


Properties of Equality

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Properties of Equality	Property	Example(s)
Addition Property of Equality	If $a = b$, then $a + c = b + c$. If $x = y$ then $x + 2 = y + 2$	$\begin{array}{r} x - 7 = 14 \\ +7 \quad +7 \\ \hline x = 21 \end{array}$
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$. If $x = y$ then $x - 2 = y - 2$	$\begin{array}{r} x + 7 = 14 \\ -7 \quad -7 \\ \hline x = 7 \end{array}$
Multiplication Property of Equality	If $a = b$, then $ac = bc$. If $x = y$ then $3x = 3y$	$7 \cdot \frac{x}{7} = 14 \cdot 7$ $x = 98$
Division Property of Equality	If $a = b$, then $a/c = b/c$. If $x = y$ then $\frac{x}{3} = \frac{y}{3}$	$\frac{7x}{7} = \frac{14}{7}$ $x = 2$

Properties of Operations and Identities

Properties of Operations and Identities	Property	Example(s)
Commutative Property of Addition	Change order $a + b = b + a$	$9 + 1 = 1 + 9$ $10 = 10$
Commutative Property of Multiplication	$a \cdot b = b \cdot a$	$6 \cdot 8 = 8 \cdot 6$ $48 = 48$
Associative Property of Addition	Grouping $a + (b + c) = (a + b) + c$	$1 + (7 + 9) = (7 + 1) + 9$ $1 + 16 = 8 + 9$ $17 = 17 \checkmark$
Associative Property of Multiplication	$a \cdot (b \cdot c) = (a \cdot b) \cdot c$	$8 \cdot (3 \cdot 9) = (8 \cdot 3) \cdot 9$ $8 \cdot 27 = 24 \cdot 9$ $216 = 216$
Distributive Property of Multiplication over Addition	 $a \cdot (b + c) = a \cdot b + a \cdot c$	$3 \cdot (10 + 5) = 3 \cdot 10 + 3 \cdot 5$ $3 \cdot 15 = 30 + 15$ $45 = 45$

* Additive Identity Property	$a + 0 = a$	$516 + 0 = \boxed{516}$
Multiplicative Identity Property	$a \cdot 1 = a$	$\frac{2}{3} \cdot \frac{3}{5} + \frac{2}{3} \cdot \frac{5}{5} = \frac{9}{15} + \frac{10}{15} = \frac{19}{15}$
Additive Inverse Property	$a + (-a) = 0$	$\pi - \pi = 0$
Multiplicative Inverse Property	*reciprocal* $\frac{a}{b} \cdot \frac{b}{a} = 1$	$\frac{2}{1} \cdot \frac{1}{2} = \boxed{1}$
Multiplicative Property of Zero	$a \cdot 0 = 0$	$516 \cdot 0 = \boxed{0}$
Exponential Property of Equality	$a^b = a^c, \text{ then } b = c$	$2^8 = 2^{x+2}$ $8 = x + 2$ $\boxed{x = 6}$

Equations & Inequalities

Equations and Inequalities Warm Up

1. $13 - 4m = -(m + 5)$

$$13 - 4m = -m - 5$$

$$18 = 3m$$

$$\boxed{6 = m}$$

2. $-32 + 5n = 7(6 + 6n)$

$$-32 + 5n = 42 + 42n$$

$$-74 = 37n$$

$$\boxed{-2 = n}$$

3. $114 < -6n - 5(5n + 2)$



$$114 < -6n - 25n - 10$$

$$114 < -31n - 10$$

$$\frac{124}{-31} < \frac{-31n}{-31}$$

$$-4 > n$$

$$n < -4$$

Literal Equations

Solving For a Variable Notes

Example #1:

Solve $-5x + y = -56$ for x .

$$\begin{array}{r} -y \quad -y \\ -5x = -56 - y \\ \underline{-5} \quad \underline{-5} \end{array}$$

Use inverse operations

what's happening to x ?

Do	undo
$x - 5$	$-y$
$+ y$	$\div -5$

$$x = \frac{-56 - y}{-5}$$

Example #2:

Solve $2x - 4y = 7$ for x .

Do	undo
$\cdot 2$	$+4y$
$-4y$	$\div 2$

$$\begin{array}{r} 2x = 4y + 7 \\ \underline{2} \quad \underline{2} \\ x = \frac{4y + 7}{2} \end{array}$$

Example #3:

Solve $\frac{a(y+1)}{a} = \frac{b}{a}$ for y .

Do	undo
$+1$	$\div a$
$\cdot a$	-1

$$\begin{array}{r} y + 1 = b/a \\ \underline{y + 1} \quad \underline{y + 1} \\ y = b/a - 1 \end{array}$$

Practice Problems:

1. $P = \frac{4W}{H^2}$ for w .

$$\frac{PH^2}{4} = W$$

$\cdot 4$	$\cdot H^2$
$\div H^2$	$\div 4$

$$\frac{P - 2w}{2} = 2$$

2. $P = 2l + 2w$ for l .

