Algebra 1 Workbook

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MATH

IDENTIFYING MULTIPLICATION

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

2. Simplify the following expression.

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

3. What number would make the expression true?

$$4 \times 3(1)(?? \cdot 1) = 24$$

4. What term would make the expression true?

$$??(3 \cdot x) \times (5)(2) = 60x^2$$

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

6. If $(3)(x^2) = 10 \times 2$, what does $9x^2$ equal?

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THE ASSOCIATIVE PROPERTY

1. Give an example of an expression that demonstrates the associative property with multiplication.

2. What are the two main operations that the associative property works for?

3. Using the associative property, rewrite and simplify $2 \times (3 \times 4)$.

4. According to the associative property, what number would make the most sense in the expression?

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

5. What does the word “associate” refer to in math?

6. Rearrange $(3 + 6) + 2$ using the associative property, then simplify.

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7. Give an example of an expression that demonstrates the associative property with addition.

8. What number would make the following expression true?

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

9. Give an example of an expression that does not demonstrate the associative property.

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THE 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 with multiplication.

3. According to the commutative property, what number would make the most sense in the expression?

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

4. Using the commutative property, rewrite 3×4 and then simplify.

5. Rearrange $(3 + 6) + 2$ using the commutative property and then the associative property.

6. Give an example of an expression that demonstrates the commutative property with addition.

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7. What number would make the following expression true?

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

8. What are the two main operations that the commutative property works for?

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THE TRANSITIVE PROPERTY

1. If $AB = CD$ and $CD = EF$ then what is the value of EF?

2. If $x = 2$ and $y = x$, then what does the transitive property tell us?

3. According to the transitive property, if $x = 2y$ and $2y = 5z$, then what is the value of x?

4. Give an example that demonstrates the transitive property.

5. Use the transitive property to solve for z.

$$x = y$$

$$y = 3 - z$$

$$x = -2z + 7$$

6. Transitive comes from the word “transit,” which means, to what?

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7. By the transitive property, what expression would make the following statement true?

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

8. Use the transitive property to solve for x.

$y = 2x + 3$

$y = z$

$z = 5x - 9$

9. According to the transitive property, what expression would make the most sense in the following statement?

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

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THE DISTRIBUTIVE PROPERTY

1. Use the distributive property to solve for x.

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

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. What three main operations are used in the distributive property?

5. What does distributing remove from the expression?

6. Use the distributive property to solve for x.

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

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7. What value would make the following expression true?

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

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THE DISTRIBUTIVE PROPERTY WITH FRACTIONS

1. Perform the indicated operation and then simplify.

$$\frac{4y^3z^2}{3x} \times \frac{x^2y}{2z^2}$$

2. Use the distributive property to expand the expression.

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

3. Fill in the blank with the correct words: When we are distributing fractions, we multiply the outside numerator with the _____ of the terms inside the parentheses and the outside denominator with the _____ of the inside terms.

4. Use the distributive property to solve for x.

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

5. Use the distributive property to show that $x = -10$.

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$$\frac{2}{3}\left(\frac{x}{2}-6\right)=4\left(\frac{x}{3}+\frac{3}{2}\right)$$

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

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

7. What term would make the following expression true?

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

8. What term would make the following expression true?

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

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THE DISTRIBUTIVE PROPERTY AND BINOMIAL MULTIPLICATION

1. Perform the indicated operation and simplify.

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

2. How many terms does a binomial have?

3. Use the distributive property to expand the expression.

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

4. What term would make the following expression true?

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

5. Use the distributive property to show that $x = 3$.

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

6. Explain why $(x-2)(x+1) \neq x^2 - 2$.

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7. Use the distributive property to expand the expression.

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

8. What term would make the following expression true?

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

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GROUPING SYMBOLS WITH PEMDAS AND ORDER OF OPERATIONS

1. Write the expression with parentheses.

$$\frac{a}{b+c}$$

2. Simplify the expression.

$$2\left([3+1]-4\right)-[6+3]$$

3. Put in grouping symbols that will make the equation true.

$$2\ x+1\ /\ 3+5\ x-2=\frac{2(x+1)}{3+5x-10}$$

4. Simplify the expression.

$$|2(1-4)|-(2-5)\left[(-1)(3+2)+9\right]$$

5. What number would make the expression true?

$$(3+1)\left[2(??-5)+7\right]-|(4-6)|=4\left[-2+7\right]-|-2|$$

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6. Give three different examples of a grouping symbol.

