# Algebra 1 Workbook

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MATH

## VARIABLES

1. Which value can we identify as the variable in the expression?

$$3y^2 + ay - 6 = 1$$

2. Identify any constant(s) in the equation.

$$x^2 - 3x + 2 = 0$$

3. How many terms exist in the equation?

$$x^2 - 3x + 2 = 0$$

4. Identify any coefficient(s) in the expression.

$$2x^2 + bx - c$$

5. Which value is the variable representing?

$$x - 7 = 2$$

6. Which value is the variable representing?

$y+3=8$

## IDENTIFYING MULTIPLICATION

1. Give three different examples of how we can write "$a$ times $b$" mathematically.

2. Simplify the expression.

$$5(2 \cdot 3) \times (1)(a)$$

3. Find the value of the expression.

$$4 \times 3(1)(2 \cdot 1)$$

4. Find the value of the expression.

$$2(4)(3 \cdot 4) \times (5)(2)$$

5. Why do we have different ways to write multiplication?

6. Simplify the expression.

$$(-3)(2) \times 4 \cdot (-2)(2 \cdot 1)$$

## ASSOCIATIVE PROPERTY

1. Give an example of an expression that demonstrates the Associative Property of Multiplication.

2. Using the Associative Property, rewrite and simplify $2 \times (3 \times 4)$.

3. According to the Associative Property, what number would make the most sense in the place of the variable?

$$42 + (31 + 17) = (42 + x) + 17$$

4. Rearrange $(3 + 6) + 2$ using the Associative Property, then simplify.

5. Give an example of an expression that demonstrates the Associative Property of Addition.

6. According to the Associative Property, what number would make the most sense in the place of the variable?

$$(4 \times 2) \times 9 = x \times (2 \times 9)$$

## COMMUTATIVE PROPERTY

1. Using the Commutative Property, rewrite $6 + 19$ and then simplify.

2. Give an example of an expression that demonstrates the Commutative Property of Multiplication.

3. According to the Commutative Property, what's the value of the variable in the equation?

$$11 + (23 + 6) = 11 + (6 + x)$$

4. Rearrange $(3 + 6) + 2$ using the Commutative Property and then the Associative Property.

5. Give an example of an expression that demonstrates the Commutative Property of Addition.

6. According to the Commutative Property, what's the value of the variable in the equation?

$$(4 \times 2) \times 9 = (x \times 9) \times 4$$

## TRANSITIVE PROPERTY

1. If $AB = CD$ and $CD = EF$, what's another way to express $EF$?

2. According to the Transitive Property, if $x = 2y$ and $2y = 5z$, what's the value of $x$?

3. Give an example that demonstrates the Transitive Property.

4. By the Transitive Property, what value would make the statement true?

If $2 + 3 = x$ and $4 + 1 = 5$, then $2 + 3 = 5$.

5. Use the Transitive Property to write an equation that only includes $x$ variables, without any $y$ or $z$ variables.

$y = 2x + 3$

$y = z$

$z = 5x - 9$

6. According to the Transitive Property, what expression would make the most sense in the following statement?

If $x = 2y$ and $2y = ??$, then $x = 5z$.

## UNDERSTOOD 1

1. What happens when we multiply something by $1$?

2. Simplify the expression.

$$\frac{1x^1}{1(1^1)}+\frac{1}{1(1x)}-1^1$$

3. What value of $x$ makes the equation true?

$$1(2^1)-\frac{1}{1(1)^1}+\frac{x^1}{1\times 1}=4$$

4. Simplify the expression by removing any “understood $1$s.”

$$\frac{x^1}{4x^3}+\frac{5x^4}{1x}$$

5. What happens when we divide something by $1$?

6. Simplify the expression by removing any “understood $1$s.”

$$\frac{x}{1^1} \cdot \frac{x^2 + 1(1)}{5x^2}$$

## ADDING AND SUBTRACTING LIKE TERMS

■ 1. Give an example of like terms that can added.

■ 2. Simplify the expression.

$$-x + 6x - 8x + 3x$$

■ 3. What stays the same when adding or subtracting like terms?

■ 4. Simplify the expression.

$$x + 2x^2 - y - 5x^2 + 7y - 4x$$

■ 5. Simplify the expression.

$$\frac{1}{3}x - 5x^2 + \frac{1}{2}x^2 - x - y$$

■ 6. Simplify the expression.

$$2a^2b - 5ab - 3ab^2 + a^2b + 4ab$$

## MULTIPLYING AND DIVIDING LIKE TERMS

1. Simplify the expression.

$$\frac{3x^2}{x^3}$$

2. Simplify the expression.

$$2a^2 \cdot 6b^3 \cdot ab^2$$

3. Simplify the expression.

$$\frac{6x^a}{3x^b}$$

4. Simplify the expression.

$$3x^a \cdot 5x^b$$

5. Simplify the expression.

$$\frac{5y^2 \cdot 4x^3 \cdot 2xy}{x^2y}$$

6. Simplify the expression.

$$\frac{2y^2 \cdot 3x^3y \cdot x^2y^2}{x^4y^2}$$

## DISTRIBUTIVE PROPERTY

1. Use the Distributive Property to simplify the expression.

$$5(x-2)+\frac{1}{2}(6-2x)$$

2. Use the Distributive Property to expand the expression.

$$-\frac{2}{5}(10-5x)$$

3. Give an example that demonstrates the Distributive Property with subtraction.

4. Which three main operations are used in the Distributive Property?

5. Use the Distributive Property to simplify the expression.

$$2(5-3x)-2(x-4)$$

6. What value would make the following equation true?

$$2(x+3) = ?? + 6$$

## DISTRIBUTIVE PROPERTY WITH FRACTIONS

1. Use the Distributive Property to expand the expression.

$$-\frac{x^2z}{y^3}\left(\frac{y^2}{2}-\frac{xz^3}{z^2}\right)$$

2. Fill in the blanks.

"When we're distributing fractions, we multiply the numerator of the coefficient by the __________ of the terms inside the parentheses, and we multiply the denominator of the coefficient by the __________ of the terms inside the parentheses."

3. Use the Distributive Property to expand the expression.

$$\frac{2}{3}\left(\frac{x}{2}-6\right)$$

4. Explain why the two sides of the equation aren't equal to one another.

$$\frac{3}{2}\left(\frac{x}{5}-\frac{y}{2}\right) \neq \frac{3x}{10}-\frac{y}{2}$$

5. What missing value would make the equation true?

$$\frac{2ab}{c^2}\left(\frac{3ac}{b}+a^2c^2\right)=\frac{6a^2}{c}+??$$

6. Use the Distributive Property to show that the equation is true.

$$\frac{x^2}{3z}\left(\frac{2x}{z}+y^2\right)=\frac{2x^3}{3z^2}+\frac{x^2y^2}{3z}$$

## PEMDAS AND ORDER OF OPERATIONS

1. Simplify the expression.

$$\sqrt{2(5-3)} - |3[6-7]|$$

2. Using PEMDAS, evaluate each expression separately to show that they are not equal.

$$4 \times (3-1) - (4 \div 2 + 2)$$

$$(4 \times 3 - 1) - 4 \div (2 + 2)$$

3. Use order of operations to simplify the expression.

$$(10 - [(-1)^2 + 1 - 6 \div 6])^{1/2} + 4 \div 2$$

4. Use order of operations to simplify the expression.

$$3 - [(-2)^2 x + (3 - 7)]$$

5. Using order of operations, explain why $9 + 6 \div 3 \neq 5$.

6. Use order of operations to simplify the expression.

$$\frac{-2+3-10\cdot 2\cdot [(5-4)+2]}{2}$$

## EVALUATING EXPRESSIONS

1. Explain what went wrong in the following statement?

If $x^2 - x + 1$ when $x = -2$, then $-2^2 - -2 + 1 = -4 + 2 + 1 = -1$.

