$

Write the polynomial in descending degree.  
Use zero for any missing powers.  
Write the coefficients of the dividend.

Divide  $2x^3 + 5x^2 - x - 6$  by  $x + 2$



The Remainder Theorem: When a polynomial in  $x$ ,  $P(x)$ , is divided by a binomial in the form  $x - a$ , the remainder is  $P(a)$ .

Example 4: Use the remainder theorem to determine the remainder when  $P(x) = x^3 - 10x + 6$  is divided by  $x + 4$   
Check your answers using synthetic or long division.

What is the remainder when  $P(x) = 11x - 4x^4 - 7$  is divided by  $x - 3$   
Check your answers using synthetic or long division.

Example 5:

- a. For the dividend, determine the value of  $k$  if the remainder is 3

$$(x^3 + kx^2 + x + 5) \div (x + 2)$$

- b. When  $3x^2 + 6x - 10$  is divided by  $x + k$ , the remainder is 14.  
Determine the value(s) of  $k$ .

# Homework

1. Assignment Handout; BLM: Remainder Theorem
2. Text Pages 124 - 125, Exercises # 1 - 4, 6, 8, 9, 11, 12, C3



## Attachments

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