7. Rewrite the following as a fraction.

$$[2(x+1)-3]/[5x-3(4x)]$$

8. Simplify the following expression.

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

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

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

10. Use the order of operations to simplify the expression.

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

11. What do the letters in PEMDAS stand for?

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12. What number would make the equation true?

$$2^2 + 4 \cdot \left[(2 - ??) \div |-4|\right] = 4 + 4 \cdot \left[1 \div 4\right]$$

13. Use the order of operations to simplify the expression.

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

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

15. Put symbols of inclusion that make the equation true.

$$4 - 5\ 3\ x + -1^2 = 4 - 15x - 5$$

16. What operations must be performed before multiplication and division?

17. Using the order of operations, explain why $\sqrt{(2+7)} \neq \sqrt{2} + \sqrt{7}$.

18. Simplify this expression.

$$3\{2[4 + 3(7 - 5) - 4]\}$$

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19. Use the order of operations to simplify the expression.

$$3 + 2(x + 1)$$

20. Use order of operations to simplify the expression.

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

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UNDERSTOOD 1

1. What is $x + 4x + x + x$?

2. What happens when you multiply something by 1?

3. Simplify the following expression.

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

4. What number would make the expression true?

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

5. Simplify the following expression.

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

6. Simplify the following expression.

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

7. Give an example of an expression where it would be useful to write out the understood 1.

8. Simplify the following expression.

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

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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. In your own words, what does it mean to "evaluate an expression"?

3. Find the value of x in $x + 1 = y - 2z$, 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 following expression.

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

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INVERSE OPERATIONS

1. Use inverse operations to solve for x in $3x = 5$.

2. What is the inverse operation of division?

3. Using division and multiplication, write two ways that we can solve for x.

$$\frac{1}{5}x = 10$$

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.

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

6. Using inverse operations, solve for x.

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$$2x^2 = 8$$

7. What went wrong in the following set of steps?

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

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

$$x = -9$$

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SIMPLE EQUATIONS

1. Solve for x.

$$2x - 5 = 11$$

2. If $x = 16$, what number would make the following equation true?

$$x - ?? = 11$$

3. Solve for x.

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

4. What went wrong in the following set of steps?

$$2x - 11 = -3$$

$$2x = 8$$

$$x = 16$$

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BALANCING EQUATIONS

1. How would you solve for x in the following equation?

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

2. What is the next step in balancing the following equation? In words, explain why.

$$2x - 3 = 5x$$

3. Solve for x in the following equation.

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

4. What when wrong in the following steps?

$$-2x + 3 = 3x$$

$$-2x + 3 - 2x = 3x - 2x$$

$$3 = x$$

5. What missing term makes sense in the following series of steps?

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$-3(4-10x)+2=5x$

$-12+30x+2=5x$

$-10+\ ??=5x$

6. Solve for x in the following equation.

$(x-1)+2(3x+1)=-4(1-x)+9$

7. What would be your next step in balancing the equation? Explain why.

$2x-6+5x+10=11-3x+x+4$

8. Solve for x in the following equation.

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

9. What missing equation would make the solution true?

$-2(4-x)=5(-3x+1)+7$

$-8+2x=-15x+12$

$?????=???????$

$17x=20$

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$$x = \frac{20}{17}$$

10. Explain what's incorrect in the following set of steps.

$$2x - 1 = 4 - 3x$$

$$1 - 4 = -3x - 2x$$

11. What number would make the following true?

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

$$??x = -15$$

12. Solve for x in the given equation.

$$5 - x = 17 - 4x$$

13. What went wrong in the following set of steps?

$$-4 - x - 2x = 5x - 11$$

$$-4 - 3x = 5x - 11$$

$$-15 = 8x$$

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14. If $x = -2$, solve for y in the given equation.

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

15. What missing equation would make the solution true?

$$6x - 13 + 5x = -x + 9$$

$$11x - 13 = -x + 9$$

$$12x - 13 = 9$$

$$?? = ??$$

$$x = \frac{22}{12}$$

16. What missing value would make the following true?

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

$$2y + 5 = ??x + 3$$

17. If $y = -3$, solve for x in the given equation.

$$2x - (x + y) = 5y - x + 7$$

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18. Solve for y in the given equation.