2. What does it mean to "evaluate an expression"?

3. Find the value of $y - 2z - 1$ when $y = 4$ and $z = -3$.

4. Evaluate the expression when $a = 1$, $b = -3$, and $c = -4$.

$$\frac{\sqrt{b^2 - 4ac}}{2a}$$

5. Show that $x = -4$ by plugging it into the equation.

$$x^2 - 4 = -3x$$

6. Evaluate the expression when $a = -1$, $b = -2$, and $c = -3/2$.

$$\frac{5a + 1}{3 - 2b + 4c^2a}$$

## INVERSE OPERATIONS

1. Use inverse operations to figure out what should replace the "?" in order to make the equation true.

$$5x\ ?=x$$

2. What is the inverse operation of division?

3. Using both division and multiplication, find two values that can replace the "?" in order to make the equation true.

$$\frac{1}{5}x\ ?=x$$

4. What value of the missing exponent would make the equation true?

$$(x^3)^? = x$$

5. Put an expression in place of the question mark that would make the equation true.

$$\frac{1}{7}\ ?=1$$

6. Use inverse operations to find a value to replace the "?" that will make the equation true.

$$(\sqrt[4]{a+b})^{?} = a+b$$

## SIMPLE EQUATIONS

1. Solve the equation for $x$.

$$2x - 5 = 11$$

2. If $x = 16$, what value of the "??" would make the equation true?

$$x - ?? = 11$$

3. Solve the equation for $x$.

$$\frac{x+1}{3} = 7$$

4. What went wrong in this set of steps?

$$2x - 11 = -3$$

$$2x = 8$$

$$x = 16$$

5. What went wrong in this set of steps?

$$2 - \frac{1}{3}x = 1$$

$$-\frac{1}{3}x = 3$$

$$x = -9$$

6. Solve the equation for $x$.

$$\frac{1}{4}x + 3 = 5$$

## BALANCING EQUATIONS

1. Solve the equation for $x$.

$$2(-3x+5)-1=-3(1-5x)$$

2. Solve the equation for $x$.

$$x-2(1-x)+5=3(2x+4)-6$$

3. If $x=-2$, solve for $y$.

$$3x+2y-7=1-5x-y$$

4. Solve for $a$.

$$7(4a-3)=-(6a-5)+8$$

5. Solve for $a$.

$$-2(1-a)+3(a+7)=-2$$

6. What missing number should replace the "$??$" in order to make the equation true?

$$-3(x-5)=2x-(3-x)$$

$$??x+15=3x-3$$

## EQUATIONS WITH SUBSCRIPTS

1. It takes Peter $6$ hours to paint a room and Laura $8$ hours to paint that same room. Use the equation below to determine how long it would take for Peter and Laura to paint the room together, where $R_1$ is the number of hours it takes Peter, $R_2$ is the number of hours it takes Laura, and $T$ is the number of hours it takes them together.

$$\frac{R_1R_2}{R_1+R_2}=T$$

2. Solve the equation for $P_2$.

$$P_1R+\frac{P_2}{V}=d$$

3. The profit function for a company is given by $P=Rx-C_1-C_2x$, where $P$ is the profit, $R$ is the selling price of their product, $C_1$ is the company's fixed cost, $C_2$ is their variable cost, and $x$ is the total number of products sold. What is the selling price $R$ when $P=114$, $C_1=550$, $C_2=3.50$, and $x=16$?

4. Solve the equation for $x_1$.

$$\frac{3V}{x_1} = td_0 + 2x_2d_1$$

■ 5. Solve the equation for $Y_2$ when $t_1 = 2$, $t_2 = 11$, $D = 1/3$, and $Y_1 = 25$.

$$3t_1 + \frac{15t_2D}{Y_2} = Y_1 - 5$$

■ 6. The volume of the medium size box at the post office is given by $V = d_1 \times d_2 \times d_3$, where $d_1$, $d_2$, and $d_3$ are the length, width, and height, respectively. Given $d_1 = 4$ and $d_2 = 5$, find the relationship between volume and height.

## WORD PROBLEMS INTO EQUATIONS

1. Write the phrase as an algebraic expression.

Six more than three times a number

2. Find the value of the expression.

The quotient of $150$ and $5$

3. Write the phrase as an algebraic expression.

Half of five times a number

4. Find the value of the expression.

$3$ less than the product of $2$ and $7$

5. Find the value of the expression.

$\frac{1}{3}$ of $2$ more than $7$

6. David's age is five more than twice Jane's age. If Jane is $6$, how old is David?

## CONSECUTIVE INTEGERS

1. Write the next five consecutive integers following $-4$.

2. Give an example of three consecutive negative integers.

3. Write the four consecutive integers that precede $-3$.

4. Find three consecutive integers that sum to $60$.

5. Find three consecutive odd integers that sum to $21$.

6. If, given three consecutive integers, the third integer is $10$ more than the sum of the first two integers, what is the third integer?

## ADDING AND SUBTRACTING POLYNOMIALS

1. Which part(s) of the terms stay the same when we add or subtract like terms?

2. Simplify the expression.

$$(2x^3 - 5x^2 + x - 3) - (x^2 - 2x + 7)$$

3. What went wrong in this set of steps?

$$6x^3 + 7 + x^2$$

$$7x^3 + 7$$

4. Simplify the expression.

$$(10a^2b + 3ab^2 - ab) + (2ab^2 - a^2b + ab)$$

5. Simplify the expression.

$$(x^4 - 5y^3 + z - xy) - (2y^4 + 6xy - z + x^4)$$

6. What went wrong in this set of steps?

$$9 - x^3 + 3 + 4x^3$$

$$12 + 3x^6$$

## MULTIPLYING POLYNOMIALS

1. Use the Distributive Property to expand the expression.

$$\frac{1}{2}(6x+4)(x-1)$$

2. What should we put in place of the "??" to make the expression true?

$$(2x+1)(5-x)=??+10x-x+5$$

3. What went wrong in this set of steps?

$$(a-2)^2$$

$$a^2-4$$

4. Use the Distributive Property to expand the expression.

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

5. Fill in the blank.

$$(3-a)(5+a)=15+\_\_\_-a^2$$

6. Expand the expression.

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

## DIVIDING POLYNOMIALS

1. Simplify the expression using polynomial long division.

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

2. What went wrong in setting up the long division problem?

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

$$5x^4 - 3x^2 + x - 2 \,\big)\overline{\,x^2 + 1\,}$$

3. Express the full solution of the polynomial long division.

$$
\begin{array}{r l}
 & \quad 3x \quad -1 \\
x^2 - 3 \,\big) & \overline{3x^3 - x^2 \quad + x \quad - 5} \\
 & -(3x^3 + 0x^2 - 9x) \\
\hline
 & \qquad -x^2 + 10x - 5 \\
 & \quad -(-x^2 + 0x + 3) \\
\hline
 & \qquad\qquad 10x - 8
\end{array}
$$

4. Simplify the expression using polynomial long division.

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

5. Simplify the expression using polynomial long division.

$$\frac{x^5 - x^3 + 4x^2 - x + 6}{2x^3 - 5}$$

6. Simplify the expression using polynomial long division.

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

## MULTIPLYING MULTIVARIABLE POLYNOMIALS

1. Simplify the expression.

$$(a - 3y)(2a + y)$$

2. Simplify the expression.

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

3. Fill in the blanks with the correct terms.

$$(5a - b)(7b - 3a)$$

$$35ab - 15a^2 + \_\_\_ + 3ab$$

$$\_\_\_ - 15a^2 + \_\_\_$$

4. What went wrong in this set of steps?

$$(a^2 + 6b)(-a - b^2)$$

$$-a^3 - a^2b^2 - 6ab - b^3$$

$$-a^3 - 7ab - b^3$$

5. Fill in the the multiplication chart with the correct terms, given the following product of binomials.

$$(4a + 3b)(-a + 2b^2)$$

| | | **3b** |
|---|---|---|
| **-a** | | -3ab |
| | | |

6. Simplify the expression.

$$(5ax - 3by)(a + y) - (a - y)(2ax + 4by)$$

## DIVIDING MULTIVARIABLE POLYNOMIALS

1. Find the quotient.

$$\frac{3x^2 + 6xy - 2y^2}{x - 2y}$$

2. Identify the quotient, remainder, and divisor.

$$
\begin{array}{r|l}
 & x^2 \quad -xy \qquad +y^2 \\ \hline
x+y & x^3 + 0x^2y + 0xy^2 + y^3 \\
 & \underline{-(x^3 + x^2y)} \\
 & \qquad -x^2y + 0xy^2 \\
 & \qquad \underline{-(-x^2y - xy^2)} \\
 & \qquad\qquad\qquad xy^2 + y^3 \\
 & \qquad\qquad\qquad \underline{-(xy^2 + y^3)} \\
 & \qquad\qquad\qquad\qquad\quad 0
\end{array}
$$

