6/2/14 Sec R.1 and Sec R.4

R.1 The Language, Notation, Numbers of Math

Set Notation: a List of Numbers or a Rule to describe a List of Numbers

Ex $\{1, 5, 7, 12\}$

$$\underset{\substack{\uparrow\\ \text{the}\\ \text{set of}}}{\{}\ \underset{x}{X}\ \underset{\substack{\uparrow\\ \text{such}\\ \text{that}}}{|}\ \underbrace{x \text{ is a Natural\# divisible by } 5}_{\text{Rule}}\ \}$$

$$= \{5, 10, 15, 20, \ldots\}$$

$$\{1, 4, 7, 10, \ldots\}$$

$\mathbb{N}$ = Natural Numbers = $\{1, 2, 3, 4, \ldots\}$
(counting #s)

$\mathbb{W}$ = Whole Numbers = $\{0, 1, 2, 3, 4, \ldots\}$

$\mathbb{Z}$ = Integers = $\{\ldots -2, -1, 0, 1, 2, \ldots\}$

$\mathbb{Q}$ = Rational Number = $\{\frac{p}{q} \mid p, q \in \mathbb{Z}, q \neq 0\}$

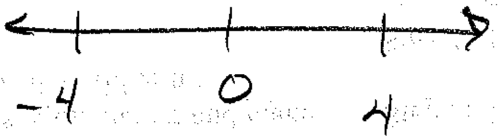
$\mathbb{H}$ = Irrational Number = $\{n \mid n \in \mathbb{Q}$

$\mathbb{R}$ = Real Numbers = $\{r \mid r \in \mathbb{Q}, r \in \mathbb{H}\}$

26 $\{-8, 5, -2\tfrac{3}{5}, 1.75, -\sqrt{2}, -0.6, \pi, \tfrac{7}{2}, \sqrt{64}\}$

$\mathbb{Z}\quad \mathbb{N}\quad \mathbb{Q}\quad \mathbb{Q}\quad \mathbb{H}\quad \mathbb{Q}\quad \mathbb{H}\quad \mathbb{Q}\quad \mathbb{N}$

Absolute Value: the distance of a Number to zero on a Numberline Regardless of direction



$|4| = 4$

$|-4| = 4$

$$|x| = \begin{cases} x \text{ if } x \geq 0 \\ -x \text{ if } x < 0 \end{cases}$$

Properties of Zero

Division can be rewritten using the Related product.

$12 \div 3 = x \Rightarrow 3 \cdot x = 12$

$x = 4$

1. $0 \div 5 = n \Rightarrow 5 \cdot n = 0$ $\qquad \frac{0}{k} = 0$

$n = 0$

2. $5 \div 0 = n \Rightarrow 0 \cdot n = 5$ $\qquad \frac{N}{0}$ undefined

undefined

Exponent is Repeated Multiplication

$$(3)(3)(3)(3) = \underbrace{3}_{\text{base}}^{4} \leftarrow \text{exponent}$$

Exponents with Negatives

$$-3^4 = -1 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = -81$$

$$(-3)^4 = \underbrace{(-3)(-3)}_{+}\underbrace{(-3)(-3)}_{+} = 81$$

Roots (Radicals)

$$\sqrt{64} = 8 \quad \text{because} \quad 8^2 = 64$$

$$\text{index} \rightarrow \overset{\text{Radical}}{\sqrt[4]{\underbrace{81}_{\text{Radicand}}}} = x \qquad x^4 = 81$$

$$= 3$$

$$\sqrt[n]{a} = b \quad \text{if} \quad b^n = a$$

Order of Operations

Parenthesis,

Exponents.

left to Right
Multiplication
Division

left to Right
Addition
Subtraction

$$2(\underbrace{3+4}) - \sqrt[3]{8} \div (\underbrace{15-13})$$

$$2(7) - \sqrt[3]{8} \div (2)$$

$$2(7) - 2 \div 2$$

$$14 - 1$$

$$\boxed{13}$$

R.4 Factoring Polynomials

Factoring : the process of writing a polynomial as a product

$6x^3 - 4x$

- Always Look for a Greatest Common factor

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

- Factoring by Grouping

$$\underbrace{x^3 - 2x^2} \; \boxed{+} \; \underbrace{3x - 6}$$

$$\underbrace{x^2(x-2)} + \underbrace{3(x-2)}$$

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

Quadratic means highest power of the polynomial is 2

General form $ax^2 + bx + c$

Method 1: The "AC" Method

$$ax^2 + bx + c$$

1st find $a \cdot c$

2nd factor ac

3rd find factors of ac that add b

4th Rewrite polynomial

5th factor by grouping

Ex: $5x^2 + 26x + 5$

$a = 5$ $\quad$ $\underbrace{b = 26}$ $\quad$ $c = 5$

ac	b.
25	26
1,25	26 ✓

$$5x^2 + 1x + 25x + 5$$

$$x(5x + 1) + 5(5x + 1) = (5x+1)(x+5)$$

$3x^2 - 11x - 4$

-12	-11
-12, 1	-11 ✓
~~2, 6~~	~~-4~~
~~3, -4~~	~~-1~~

$\underline{3x^2 + 1x} - \underline{12x - 4}$

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

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

Method 2: Synthetic Factoring

$5x^2 + 26x + 5$

25	26
25, 1	26 ✓

$(x+5)(5x+1)$

$a \rightarrow \frac{25}{5} = \frac{5}{1}(1x+5)$

$a \rightarrow \frac{1}{5} = \frac{1}{5}(5x+1)$

$3x^2 - 11x - 4$

-12	-11
$-12, 1$	-11 ✓

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

$$\frac{-12}{3} = \frac{-4}{1} \quad (x-4)$$

$$\frac{1}{3} = \frac{1}{3} \quad (3x+1)$$

Factoring Special Forms

Difference of Squares

$$a^2 - b^2 = (a+b)(a-b)$$

Ex: $\underset{\overset{\uparrow}{(3x)^2}}{9x^2} - \underset{\overset{\uparrow}{2^2}}{4} = (3x+2)(3x-2)$

Sum or Difference of Cubes

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

Perfect Square Trinomial

$$a^2 + 2ab + b^2 = (a+b)^2$$

$$a^2 - 2ab + b^2 = (a-b)^2$$

$$49x^2 + \underset{?}{42x} + 9 = (7x+3)^2$$

$(7x)^2$ $\quad 2(7x)(3)$ ✓ $\quad (3)^2$

$x^2 + 4$ Does Not Factor

$\longrightarrow$ (Prime)

$\xcancel{(x+2)^2}$

$(x+2)^2$

$(x+2)(x-2)$

$x^2 \cancel{-2x+2x} - 4$