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

19. Solve for the variable by keeping the equation balanced.

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

20. Solve for the variable.

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

21. Solve the equation.

$$4x - 3 = 17$$

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SIMPLE EQUATIONS WITH SUBSCRIPTS

1. Give three different examples of the variable Y with a subscript.

2. 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.

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

3. Solve for P_2 in the following equation.

$$P_1 R + \frac{P_2}{V} = d$$

4. The profit function for a The Coat Company is given by $P = Rx - C_1 - C_2 x$, where P is the profit, R is the selling price, C_1 is the fixed cost, C_2 is the variable cost, and x is the total number of coats sold. What is the selling price R when $P = 114$, $C_1 = 550$, $C_2 = 3.50$, and $x = 16$?

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5. Give an example of a subject besides math that uses variables with subscripts.

6. The volume of the medium size box at the post office is given by

$$V = x_1 \times \frac{x_2}{2} \times \frac{x_3}{9}$$

where V is the volume of the box, x_1 is the length, $x_2/2$ is the width, and $x_3/9$ is the height. Find the height of the box that has a volume of 120 in^3, a length of 4 in, and a width of 5 in.

7. Solve for x_1 in the following equation.

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

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

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

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EQUATIONS WITH PARENTHESES

1. Simplify the following expression.

$-(2x^0 + 3^0y) - 3y + x$

2. Solve for x in the given equation.

$2(x - 1) - 5(7 + 2x) = -(6 - x)$

3. Simplify $-(2x^2y)^0$.

4. Simplify $-2x^2y^0$.

5. Solve for a in the given equation.

$-2(3^0 - a) + 3(a + 7) = -(a^0 + 1)$

6. What missing number would make the following true?

$-3(4^0x - 5) = 2x - (3 - x)$

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

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7. Write out the equation of the first step in solving the following for x.

$6(1-x)-3(2x+4)=-(5x+7)-10$

8. What went wrong in the following set of steps?

$-(6-2x)-3x=7(x-1)$

$-6-2x-3x=7x-7$

9. Solve of y in the given equation.

$-2^0(9-y)+3(3y-1)=4y^0+1$

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WORD PROBLEMS INTO EQUATIONS

1. Give three different words that mean “addition”.

2. Write 2×5 as a phrase using the word “product”.

3. Write the phrase as an algebraic expression.

Six more than three times a number

4. Find the value of the expression.

The quotient of 150 and 5

5. Write the phrase as an algebraic expression.

Half of five times a number

6. Write $8 - 3$ as a phrase using the word “less”.

7. Find the value of the expression.

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3 less than the product of 2 and 7

8. Give three different words that mean “subtraction.”

9. Find the value of the expression.

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

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CONSECUTIVE INTEGERS

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

2. Give an example of three consecutive negative integers.

3. Write the inequality sign that relates the two integers.

$-6 \qquad -10$

4. Write the previous four consecutive integers before -3.

5. Write the following numbers in ascending order (smallest to largest).

$-1 \qquad 0 \qquad -4 \qquad 2 \qquad -3$

6. Circle the numbers that are not integers.

$-10 \qquad \frac{6}{7} \qquad 3 \qquad 7.34 \qquad \frac{8}{4} \qquad 9.0$

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7. Write the following in descending order (largest to smallest).

$-11 \qquad -13 \qquad -5 \qquad 11 \qquad 3$

8. Give an example of two types of numbers that are not integers.

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ADDING AND SUBTRACTING LIKE TERMS

1. Give an example of like terms.

2. Simplify the expression.

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

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

4. Simplify the expression.

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

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MULTIPLYING AND DIVIDING LIKE TERMS

1. Simplify the expression.

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

2. Simplify the expression.

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

3. Simplify the expression.

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

4. Simplify the expression.

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

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ADDING AND SUBTRACTING POLYNOMIALS