3. How should we rewrite the expression before starting the long division?

$$\frac{2y^3 - xy^2 + x^3}{x - y}$$

■ 4. Find the quotient.

$$\frac{6x^2-xy+2y^2}{2x-y}$$

■ 5. In words, what's the first question we should ask when solving this long division problem?

$$2x+3y\ \overline{\big)\ 6x^4-x^2y+xy^2+4y^4}$$

■ 6. Find the quotient.

$$(y^2+xy-3x^2)\div(y+x)$$

## GREATEST COMMON FACTOR

1. Factor out the greatest common factor.

$$3x^2y^3 + 12x^3y^2 - 9x^4y^4$$

2. Factor the polynomial in the numerator and simplify the resulting expression. Fill in the blank with the correct term.

$$\frac{3x^3 - 12x}{3x} = x^2 - \_\_\_\_$$

3. Factor the expression.

$$9s^3t^2 + 15s^2t^5 - 24s^5t + 6s^4t^2$$

4. What went wrong when the polynomial was factored?

$$10x^3y^4 - 5x^4y^2 - 20x^6y^3$$

$$x^3y^2(10y^2 - 5x - 20x^3y)$$

5. Factor the polynomial in the numerator and simplify the resulting expression.

$$\frac{4x^4 - 8x^3 - 32x^2}{4x^2}$$

■ 6. Fill in the blank with the correct term.

$$4a^3b - 10ab^2 + \underline{\qquad} = 2ab(2a^2 - 5b + 3a^2b^2)$$

## QUADRATIC POLYNOMIALS

1. Factor the quadratic expression.

$$2x^2 + 2x - 12$$

2. What went wrong when the polynomial was factored?

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

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

3. Factor the quadratic expression.

$$x^2 + 3x - 28$$

4. Factor the quadratic expression.

$$x^2 - 9x + 18$$

5. Fill in the blank with the correct term.

$$5x^2 - 40x + 60 = \_\_\_(x - 2)(x - \_\_\_)$$

6. Factor the quadratic expression.

$$x^2 - x - 2$$

## DIFFERENCE OF SQUARES

1. Factor the expression.

$$4y^2 - 36$$

2. What went wrong when the polynomial was factored?

$$9a^4 - 25b^2$$

$$(9a^2 - 25b)(9a^2 + 25b)$$

3. Factor the expression.

$$49x^6y^2 - 36z^4$$

4. Fill in the blank with the correct term.

$$\_\_\_\_\_ - 25y^2 = (2xz^2 - 5y)(2xz^2 + 5y)$$

5. Factor the expression.

$$2x^2 - 288$$

6. Factor the expression.

$$5a^3 - 20ab^2$$

## ZERO THEOREM

1. Find the zeros of the function.

$$y = x^2 - 5x + 6$$

2. Find the zeros of the function.

$$y = x^2 - 4x - 5$$

3. Find the $x$-intercepts.

$$f(x) = x^2 + 10x + 24$$

4. Find the $x$-intercepts.

$$f(x) = x^2 - 7x + 6$$

5. Use the Zero Theorem to find the solutions to the quadratic equation.

$$4x^2 - 16 = 0$$

6. Use the Zero Theorem to find the solutions to the quadratic equation.

$$25 - 9x^2 = 0$$

## COMPLETING THE SQUARE

1. Solve for $x$ by completing the square.

$$x^2 - 6x + 5 = 0$$

2. Fill in the blank with the correct term.

$$x^2 - \underline{\qquad} + \frac{9}{4} = -2 + \frac{9}{4}$$

3. Complete the square but don't solve for the roots.

$$y^2 - 4y + 1 = 0$$

4. Solve for $y$ by completing the square.

$$y^2 + 3y = 1$$

5. Solve for $x$ by completing the square.

$$x^2 + 6x + 11 = 0$$

6. Solve for $x$ by completing the square.

$$2x^2 + 8x + 35 = 0$$

## QUADRATIC FORMULA

1. Write the quadratic formula for the following quadratic equation.

$$x^2 - 5x - 24 = 0$$

2. What went wrong in the way the quadratic formula was applied?

$$3x^2 - 5x + 10 = 0$$

$$x = \frac{-5 \pm \sqrt{(-5)^2 - 4(3)(10)}}{2(3)}$$

3. Solve for $z$ using the quadratic formula.

$$z^2 = z + 3$$

4. Fill in the blank with the correct term if the quadratic formula below was built from the quadratic equation.

$$\_\_\_\_ x^2 + 3x - 5 = 0$$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(-2)(-5)}}{2(-2)}$$

5. What went wrong if the quadratic formula below was built from the quadratic equation?

$$x^2 + 2x = 7$$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(7)}}{2(1)}$$

6. Solve for $t$ using the quadratic formula.

$$4t^2 - 1 = -8t$$

## CARTESIAN COORDINATE SYSTEM

1. Graph the point $(-2,3)$ in the Cartesian plane.

2. In which quadrant should we plot the point $(1,6)$?

3. What is the $y$-coordinate of any point that lies on the $x$-axis? Give an example of a coordinate point that lies on the $x$-axis.

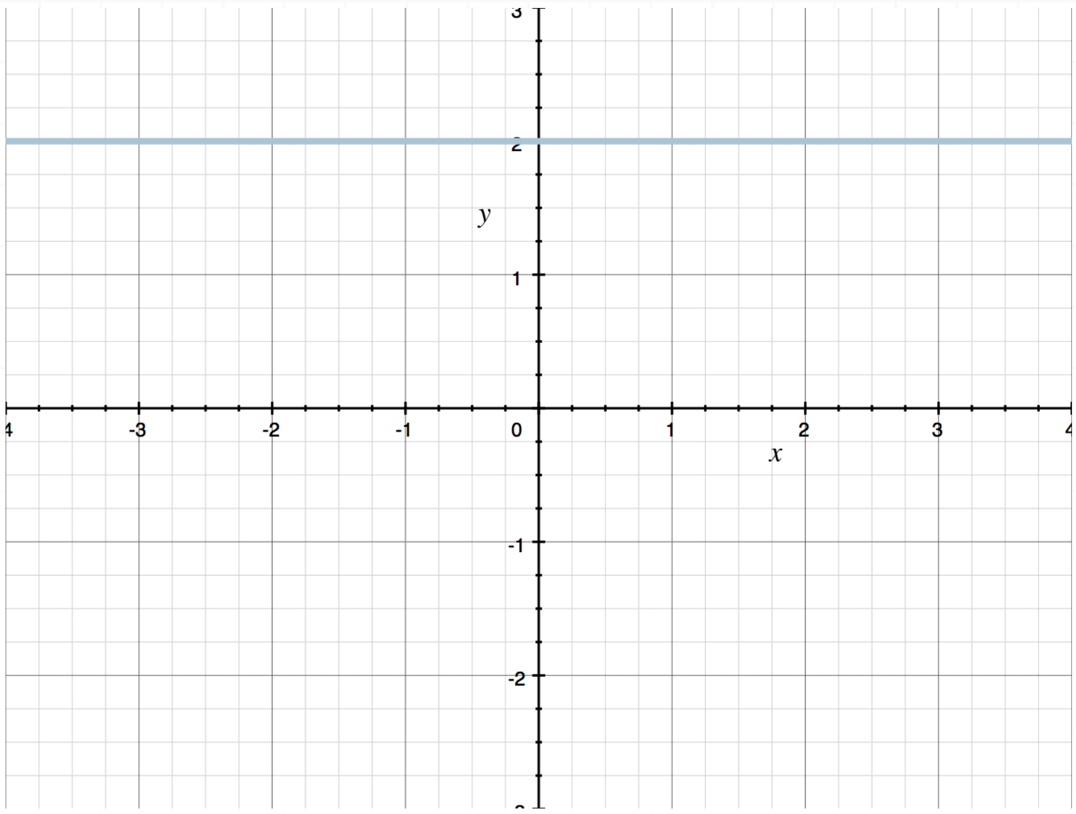
4. Graph the point $(-1,-5)$ in the Cartesian plane.

