Aim: How do we use long division to divide a polynomial by a binomial? (Chapter 5.4)

Do now: Find each Product

a) $7(-5v-8)$

b) $2x(-2x-3)$

c) $(x-3)(6x-2)$

d) $(7r^2-6r-6)(2r-4)$

I- Division of Polynomials

1) Divide x^2-x – 6 by x – 3

2) Divide $(m^2-7m-11)\div(m-8)$

Question: What differences do you notice between problem 1 and 2?

II – Long division

1) Lets divide 672 by 23

2) **Divide using long division. Check your answers.**

1. $(2x^2+7x-5)\div(x+1)$

2. $(x^3+x^2-14x-27)\div(x+3)$

3. $(2x^3+13x^2+16x+5)\div(x+5)$

Student Version

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3)

take note

Key Concept The Division Algorithm for Polynomials

You can divide polynomial $P(x)$ by polynomial $D(x)$ to get polynomial quotient $Q(x)$ and polynomial remainder $R(x)$. The result is $P(x) = D(x)Q(x) + R(x)$.

$$D(x)\overline{)P(x)}$$
$$Q(x)$$
$$\vdots$$
$$R(x)$$

If $R(x) = 0$, then $P(x) = D(x)Q(x)$ and $D(x)$ and $Q(x)$ are factors of $P(x)$.

To use long division, $P(x)$ and $D(x)$ should be in standard form with zero coefficients where appropriate. The process stops when the degree of the remainder, $R(x)$, is less than the degree of the divisor, $D(x)$.

The Factor Theorem

The Factor Theorem

The following statements are equivalent for any polynomial $P(x)$.

1. The remainder is zero when $P(x)$ is divided by $x - c$.
2. $x - c$ is a factor of $P(x)$.
3. c is a solution to $P(x) = 0$.
4. c is a zero of the function $P(x)$, or $P(c) = 0$.

9-15

4) **Determine whether each binomial is a factor of $x^3 - 3x^2 - 4x$.**

a. $x - 4$ **b.** $x + 2$

c. $x - 3$ **d.** $x + 1$

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III- **Divide using synthetic division.**

1) **a.** $(x^3 - 7x^2 - 36) \div (x - 2)$

To start, write the coefficients of the polynomial. Use 2 for the divisor.

2	1	-7	0	-36
		2	-10	-20
	1	-5	-10	-56

b. $(x^3 + x^2 - 14x - 27) \div (x + 3)$

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

2) **Use synthetic division and the given factor to completely factor each polynomial function.**

$y = 2x^3 + 9x^2 + 13x + 6; (x + 1)$

3)

The **Remainder Theorem** provides a quick way to find the remainder of a polynomial long-division problem.

take note

Theorem The Remainder Theorem

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

4) **Use synthetic division and the Remainder Theorem to find *P*(*a*).**

$P(x) = 5x^3 - 12x^2 + 2x + 1, a = 3$