1. What stays the same when adding and subtracting like terms?

2. Simplify the expression.

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

3. What went wrong in the following set of steps?

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

$$7x^3 + 7$$

4. What is the coefficient in the following expression?

$$5x^8$$

5. Simplify the expression.

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

6. What is the exponent in the following expression?

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$3z^8$

7. Simplify the expression.

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

8. What is the variable in the following expression?

$$-y^4$$

9. What went wrong in the following set of steps?

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

$$12 + 3x^6$$

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MULTIPLYING POLYNOMIALS

1. Expand the expression.

$$(2x - y)^2$$

2. What does FOIL stand for?

3. What went wrong in the following set of steps?

$$(a - 2)^2$$

$$a^2 - 4$$

4. Expand the expression.

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

5. Fill in the blank.

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

6. Expand the expression.

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

7. What went wrong in the following set of steps?

$(x - y)(x + y)$

$x^2 - 2xy - y^2$

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DIVIDING POLYNOMIALS

1. In words, what is the first question you should ask when solving the problem using long division?

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

2. Simplify the expression using polynomial long division.

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

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

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

$5x^4 - 3x^2 + x - 2 \;|\; x^2 + 1$

4. Given the following long division, write the answer as

$$\text{quotient} + \frac{\text{remainder}}{\text{divisor}}$$

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$$
\begin{array}{r}
3x-1 \\
\hline
x^2-3 \;\big|\; 3x^3-x^2+x-5 \\
-3x^3 \quad +9x \\
\hline
-x^2+10x-5 \\
x^2 \quad\quad -3 \\
\hline
10x-8
\end{array}
$$

5. Use long division to simplify the expression.

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

6. How would you rewrite the expression before starting the long division process?

$$(6x^3 - x + 7) \div (x + 1)$$

7. Set up but do not solve the following division problem.

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

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8. Simplify the expression using polynomial long division.

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

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MULTIPLYING MULTIVARIABLE POLYNOMIALS

1. Why can we not add the following two terms?

$$2x^3y + x^3y^2$$

2. Simplify the expression.

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

3. What went wrong in the following set of steps?

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

$$-2x^2 - bx - 6bx + 3b^3$$

4. Simplify the expression.

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

5. Fill in the blanks with the correct terms.

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

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

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

6. What does FOIL stand for when used in multiplying multivariable polynomials?

7. Fill in the following chart for the multiplication of the following two expressions.

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

	2x	-3y
x^2		
y		

8. What went wrong in the following set of steps?

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

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

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

9. Fill in the blanks of the multiplication chart with the correct terms when given the following problem.

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

		3b
-a		-3ab

10. Simplify the following expression.

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

11. What went wrong in this set of steps?

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

$-6xy - 2x^3$

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DIVIDING MULTIVARIABLE POLYNOMIALS

1. Set up but do not solve the long division problem.

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

2. Find the quotient.

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

3. Given the following long division, identify the quotient, remainder, and divisor.

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$$
\begin{array}{r}
x^2 - xy + y^2 \\
x+y \overline{\big)\, x^3 + 0x^2y + 0xy^2 + y^3} \\
\underline{-(x^3 + x^2y)} \\
-x^2y + 0xy^2 \\
\underline{-(-x^2y - xy^2)} \\
xy^2 + y^3 \\
\underline{-(xy^2 + y^3)} \\
0
\end{array}
$$

4. How would you rewrite the expression before starting the long division process?

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

5. Find the quotient.

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

6. In words, what is the first question you should ask when solving this long division problem?

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

7. What went wrong in setting up the long division?

$$\frac{7x^3+x^2y-2xy^2+y^3}{x-2y}$$

$$7x^3+x^2y-2xy^2+y^3 \overline{)\,x-2y}$$

8. Fill in the blanks with the correct terms.

$$(2x-y)(\ \_\_\_\_\ ) = 6x^2-3xy$$

9. Find the quotient.

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

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GREATEST COMMON FACTOR OF TRINOMIALS

1. Factor out the greatest common factor.

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

2. Fill in the blank with the correct term.

$$4a^3b - 10ab^2 + \_\_\_\_ = 2ab(2a^2 - 5b + 3a^2b^2)$$

3. What went wrong in the following factoring?

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

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

4. Factor out the greatest common factor.

$$2x + 8xy^2 - 16bx^2$$

5. Fill in the blank with the correct term.

$$6axy + \_\_\_\_ - 2abx^2y = ax(6y + 3ab - 2bxy)$$

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6. Give an example of a trinomial in the variable x.

7. Factor out the greatest common factor.

$$16ab^2c^3 + 8a^3b^3c - 12a^2b^3c^2$$

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GREATEST COMMON FACTOR OF POLYNOMIALS

1. Factor the expression.

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

2. Fill in the blank with the correct term.

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

3. What is the greatest common factor of the polynomial?

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

4. What is the difference between a trinomial and a polynomial?

5. Factor the expression.

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

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6. What went wrong in the following factoring.