5. In which quadrant should we plot $(3,-7)$?

6. What is the $x$-coordinate of any point that lies on the $y$-axis? Give an example of a coordinate point that lies on the $y$-axis.

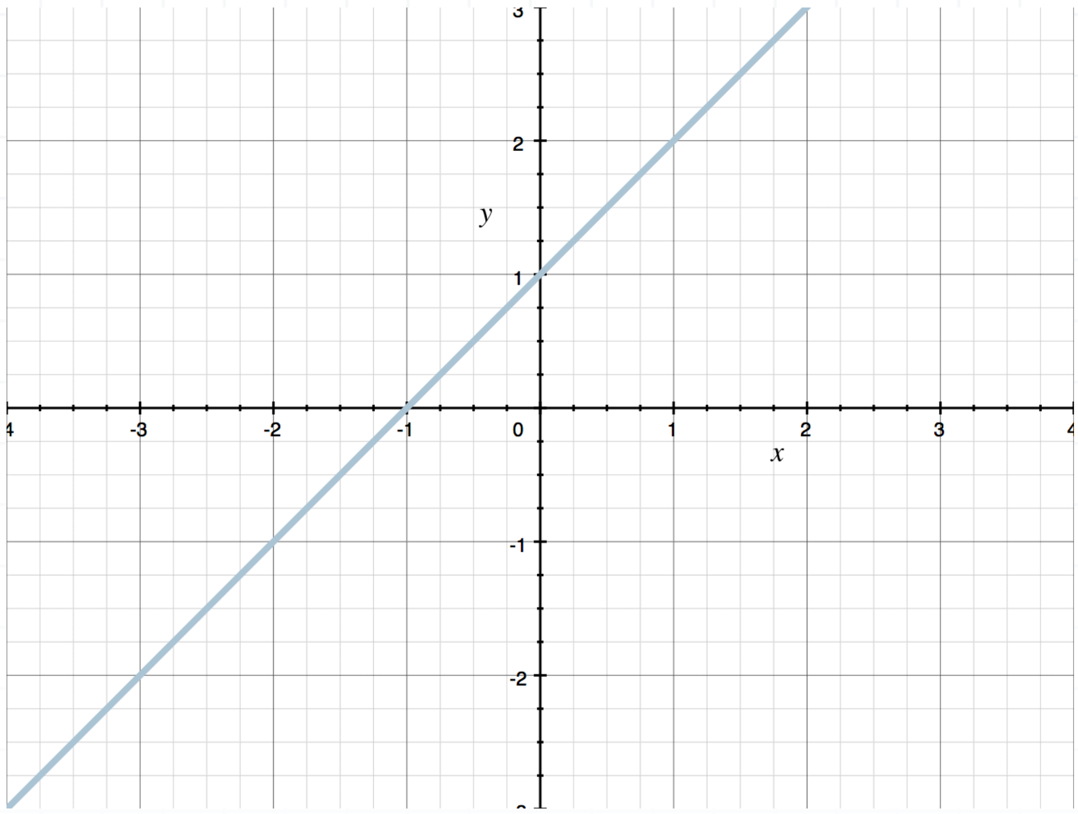
## SLOPE

1. What is the slope of the line?



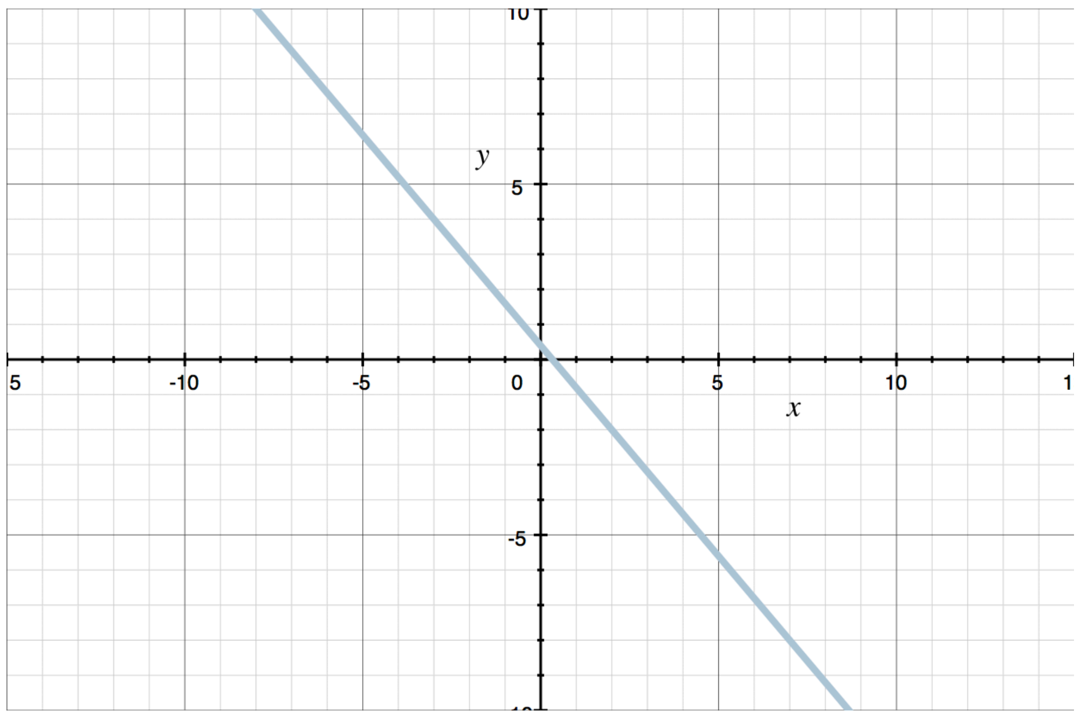

2. What direction is an undefined slope: horizontal or vertical? Use the formula for the slope to explain why.

3. What is the slope of the line?




4. What is the slope of the line that passes through the points $(-1,3)$ and $(4,-7)$?

5. What is the slope of the line?



6. Find the slope of the line that passes through $(3,5)$ and $(-1,5)$.

## POINT-SLOPE AND SLOPE-INTERCEPT FORMS OF A LINE

1. Find the equation of the line that passes through $(3,0)$ with slope $-2$.

2. Find the equation of the line that passes through the points $(-2,3)$ and $(2,-4)$.

3. Find the equation of the line that passes through the points $(5,-4)$ and $(6,0)$.

4. Identify the $y$-intercept and slope $m$ defining the line.

$$y=-\frac{1}{4}(x+12)$$

5. Convert the point-slope equation into a slope-intercept equation.

$$y-3=\frac{1}{3}(x-6)$$

6. Find the equation of a line that passes through the points $(1,-1)$ and $(0,3)$. Write the solution in slope-intercept form.

## GRAPHING LINEAR EQUATIONS

1. Graph the line.

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

2. Describe how we would use the slope to find another point on the line if the slope is $m = 2/3$ and the line passes through $(x_1, y_1) = (-1,2)$.

3. Graph the line.

$$y + 2 = -3x + 1$$

4. Use the slope $m = 1/3$ to find two more points on the line passing through $(1,2)$. Move right to determine one point and left to determine another.

5. Graph the line.

$$y = -2(3x + 1)$$

6. Give two points that lie on the line, find the slope, and graph the line.

$$y + 3 = -\frac{1}{2}(4x + 10)$$

## FUNCTION NOTATION

■ 1. Find and simplify $f(x+1)$ if $f(x)=4x-5$.

■ 2. What went wrong in this set of steps?

Evaluate $f(x)=x^2+1$ at $x=-2$.

$$f(-2)=-2^2+1$$

$$f(-2)=-4+1$$

$$f(-2)=-3$$

■ 3. Find and simplify $h(s^2)$ if $h(s)=-s^2+3s-1$.