$\cdot 2$	$-2w$
$+2w$	$\div 2$

$$\frac{5}{9}(F - 32) = C$$

3. $F = \frac{9}{5}C + 32$ for C .

$\cdot 9/5$	-32
$+32$	$\div 9/5$

Dividing by a fraction is the same as multiplying by its reciprocal!

Word Problems

Word Problems Recap

1. Avery wants a 90% test average in algebra. She has made the following test scores already: 88, 93, 82, 78, 94... What is the lowest score she could make on the 6th test to have the average she wants.

Work:

$$\frac{88+93+82+78+94+x}{6} = 90$$

$$435 + x = 540$$

$$\boxed{x=105}$$

2. James bought 5 baseball cards and a snack at the mall. He spent 18 dollars total. And the snack cost 4 dollars. How much was each baseball card?

Work:

$$5x + 4 = 18$$

$$5x = 14$$

$$x = 2.8$$

$$\boxed{\$2.80}$$

3. The sum of three consecutive even integers is 60. Find all three integers.

Work:

$$\underline{x + x + 2 + x + 4 = 60}$$

$$3x + 6 = 60$$

$$3x = 54$$

$$x = 18$$

$$\underline{18, 20, 22}$$

Function Notation

Warm-up

$$f(x) = -2x^2 - 3x + 4 \text{ and } g(x) = -5x^2 + 7x - 2$$

1. Find $3f(x) + 2g(x)$

$$3(-2x^2 - 3x + 4) + 2(-5x^2 + 7x - 2)$$
$$\underline{-6x^2} \quad \underline{-9x} \quad \underline{+12} \quad \underline{-10x^2} \quad \underline{+14x} \quad \underline{-4}$$
$$\boxed{-16x^2 + 5x + 8}$$

2. Find $g(x) - f(x)$

$$(-5x^2 + 7x - 2) - (-2x^2 - 3x + 4)$$
$$\underline{-5x^2} \quad \underline{+7x} \quad \underline{-2} \quad \underline{+2x^2} \quad \underline{+3x} \quad \underline{-4}$$
$$\boxed{-3x^2 + 10x - 6}$$

3. Find $g(-2)$

$$g(-2) = -5(-2)^2 + 7(-2) - 2$$

$$= -5(4) - 14 - 2$$

$$= -20 - 14$$

$$\boxed{g(-2) = -34}$$

Properties of Equality

Justify Your Steps to Solve the Equation

Equation	Steps
$3(x - 2) + 10 = 25$	Original Equation
$3x - 6 + 10 = 25$	6. Distributive Property
$3x - 6 = 15$	7. Subtraction Property
$3x = 21$	8. Addition Property
$x = 7$	9. Division Property

Equations and Inequalities

2. $3x - 5 < 2x + 11$

$$\boxed{x < 16}$$

3. $2x + 4(7x - 3) - 8 = 5x - 30$

$$2x + 28x - 12 - 8 = 5x - 30$$
$$30x - 20 = 5x - 30$$

$$25x = -10$$
$$x = -10/25 = \boxed{-\frac{2}{5}}$$

4. $2(x - 3) = 5x + 12$

$$2x - 6 = 5x + 12$$
$$3x = 18$$
$$\boxed{x = 6}$$

5. $-8x - 16 = -8(2x - 6)$

$$-8x - 16 = -16x + 48$$
$$-8x = -16x + 64$$

$$8x = 64$$
$$\boxed{x = 8}$$

6. $\frac{x}{2} = \frac{7}{10}$

$$10x = 14$$

$$x = \frac{14}{10} = \boxed{\frac{7}{5}}$$

Functions and Rate of change

Write an equation for the function in the table.

hint Determine the slope using the slope formula. Find the y intercept from the table.

Time (years)	0	1	2	3	4	5
Number of Rabbits	4	6	8	10	12	14

$$y = 2x + 4$$

+2 +2 +2 +2

Use the following functions to find the given value or expression:

$$f(x) = x + 2$$

$$g(x) = \frac{1}{2}x + 1$$

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

$$m(x) = 3 - x$$

1) $f(0) = \underline{2}$

4) $g(2) + h(2) = \underline{7}$

2) $g(8) = \underline{5}$

5) $2g(x) + 3f(x) = \underline{4x + 8}$
 $x + 2 + 3x + 6$

3) $h(2) = \underline{5}$

6) $(f + g)(x) = \underline{\frac{3}{2}x + 3}$
 $x + 2 + \frac{1}{2}x + 1$

7) $(f - m)(x) = \underline{2x - 1}$
 $x + 2 - 3 + x$

More on Functions

Find the following values:

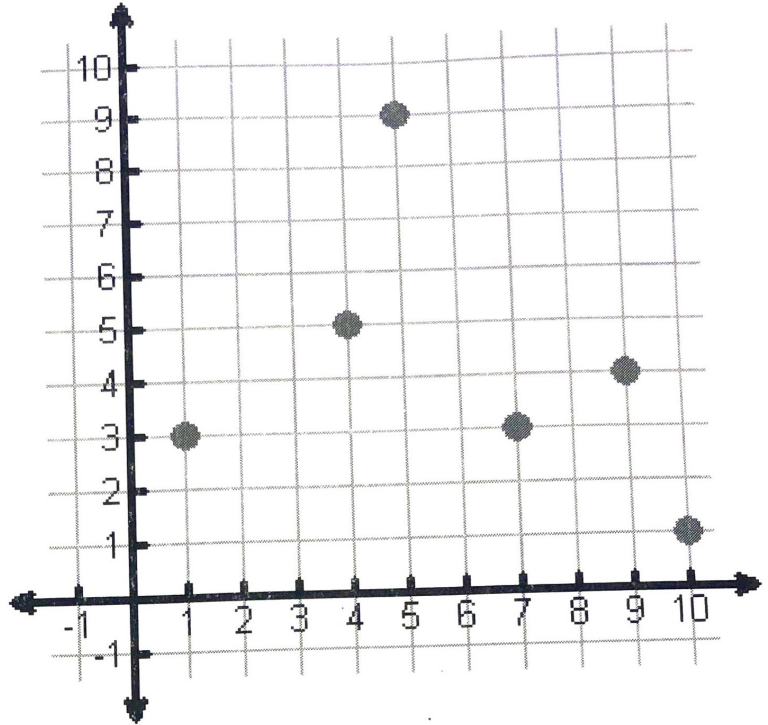
$$g(1) = \underline{3}$$

$$g(5) = \underline{9}$$

$$g(10) = \underline{1}$$

$$g(\underline{4}) = 5$$

$$g(\underline{9}) = 4$$



State if the following is a relation or a function, then state why or why not.

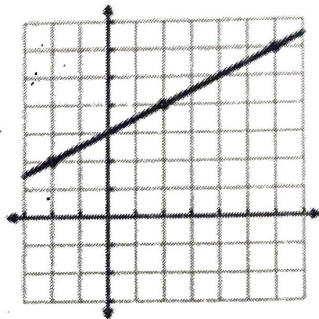
1) $\{(5,2) (6,3) (7,4) (8,3)\}$ *yes*
no repeat input

2)

input	3	2	0	3
output	4	-1	2	-3

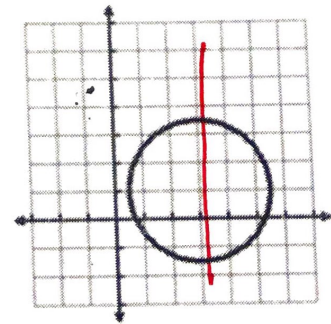
NO!
repeat input.

3)



yes, VLT

4)



NO
VLT

Literal Equations

1) For **y**: $-12x + 4y = -8$

$$y = \frac{12x - 8}{4} \quad \boxed{y = 3x - 2}$$

2) **W**: $P = 2(L + W)$

$$\boxed{\frac{P}{2} - L = W}$$

3) For **a**: $ax + by = c$

$$\boxed{a = \frac{c - by}{x}}$$

4) For **t**: $P = \frac{t}{m^2}$

$$\boxed{Pm^2 = t}$$

5) For **z**: $m = \frac{z(b+x)}{2}$

$$\boxed{z = \frac{2m}{b+x}}$$

$$\frac{2m}{b+x} = \frac{z(b+x)}{b+x}$$
$$\frac{2m}{b+x} = z$$

6) **F**: $C = \left(\frac{5}{9}\right)F - 32$

$$\boxed{\frac{9}{5}(C + 32) = F}$$

Word Problems

- 1) Sara wants to have an average of at least 90 on her tests. If she took three tests and earned an 84, 95, and 82, what is the lowest grade she has to earn on the fourth test?

$$\frac{84+95+82+x}{4} \geq 90 \quad 261+x \geq 360$$
$$x \geq 99$$

- 2) Lola travelled to New York to visit her grandmother. When she arrived at the airport she had to take a taxi to her grandmother's house. The sign says the cost for the taxi is \$5.00 plus .20 a mile. Create an equation that models the situation. State what x and y represent in your equation.

$$y = .2x + 5$$

x = miles traveled

y = total cost

- 3) Jordan is trying to find the sum of 3 consecutive **odd** integers. Their sum is 249. Find the 3 numbers. Show all work.

