

section 1.4
properties of Real numbers

Equations : =

There is many expressions that describe the relationship between two quantities.

Equality : =

Equality

is a mathematical expressions that imply :-
equal, amount to, represent

Examples :-

write each sentence as an equation :-

a) The difference of x and seven is 45.

$$x - 7 = 45$$

b) The product of 5 and x amounts to the sum of x and 14.

$$5 \cdot x = x + 14$$

c) The quotient of y and 23 is the same as 20 subtracted from y .

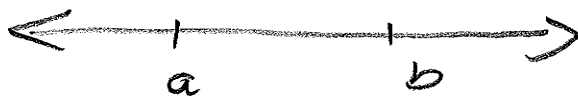
$$\frac{y}{23} = y - 20$$

Inequalities:-

Is an equation that includes at least one of the expressions

$>$ greater than -
 $<$ less than -
 \geq greater or equal -
 \leq less or equal

⊗ If $a < b$, Then
a is to the left of b in
the number line.



$$a < b$$

⊕ if $a \leq b \rightarrow b \geq a$.

Example

insert $>$, $<$, $=$ between each
pair of numbers

a) $7 \quad -7 \quad \rightarrow \quad 7 > -7$

b) $-1 \quad 11 \quad \rightarrow \quad -1 < 11$

c) $-10 \quad -12 \quad \rightarrow \quad -10 > -12$

d) $7.206 \quad 7.206 \quad \rightarrow \quad 7.206 = 7.206$

e) $\frac{4}{7} \quad \frac{5}{7} \quad \rightarrow \quad \frac{4}{7} < \frac{5}{7}$

Example

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* write each sentence using mathematical symbols :-

a) The difference of 7 and x is less than or equal 21.

$$\boxed{7 - x \leq 21}$$

b) nine is not equal to x plus y

$$\boxed{9 \neq x + y}$$

c) Thirty is greater than the sum of 9 and x squared

$$\boxed{30 > 9 + x^2}$$

* Zero is the additive identity \Rightarrow

$$a + 0 = 0 + a = a$$

* one is the multiplicative Identity

$$a \cdot 1 = 1 \cdot a = a$$

* The additive inverse or the opposite is a unique number $-a$

$$a + (-a) = (-a) + a = 0$$

* The reciprocal of a non-zero number a is a unique number $\frac{1}{a} \Rightarrow$

$$a \cdot \frac{1}{a} = \frac{1}{a} \cdot a = 1$$

EX

Find the opposite or additive inverse of

number	additive inverse	reciprocal
10	-10	$\frac{1}{10}$
$-\frac{2}{3}$	$\frac{2}{3}$	$-\frac{3}{2}$
-8.1	8.1	$\frac{1}{8.1}$
19	-19	$\frac{1}{19}$
$\frac{9}{4}$	$-\frac{9}{4}$	$\frac{4}{9}$
$-\frac{1}{8}$	$\frac{1}{8}$	-8

* Can A number additive inverse and multiplicative inverse be the same. ?

- Not for real numbers.

Properties of Real numbers:-

Commutative Properties:-

addition $a + b = b + a$
multiplicative $a \cdot b = b \cdot a$

Associative Properties

$(a + b) + c = a + (b + c)$
 $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Distributive properties:-

$a(b + c) = ab + ac$

EX

use the commutative property of addition to write:-

$9 + 4x$

$4x + 9$

EX

use associative properties of multiplication to write an expression equivalent to

$$5(6x)$$

$$5(6x) = (5 \cdot 6)x = 30x.$$

EX

use distributive property to multiply:-

a) $7(4x - y)$

$$\begin{aligned} 7(4x - y) &= 7 \cdot 4x - 7 \cdot y \\ &= 28x - 7y. \end{aligned}$$

b) $-8(3 + x) =$

$$\begin{aligned} -8(3 + x) &= -8 \cdot 3 + (-8)x \\ &= -24 - 8x \end{aligned}$$

c) $5x(y - 4)$

$$\begin{aligned} 5x(y - 4) &= 5x \cdot y - 5x \cdot 4 \\ &= 5xy - 20x. \end{aligned}$$

EX:

write as an algebraic expressions:-

a) Express the value of x nickles in \$

$$0.05 \cdot x.$$

- b) The cost of x DVDs if each one costs \$21.

$$\text{The cost} = 21 \cdot x = 21x$$

- c) Two numbers have the sum of 75. If one number is x , write an expression for the other number.

$$\text{The other number} = 75 - x$$

- d) If x is the first of two consecutive odd integers, write an expression for the next odd integers:-

$$\text{The next odd integer} = x + 2.$$

* simplifying mathematical expressions can be done by removing grouping symbols and combining like terms.

EX simplify by combining like terms:-

a) $9x - 15x + 7$

$$(9x - 15x) + 7 = -6x + 7$$

b) $8y + y$

$$8y + y = 9y.$$

c) $3x + 3$

cannot

EX simplify

a) $7st - 4st + 3 - 11 + st$

$$= 7st - 4st + st + 3 - 11$$

$$= 4st - 8.$$

b) $\frac{1}{3}(9x - 6y) - \frac{1}{2}(8x - 4y + 1) - \frac{3}{4}$

$$= \frac{1}{3} \cdot 9x - \frac{1}{3} \cdot 6y - \frac{1}{2} \cdot 8x + \frac{1}{2} \cdot 4y - \frac{1}{2} \cdot 1 - \frac{3}{4}$$

$$= 3x - 2y - 4x + 2y - \frac{1}{2} - \frac{3}{4}$$

$$= -x - \frac{5}{4} \quad \#$$