■ 4. If $g(x)=x^3-x+1$, what do we need to plug into the function in order to get the following expression?

$$g(??)=(2x+1)^3-(2x+1)+1$$

■ 5. Find the value of the expression if $f(x)=x^2+x-1$.

$$\frac{f(x+h)-f(x)}{h}$$

6. What went wrong in this set of steps?

Find $f(1)$ if $f(x) = x^3 + 3x^2 - 5x + 2$.

$$f(1) = 1^3 + 3(1)^2 - 5(1) + 2$$

$$f(1) = 1 + 9 - 5 + 2$$

$$f(1) = 7$$

## DOMAIN AND RANGE

1. Find the domain of $f(x)$.

$$f(x) = \frac{3}{x(x+1)} + x^2$$

2. Find the domain and range of the point set.

$$(-1, -3), \quad (0,5), \quad (-3,6), \quad (0, -3)$$

3. Find the domain and range of $g(x)$.

$$g(x) = \frac{\sqrt{x-2}}{3}$$

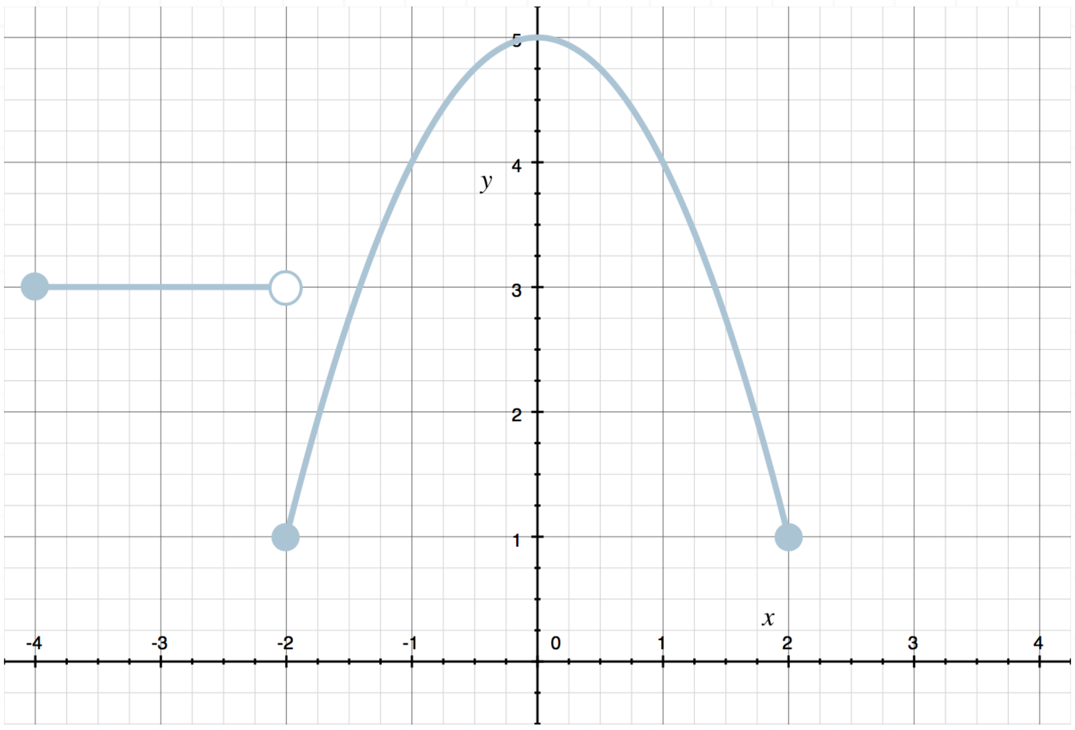
4. Find the domain and range of the function.

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

5. Find the domain and range of $g(x)$.

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

6. What is the domain and range of the graph? Hint: An empty circle indicates that exact point *is not* included as part of the graph, while a solid circle indicates that exact point *is* included as part of the graph.



## TESTING FOR FUNCTIONS

1. Determine whether or not the point set represents a function.

$$(2,-1),\ (-1,0),\ (0,-1),\ (3,2)$$

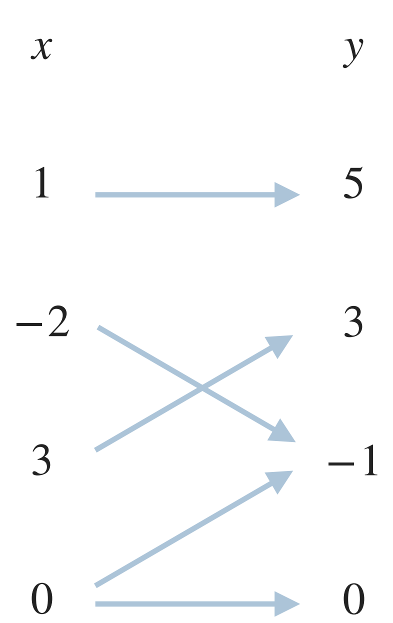
2. Fill in the blanks in the definition of a function.

For every __________, there is only one unique __________.

