8.2 Polynomial Operations

Turn in the entire 8.1 HW (all 44 questions with work shown) right now!!!

Warm-up Friday (in your notes)

Without a calculator, find the quotient and remainder of the following problem.

$$8954762 \div 23$$

$23 \times 2 = 46$ $23 \times 3 = 69$ $23 \times 4 = 92$ $23 \times 5 = 115$

$23 \times 6 = 138$ $23 \times 7 = 161$ $23 \times 8 = 184$ $23 \times 9 = 207$

$$\begin{array}{r} 0389337 \text{ R } 11 \\ 23\overline{)8954762} \\ -69\downarrow \\ \hline 205 \\ -184\downarrow \\ \hline 214 \\ -207\downarrow \\ \hline 77 \\ -69\downarrow \\ \hline 816 \\ -184\downarrow \\ \hline 172 \\ -161 \\ \hline 11 \end{array}$$

8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

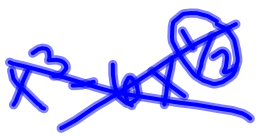
A **term** is an algebraic expression that can be written using constants, variables, multiplication and division. The constants are called coefficients. ex. $3x^2$ A **polynomial** can be written using terms and addition and subtraction. The term of the polynomial which does not include a variable is called the constant term. Any letter may be used as the variable in a polynomial.

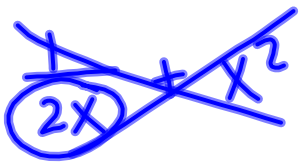
Note the characteristics of a polynomial.

- All exponents are whole numbers.
- No variables in the denominator.
- No variables under a radical.

Any letter may be used as the variable in a polynomial. Examples of **polynomials** include the following.

$x^3 - 6x^2 + \frac{1}{2}$ $y^{15} + y^{10} + 7$ $w - 6.7$ 12





8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

Degree of a Polynomial – The *exponent* of the highest power of x is the degree of the polynomial, and the coefficient of this highest power of the variable is the leading coefficient.

FOIL-ed → biggest exponent

Polynomial	Degree (exp.)	Leading Coefficient (big #)	Constant Term
$6x^7 + 4x^3 + 5x^2 - 7x + 10$	7	6	10
$1x^3$	3	1	0
$12x^0$	0	12	12
$2x^6 + 3x^7 - x^8 - 2x - 4$	8	-1	-4
$(x-3)^2(x+2)(x-7)^3$	$2+1+3=6$	1	$(-3)^2(2)(-7)^3$

$x^2 \cdot x^1 \cdot x^3$

FACTORed → add exponents

8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

Polynomial functions of degree less that 5 are often referred to by special names.

- First-degree polynomial functions are called _____linear_____ **functions.**
- Second-degree polynomial functions are called _____quadratic_____ **functions.**
- Third- degree polynomial functions are called _____cubic_____ **functions.**
- Fourth- degree polynomial functions are called _____quartic_____ **functions.**

8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

Adding and Subtracting Polynomials To add or subtract polynomials, combine like terms

ex. $(-2x^3 + x^2 - 4x) - (2x^3 - x + 4)$

DISTRIBUTE NEGATIVE

$-2x^3 + x^2 - 4x \quad -2x^3 + x - 4$

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

8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

Multiplying Polynomials To multiply polynomials, distribute/FOIL

ex. $(2x-3)(x^2+3x-5)$

$2x^3+6x^2-10x-3x^2-9x+15$

$2x^3+3x^2-19x+15$

Synthetic

* use when divisor is 1st degree binomial

$(2x^3+3x-5)\div(x-2)$ ($+0x^2$)

opposite sign → 2 | 2 0 3 −5

↓ 4 8 22

2 4 11 | 17 ← remainder

$2x^2+4x+11$ R 17

Synthetic basics

1. Bring down 1st #
2. Multiply
3. Add down column
4. Repeat for each column
5. Answer is one degree less

Don't forget the zeros for missing terms!

Long Division

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

x^2+2x-2 R $7x-7$

$x^2+x-2 \;\big|\; x^4+3x^3-2x^2+x-3$

$-(x^4+1x^3-2x^2)$

$2x^3+0x^2+x$

$-(2x^3+2x^2-4x)$

$-2x^2+5x-3$

$-(+2x^2+2x-4)$

$7x-7$

8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

Exit Ticket

on google classroom

8.2 –Operations with Polynomials odds ~~evens~~ Name _____

In Exercises 1 –8 determine whether the given algebraic expression is a polynomial. If it is, list its leading coefficient, constant term, and degree.

1. $1+x^3$

2. 7^x+2x+1

3. $(x+\sqrt{3})(x-\sqrt{3})$

4. $4x^2+3\sqrt{x}+5$

5. $\frac{7}{x^2}+\frac{5}{x}-15$

6. $(x-1)^k$

where k is a fixed, positive integer

In Exercises 7 – 14 perform the indicated operations

7. $(m^2+3)-(4-3m)$

8. $(2x^2-4x+7)-(-2x^2+3x-7)$

9. $5a^4(a^2-4a+3)$

10. $(x+2)(x^2-4x+5)$

11. $(7x-3)^2$

12. $(5-2x)^2$

13. $(2x+5)(2x-5)-(2x+5)^2$

14. $(x+3)^2+(x-3)^2$

In Exercises 15 – 19, use synthetic division to find the quotient and remainder.

15. $(3x^4 - 8x^3 + 9x + 5) \div (x - 2)$

16. $(4x^3 - 3x^2 + x + 7) \div (x - 2)$

17. $(3x^3 - 2x^2 - 8) \div (x + 5)$

18. $(2x^4 + 5x^3 - 2x - 8) \div (x + 3)$

19. $(x^6 - x^5 + x^4 - x^3 + x^2 - x + 1) \div (x - 1)$

In Exercises 20 – 22, state the quotient and remainder when the first polynomial is divided by the second using long division. Check your division by calculating: (Divisor)(Quotient) + Remainder.

20. $3x^4 + 2x^2 - 6x + 1; \quad x + 1$

21. $3x^4 - 3x^3 - 11x^2 + 6x - 1; \quad x^3 + x^2 - 2$

22. $x^5 - 1; \quad x - 1$

8.2 Polynomial Operations

EQ: How do I determine the degree of a polynomial?

Dividing Polynomials

Ex. $(3x^4 - 8x^2 - 11x + 1) \div (x - 2)$

Synthetic Division

Only works when divisor is first degree binomial

Synthetic basics

1. Bring down 1st #
2. Multiply
3. Add down column
4. Repeat for each column
5. Answer is one degree less

Don't forget the zeros for missing terms!

Long Division

to check your answer...

answer * divisor + remainder = original