$$\underline{x} + \underline{x+2} + \underline{x+4} = 249$$

$$3x = 243$$

[81, 83, 85]

$$3x + 6 = 249$$

$$x = 81$$

- 4) The width of a rectangle is 4 inches more than the length. The perimeter is 56 inches. Find the length and width of the rectangle. You must show your algebraic equation and work to get credit!

$$P = 2l + 2w$$

$$56 = 2l + 2(l+4)$$

$$56 = 4l + 8$$

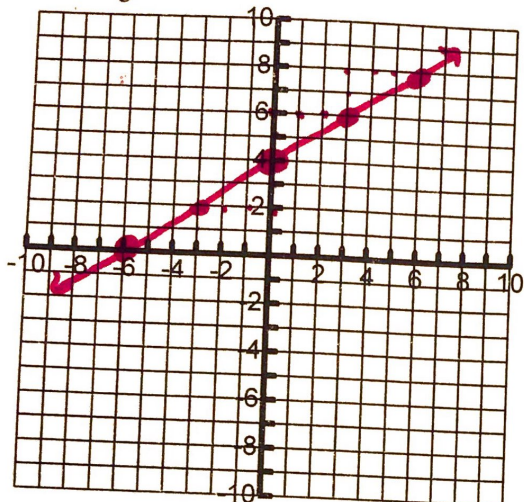
$$48 = 4l$$

$$\boxed{12 = l}$$

$$\boxed{w = 16}$$

Graphing:

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



a. State the Domain $(-\infty, \infty)$

b. State the Range $(-\infty, \infty)$

c. State the y intercept $(0, 4)$

d. State the x intercept $(-6, 0)$

e. State the End Behavior

$x \xrightarrow{\text{left}} -\infty \quad y \rightarrow \frac{-\infty}{\quad}$

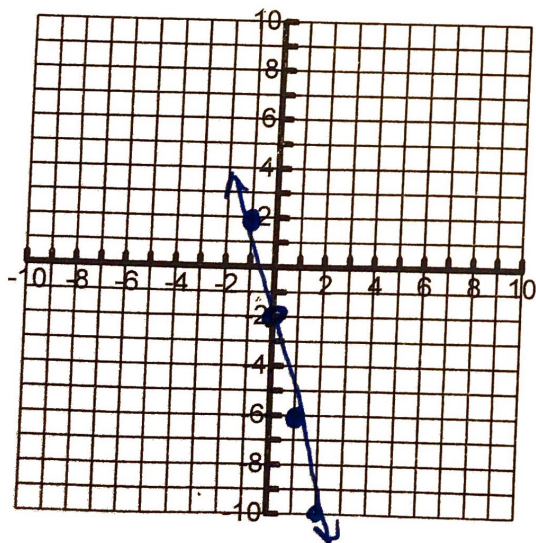
$x \rightarrow \infty \quad y \rightarrow \frac{\infty}{\quad}$

$0 = -4x - 2 \quad 2 = -4x$

$x = -\frac{1}{2}$

2) $y = -4x - 2$

$m = \frac{-4}{1}$



a. State the Domain $(-\infty, \infty)$

b. State the Range $(-\infty, \infty)$

c. State the y intercept $(0, -2)$

d. State the x intercept $(-\frac{1}{2}, 0)$

e. What is the Rate of Change?

Slope

(-4)

Arithmetic Sequences

Representation	Common Difference	Explicit Formula	Recursive Formula	Given Term														
20. $-10, -3, 4, \dots$	$+7$	$a_n = -10 + (n-1)7$ $a_n = 7n - 17$	$a_1 = -10$ $a_n = a_{n-1} + 7$	a_{17} 102														
21. Camden is collecting bugs for science class. The first day his sister helps him, and he finds 35 bugs. After day 2, he has 51 bugs. On day 3, he has 67 bugs.	$+16$	$a_n = 35 + (n-1)16$ $a_n = 16n + 19$	$a_1 = 35$ $a_n = a_{n-1} + 16$	a_5 99														
22. A museum usually has 4,000,000 visitors. They made some changes to increase visitors. The table shows the projected annual visitors to museum (in millions) after the changes. What is the projected number of visitors in 8 years? <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Year</th> <th>Visitors (millions)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> </tr> <tr> <td>1</td> <td>5.5</td> </tr> <tr> <td>2</td> <td>7</td> </tr> <tr> <td>3</td> <td>8.5</td> </tr> <tr> <td>4</td> <td>10</td> </tr> <tr> <td>n</td> <td></td> </tr> </tbody> </table>	Year	Visitors (millions)	0	4	1	5.5	2	7	3	8.5	4	10	n		$+1.5 \text{ mill}$	$a_n = 5.5 + (n-1)1.5$ $a_n = 1.5n + 4$	$a_1 = 5.5$ $a_n = a_{n-1} + 1.5$	a_8 16
Year	Visitors (millions)																	
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