3. Determine whether or not the point set represents a function.

$$(1,2),\ (-1,5),\ (1,-3),\ (0,1)$$

4. Determine whether the mapping represents a function.



5. Determine algebraically whether or not the equation represents a function.

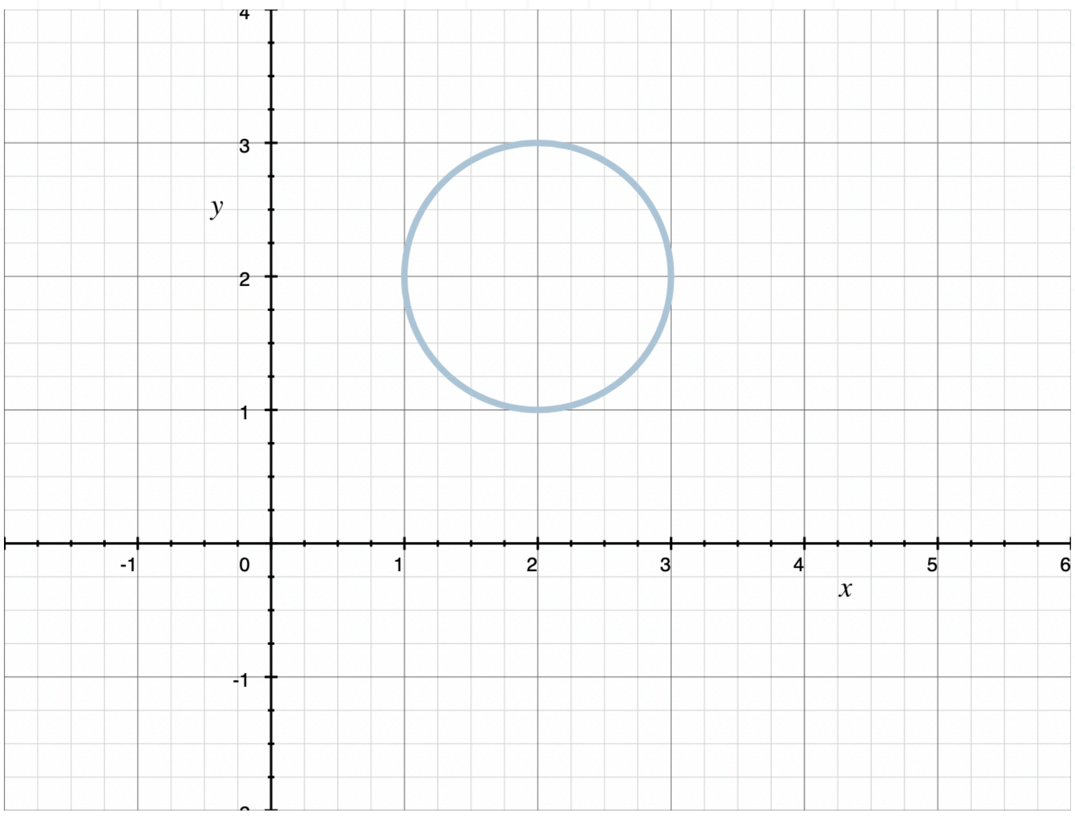
$$(x-1)^2 + y = 3$$

6. Determine algebraically whether or not the equation represents a function.

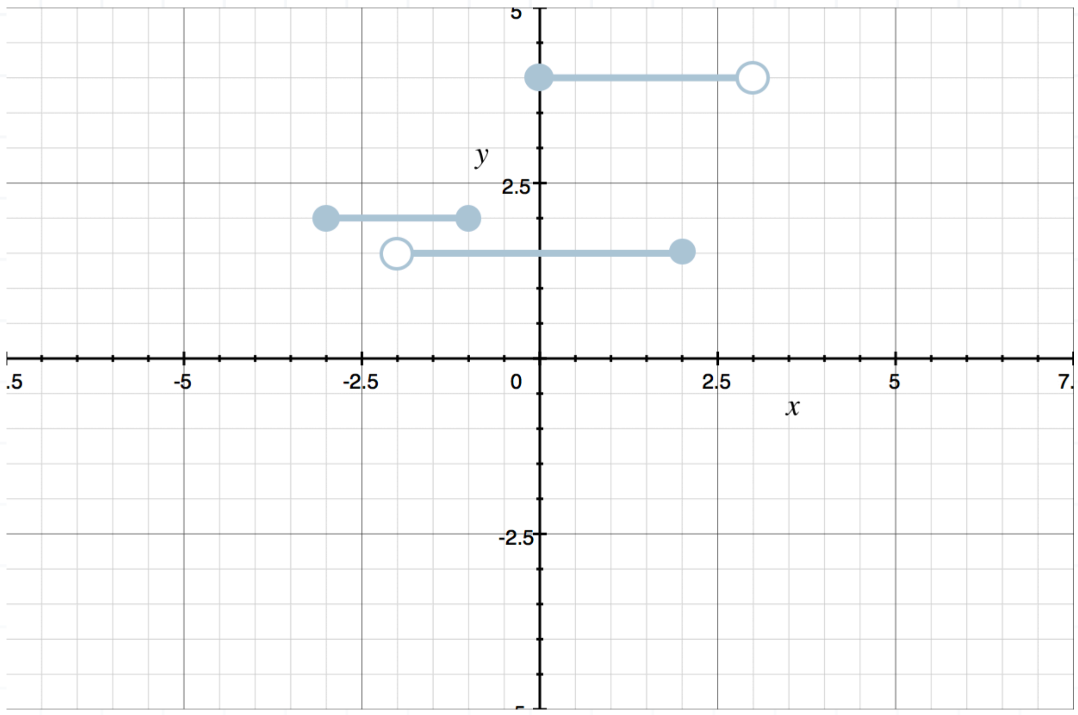
$$y^2 = x + 1$$

# VERTICAL LINE TEST

1. Use the Vertical Line Test to determine whether or not the graph is the graph of a function.




2. Use the Vertical Line Test to determine whether or not the graph represents a function. Hint: an empty circle indicates that exact point isn't included in the graph, where a solid circle indicates that exact point is included in the graph.



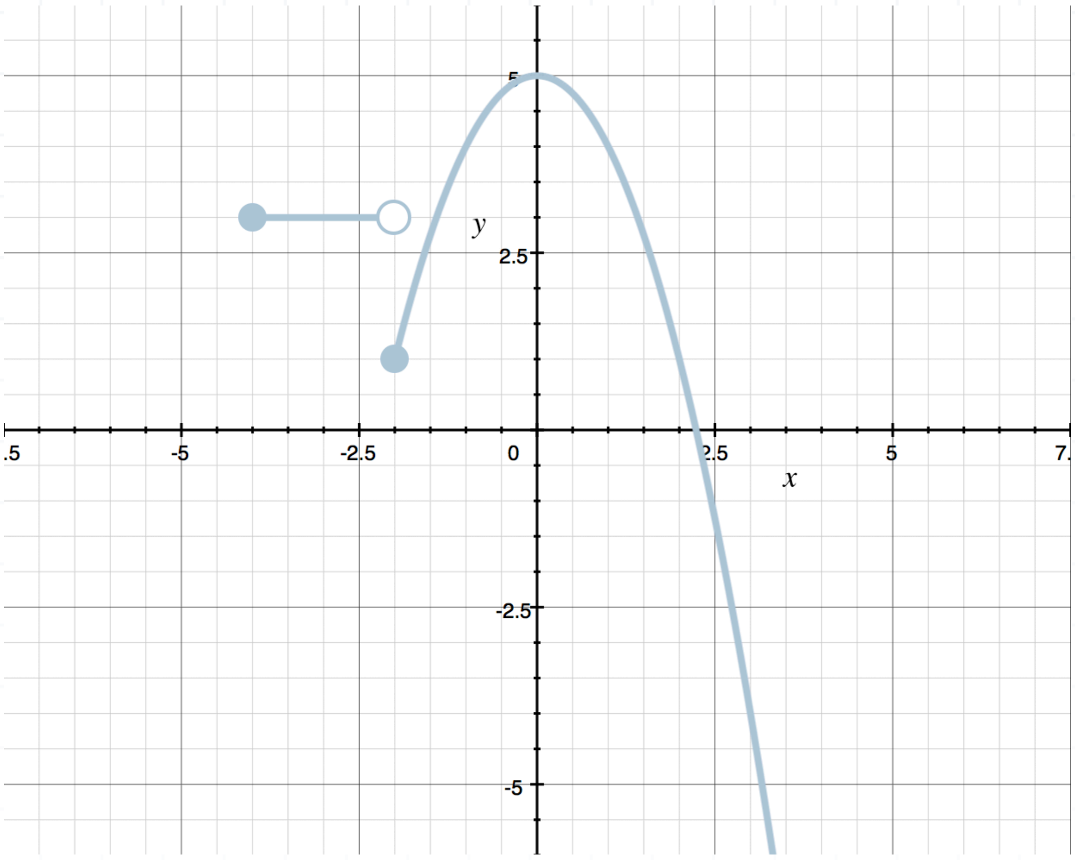

3. Explain why the Vertical Line Test can determine whether or not a graph represents a function.

4. Fill in the blanks using the words “equations” and “functions.”

Not all ___________ are ___________.

5. Draw a graph that represents a function, and explain why it’s a function.

6. Determine whether or not the graph represents a function. Hint: an empty circle indicates that exact point isn’t included in the graph, where a solid circle indicates that exact point is included in the graph.



y
x
5
2.5
-2.5
-5
.5
-5
-2.5
0
2.5
5
7.

