

Chapter 1 Section 2

Operations with Real Numbers

1) Real numbers

On the real number line, each real number corresponds to only one point on the line. For example, number 4 is between 3 and 5.

2) Inequality

Simply, if there are two numbers on the real number line, which one is bigger? The smaller numbers are on the left side and the bigger numbers are on the right side.

The same rule applies for negative numbers, for example, if negative two and negative three are on the same line, negative three is on the left side and negative two is on the right side.

- Definition of symbols

$>$: greater than

$<$: less than

$=$: equal

3) Absolute Value

The definition of absolute value is that the absolute value of a number is the distance from that number to zero on the number line.

For example, negative three changes to positive three.

- Definition of symbol

$|-a| = a$: The absolute value of negative a is positive a.

4) Adding Real Numbers

- Two positive numbers:

ex) $2+3=5$ (the sum of their absolute values)

- Two negative numbers:

ex) $(-2) + (-3) = (-5)$ (it is the sum of their absolute values 2 and 3, and just put negative sign in front)

- One positive and One negative number

ex1) $2 + (-3) = (-1)$: Take the difference between their absolute values and keep the sign of the larger number. The absolute values would be 2 and 3. The difference between them is 1. Looking at the absolute values (2 and 3) the larger number would be 3. Therefore we add the negative sign to our difference of 1.

ex2) $3 + (-2) = (1)$: Take the difference between their absolute values and keep the sign of the larger number. The absolute values would be 2 and 3. The difference between them is 1. Looking at the absolute values (2 and 3) the larger number would be 3. Therefore the difference of 1 remains positive.

- Zero and another number: the sum of 0 and any real number is the real number itself.

5) Subtraction of Real Numbers

Consider: $a - b$

If $a, b > 0$ and $a > b$, then the answer is positive.

Ex: $9 - 8 = 1$

If $a, b > 0$ and $a < b$, then the answer is negative

Ex: $8 - 9 = (-1)$

If $a, b < 0$ and $a > b$, then the answer is positive

Ex: $(-2) - (-5) = 3$: negative sign in front of 5 times negative sign change to positive sign, and then switch to $5 - 2$ form, you get three as the answer.

If $a, b < 0$ and $a < b$, then the answer is negative

Ex: $(-5) - (-2) = (-3)$: negative sign in front of 2 times negative sign change to positive sign, and then switch to $2 - 5$ form, you get negative three as the answer.

If $a > 0$, $b < 0$, then the answer is positive

Ex: $7 - (-2) = 9$: the negative sign in front of 2 times the negative sign outside the parentheses changes to a positive sign, the form is changed to $7 + 2$, you get positive nine as the answer.

If $a < 0$, $b > 0$, then the answer is negative

Ex: $(-7) - (2) = (-9)$: this type is same as the addition of two negative numbers, so answer is going to be negative nine such as $(-7) + (-2) = (-9)$

6) Multiplying Real Numbers

First of all, you have to know about a certain rule of multiplying:

- Positive sign times Positive sign equals to Positive sign: $7 * 8 = 56$
- Positive sign times Negative sign equals to Negative sign: $7 * (-8) = (-56)$
- Negative sign times Positive sign equals to Negative sign: $(-7) * 8 = (-56)$
- Negative sign times Negative sign equals to Positive sign: $(-7) * (-8) = 56$

The product of zero and real number is always zero.

7) Dividing Real Numbers

The rules of signs is same as multiplying:

- Positive sign divided by Positive sign equals to Positive sign: $6 / 2 = 3$
- Positive sign divided by Negative sign equals to Negative sign: $6 / (-2) = (-3)$
- Negative sign divided by Positive sign equals to Negative sign: $(-6) / 2 = (-3)$
- Negative sign divided by Negative sign equals to Positive sign: $(-6) / (-2) = 3$

The zero divided by any real number is zero, but any real number divided by zero is undefined.

Definition of terminology

The diagram shows a long division problem: $4 \overline{)6}$. The number 4 is the divisor, 6 is the dividend, 1 is the quotient, and 2 is the remainder. Arrows point from labels to these parts: 'Quotient' points to the 1, 'Numerator' points to the 6, 'Denominator' points to the 4, and 'Remainder' points to the 2.