## SUM OF FUNCTIONS

1. Find $(f+h)(-1)$ if $f(x)=x^2+1$ and $h(x)=2x-2$.

2. Find and simplify $(h+g)(x)$ if $g(x)=x^2+3x-1$ and $h(x)=-2x^2+4x-5$.

3. If $f(-2)=6$, $g(-2)=-3$, and $h(-2)=4$, find $(f+g+h)(-2)$.

4. Find $f(x)$ and $g(x)$.

$$(f+g)(x)=(-x^2+3x+2)+(x-7)$$

5. Let $a(x)=x^3-x^2+x-1$ and $b(x)=-x^3+x^2+x-1$. Determine the value of $(a+b)(-1)$.

6. If $f(0)=3$ and $(f+g)(0)=8$, find $g(0)$.

## PRODUCT OF FUNCTIONS

1. Find and simplify $(ab)(x)$ if $a(x) = x + 3$ and $b(x) = 5x - 4$.

2. Find $(fg)(-1)$ if $f(x) = x^2 + 3$ and $g(x) = x - 5$.

3. If $g(0) = -2$ and $(gh)(0) = -14$, find $h(0)$.

4. Given the expanded expression, determine $f(x)$ and $g(x)$.

$$(gf)(x) = x^2(x - 7) - x(x - 7) + 5(x - 7)$$

5. Find $(fh)(5)$ if $f(x) = -x^2 + 2x$ and $h(x) = 2x + 7$.

6. Find and simplify $(gh)(x)$ if $g(x) = x^2 + 1$ and $h(x) = 2x^2 + 3$.

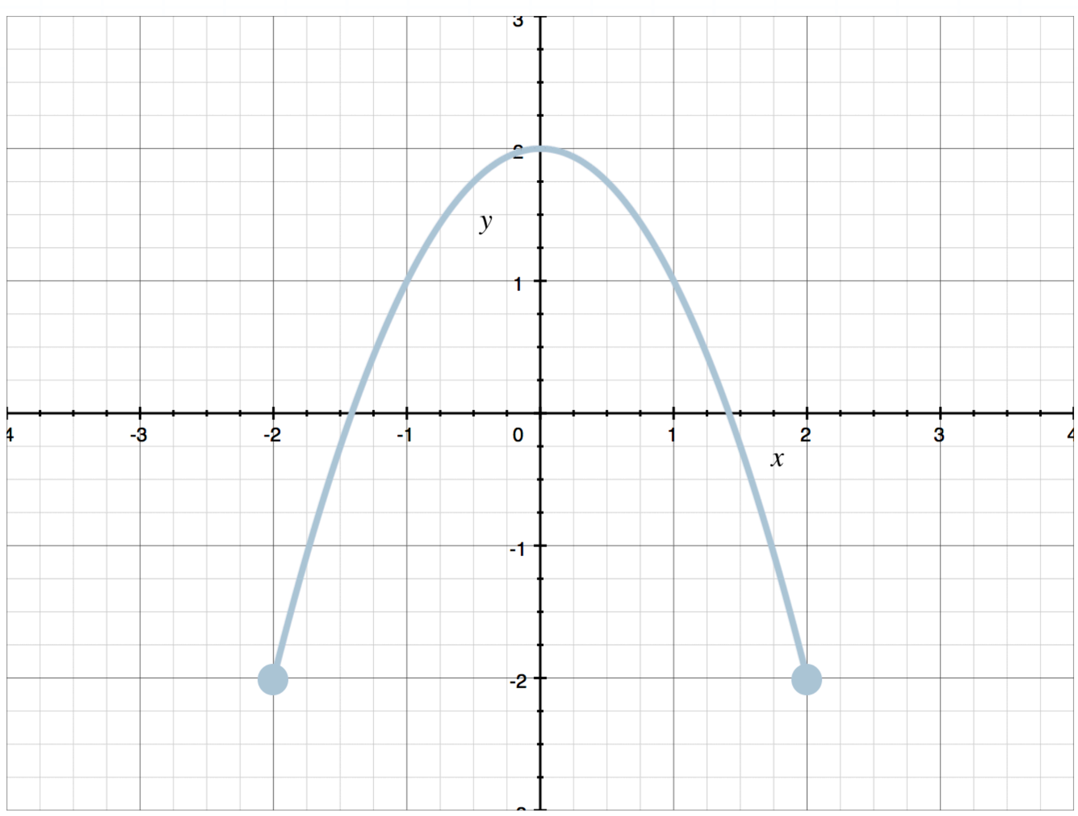
## EVEN, ODD, OR NEITHER

1. Is the function even, odd, or neither?

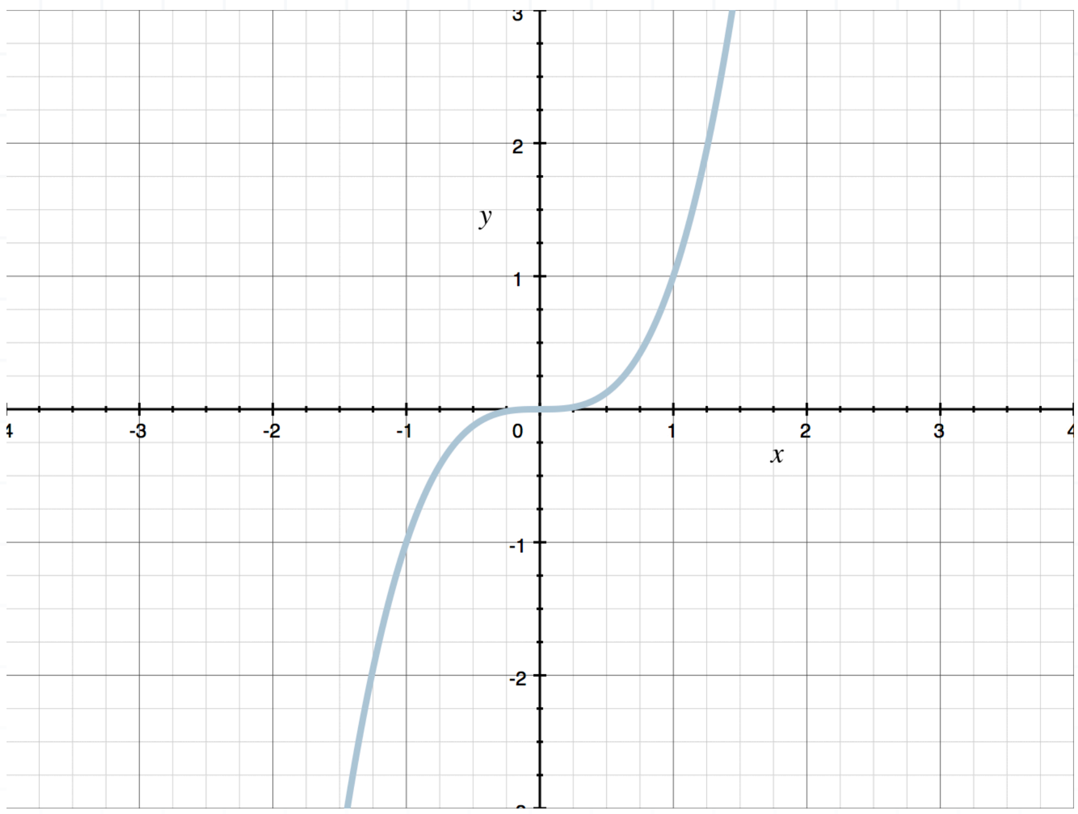
$$f(x) = -x^5 + 2x^2 - 1$$

2. Describe the symmetry of an even function, and give an example of an even function.

3. Determine whether the graph represents a function that's even, odd, or neither.



4. Determine whether the graph represents a function that's even, odd, or neither.




5. Is the function even, odd, or neither?

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

6. Is the function even, odd, or neither?

$$(-2,3),\ (-1,0),\ (0,-1),\ (1,0),\ (2,3)$$

## TRICHOTOMY

1. Solve the inequality.

$$2(x+1) \nleq -(8-x)$$

2. Give two ways to write the sentence in mathematical notation.

"$x^2$ is not greater than $4y$ and is also not equal to $4y$."

3. Give the three possible relationships in the Law of Trichotomy.

4. Find a way to express the relationships as one equality or inequality.

$x^2+x \nless 2$ and $x^2+x \ngtr 2$

5. Give two ways to write the statement in mathematical notation.

"$3(x+1)$ is not less than $-x-5$ and is also not equal to $-x-5$."

6. Solve the statement.

$-3(1-x) \ngtr 3(7-x)-2x$ and $-3(1-x) \nless 3(7-x)-2x$

## INEQUALITIES AND NEGATIVE NUMBERS

■ 1. Solve the inequality.

$$-3x + 4 < 22$$

■ 2. What went wrong in this set of steps?

$$-5x + 6 < 9 - 2x$$

$$-3x < 3$$

$$x < -1$$

■ 3. Solve the inequality.

$$-(5 - 2x) \geq 3(x - 3) + 2x$$

■ 4. Solve the inequality.

$$-6x + 7 > -3x + 2$$

■ 5. What went wrong in this set of steps?

$$-2(x + 1) \geq 3(2 + x)$$

$$-2x - 2 \geq 6 + 3x$$

$$-2x - 3x - 2 \leq 6$$

6. Solve the inequality.

$$7(1 - x) \leq 2x$$

## GRAPHING INEQUALITIES ON A NUMBER LINE

1. Give two inequalities that, when graphed on a number line, have open circles at $x = 3$.

2. Graph the inequality on a number line.

$$-2x < 4$$

3. Graph the inequality on a number line.

$$x - 1 \geq 3$$

4. Graph the inequality on a number line.

$$5(-x + 3) < -3x + 7$$

5. What's wrong with this graph of $x > 1$?

6. Graph the inequality on a number line.

$$5(x+7)-x \geq 3(x+10)+6$$

## GRAPHING DISJUNCTIONS ON A NUMBER LINE

1. What's wrong with the graph of the disjunction?

$2x \leq 4$ or $x - 5 > 3$


2. Graph the disjunction.

$x + 2 \geq 2x + 3$ or $x - 5 \geq 0$

3. Graph the disjunction of the inequalities.

$2(x - 3) + x < 2x + 1$ or $2(x - 1) - 6 > 6$

4. What's wrong with the graph of the disjunction?

$-x + 3 < 5$ or $-2(x + 2) \geq 2$

5. Graph the disjunction.

$2x + 3 \geq 3$ or $2x + 5 < x$

6. Graph the disjunction.

$-2x + 5 \geq -1$ or $x - 6 > -2$

## GRAPHING CONJUNCTIONS ON A NUMBER LINE

■ 1. Graph the conjunction of the inequalities $3(x-4)<x-2$ and $-2(x-6)+3\geq 5$.

■ 2. Graph the conjunction.

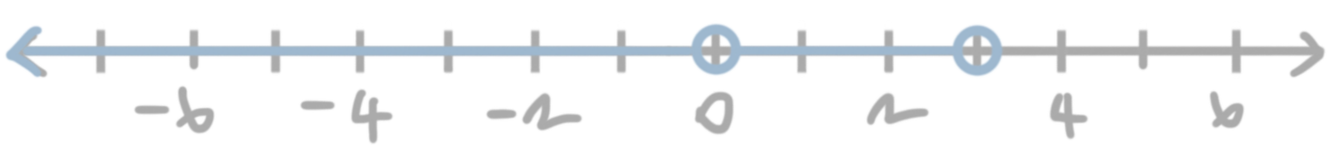
$$-8\leq -2x<10$$

■ 3. What's wrong with the graph of the conjunction?

$x\leq 3$ and $x>-4$

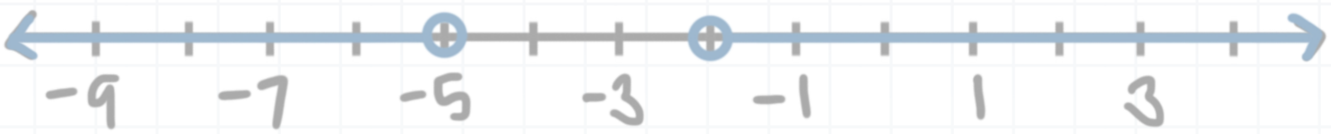

■ 4. What's wrong with the graph of the conjunction?

$x\leq 3$ and $x\neq 0$




■ 5. What's wrong with the graph of the conjunction?

$x < -2$ and $x > -5$




## 6. Graph the conjunction.

$2x - 1 \geq 3$ and $-x \geq -9$

## GRAPHING INEQUALITIES IN THE PLANE

1. Graph the inequality in the Cartesian coordinate plane.

$$x \leq 5$$

2. Graph the inequality in the Cartesian coordinate plane.

$$y < -2x + 4$$

3. Graph the inequality in the Cartesian coordinate plane.

$$y \geq -\frac{1}{3}x + 5$$

4. Graph the inequality in the Cartesian coordinate plane.

$$y \leq x - 1$$

5. Graph the inequality in the Cartesian coordinate plane.

$$y > \frac{1}{2}x - 3$$

6. Graph the inequality in the Cartesian coordinate plane.

$$y \geq 3x - 2$$

## ABSOLUTE VALUE EQUATIONS

1. Solve $|3 - x| = 1$.

2. Solve $|4x - 8| = 3x - 6$.

3. Solve $|2x - 2| = x - 6$.

4. Solve $|3x + 1| + x = 1$.

5. Solve $|2x + 5| = 3x + 6$.

6. Solve $|3x + 2| = |3x + 4|$.

## ABSOLUTE VALUE INEQUALITIES

1. Rewrite the inequality by taking away the absolute value.

$$|3x-7|\geq 2$$

2. Graph the inequality.

$$5|1-x|-7<3$$

3. Graph the inequality.

$$2(|x-4|-1)+6\leq 4$$

4. Graph the inequality.

$$-2|x+2|-3\geq 1$$

5. Graph the inequality.

$$2(3+|x-5|)-4\geq 10$$

6. Graph the inequality.

$$|6 - 2x| \leq 4$$

## TWO-STEP PROBLEMS

1. Why can't we solve this two-step problem?

If $2(x-1)-3=9+x$, what is $y+2$?

2. If $5-2x=17$, what is $x-1$?

3. If $3(2-x)+5=-(4x-2)$, what is $(x/2)+1$?

4. If $2(x+y)-6=3$, what is $x+y-1$?

5. What went wrong in this solution?

If $2x+3=7$, what is $x/3$?

$$2x+3=7$$

$$2x=4$$

$$\frac{x}{3}=\frac{4}{3}$$

6. If $a + 2b = 6 - a$ and $b = 1$, what is $a/2$?

## SOLVING SYSTEMS WITH SUBSTITUTION

1. Find the unique solution to the system of equations.

$$-x + 2y = 6$$

$$3x = y - 10$$

2. What is the easiest variable to get by itself? Set up but do not solve the substitution.

$$2y - x = 7$$

$$3x = 9 - 18y$$

3. Find the unique solution to the system of equations.

$$-5x + y = 8$$

$$y = 3x - 8$$

4. Find the unique solution to the system of equations.

$$3 - y = 2x$$

$$-4x + 10 = 2y$$

5. What went wrong if a substitution was made in the system and the result was $2x-2-x=7$?

$$y=x-2$$

$$2y-x=7$$

6. Find the unique solution to the system of equations.

$$5y=6-2x$$

$$6x+15y=18$$

## SOLVING SYSTEMS WITH ELIMINATION

1. What's the easiest way to set up the elimination method for the system of equations? Set up but do not solve the elimination.

$$6y - 3x = 8$$

$$x - 4y = 5$$

2. Find the unique solution to the system of equations.

$$2x - y = 5$$

$$-3x + y = 7$$

3. What went wrong if an elimination was done in the system and the result was $2y = 3$?

$$-4x + 3y = 7$$

$$-4x - y = 4$$

4. Find the unique solution to the system of equations.

$$x = 2y - 5$$

$$-3x + 6y = 15$$

5. Find the unique solution to the system of equations.

$$4 - 2x = 6y$$

$$7 = x + 3y$$

6. Find the unique solution to the system of equations.

$$x = 2y - 8$$

$$3y = x + 5$$

## SOLVING SYSTEMS THREE WAYS

1. Explain why using the graphing method would make the system easy to solve.

$$y = 3x - 4$$

$$y - 3 = 2(x + 1)$$

2. Find the unique solution to the system of equations using the elimination method.

$$2y = x + 5$$

$$3x - 2y = 11$$

3. In words, describe the graphical solution to a system of equations.

4. Find the unique solution to the system of equations using the substitution method.

$$5y + x = 4$$

$$3y - 3x = 6$$

5. Explain why the elimination method is a good way to solve this particular system.

$$3y - 2x = 7$$

$$2x = 4 - 6y$$

6. Find the unique solution to the system of equations using the graphing method.

$$y - 2 = -(x + 1)$$

$$y = x + 1$$

## SYSTEMS OF LINEAR INEQUALITIES

1. Graph the solution to the system of linear inequalities.

$$y > x + 1$$

$$y \leq 5 - x$$

2. Graph the solution to the system of linear inequalities.

$$2x + 2y \geq 4$$

$$y > -1$$

3. Graph the solution to the system of linear inequalities.

$$x + 3y + 3 \geq 0$$

$$3x + y + 1 \geq 0$$

4. Graph the solution to the system of linear inequalities.

$$y > 2x$$

$$x > 2y$$

5. Graph the solution to the system of linear inequalities.

$$2y + 3x \geq -4$$

$$x > y - 1$$

6. Graph the solution to the system of linear inequalities.

$$4x - 2y - 4 \geq 0$$

$$y \geq 2x - 2$$