$3x^3 - 3x^2 - 6x$

$x(3x^2 - 3x - 6)$

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

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FACTORING QUADRATIC POLYNOMIALS

1. Factor the quadratic expression.

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

2. What went wrong in the following factoring?

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

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

3. Factor the quadratic expression.

$$3x^2 + 5x - 2$$

4. Factor the quadratic expression.

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

5. Fill in the blank with the correct term.

$$2x^2 - \_\_\_ - 4 = (2x + 1)(x - 4)$$

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6. Factor the quadratic expression.

$$x^2 - x - 2$$

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FACTORING THE DIFFERENCE OF TWO SQUARES

1. Factor the expression.

$$4y^2 - 36$$

2. What went wrong in the following set of steps?

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

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

3. Factor the expression.

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

4. Fill in the blank with the correct term.

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

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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.

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

3. Complete the square in the following expression, but do not solve.

$$3y^2 - 12y + 3 = 0$$

4. Solve for a by completing the square.

$$2a^2 + 8a = -4$$

5. What is your first and second step in solving the problem by completing the square?

$$4x^2 - 16x + 28 = 0$$

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6. Explain when and why completing the square is used for factoring.

7. Solve for y by completing the square.

$$3y^2 + 9y = 3$$

8. Fill in the blank with the correct term.

$$\_\_\_\_ - 4x = 6$$

$$\left(x - \frac{2}{3}\right)^2 = \frac{22}{9}$$

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COMPLETING THE SQUARE WITH COMPLEX ROOTS

1. Solve for x by completing the square.

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

2. What went wrong in the following set of steps toward completing the square?

$$3x^2 - 12x - 7 = 0$$

$$3x^2 - 12x + 36 = 7 + 36$$

3. Fill in the blank with the correct term.

$$-2y^2 - 12y = 9$$

$$y^2 + 6y + \_\_\_\_ = -\frac{9}{2} + \_\_\_\_$$

4. Solve for x by completing the square.

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

5. Complete the square but do not solve.

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$$x^2 + 12x + 20 = 0$$

6. What is the difference in the problem when completing the square with complex roots compared to real roots?

7. Solve for z by completing the square.

$$z^2 - 8z + 25 = 0$$

8. Fill in the blank with the correct term.

$$z^2 + \_\_\_\_z + \frac{25}{4} = -7 + \frac{25}{4}$$

9. Give an example of a quadratic equation that would have complex roots.

10. Solve for z.

$$z^2 - 4z = -5$$

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QUADRATIC FORMULA

1. Solve for x using the quadratic formula.

$$4x^2 - 8x - 15 = 0$$

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

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

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

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

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

4. Solve for z using the quadratic formula.

$$z^2 = z + 3$$

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

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

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

6. Simplify the expression.

$$\frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(14)}}{2(1)}$$

7. What are two ways to solve a quadratic equation when you cannot easily factor?

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

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

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

9. Solve for t using the quadratic formula.

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

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FACTORING TO FIND A COMMON DENOMINATOR

1. Simplify the expression by combining the two fractions.

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

2. What is the one thing you need in order to add or subtract rational expressions?

3. What is the common denominator of the rational expressions?

$$\frac{x^2-1}{x^2-4} \text{ and } \frac{x+1}{3x^2-3x-6}$$

4. Simplify the expression by combining the two fractions.

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

5. What went wrong in the following simplification?

$$\frac{1}{x+1}+\frac{3x-1}{(2x-2)(x+1)}$$

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$$\frac{1}{(x+1)(2x-2)}+\frac{3x-1}{(2x-2)(x+1)}$$

6. Fill in the blank with the correct term.

$$\frac{2}{\_\_\_\_\_}-\frac{x-2}{x^2-9}=\frac{2(x-3)-4(x-2)}{4(x-3)(x+3)}$$

7. Simplify the expression by combining the two fractions.

$$\frac{4}{(x+1)(x-3)}-\frac{1}{(x+4)(x+1)}$$

8. What went wrong in the following simplification?

$$\frac{3}{x^2-25}-\frac{1}{x+5}$$

$$\frac{3-x-5}{(x-5)(x+5)}$$

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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 given 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. Give an example of a function that has a domain of $[1,\infty)$.

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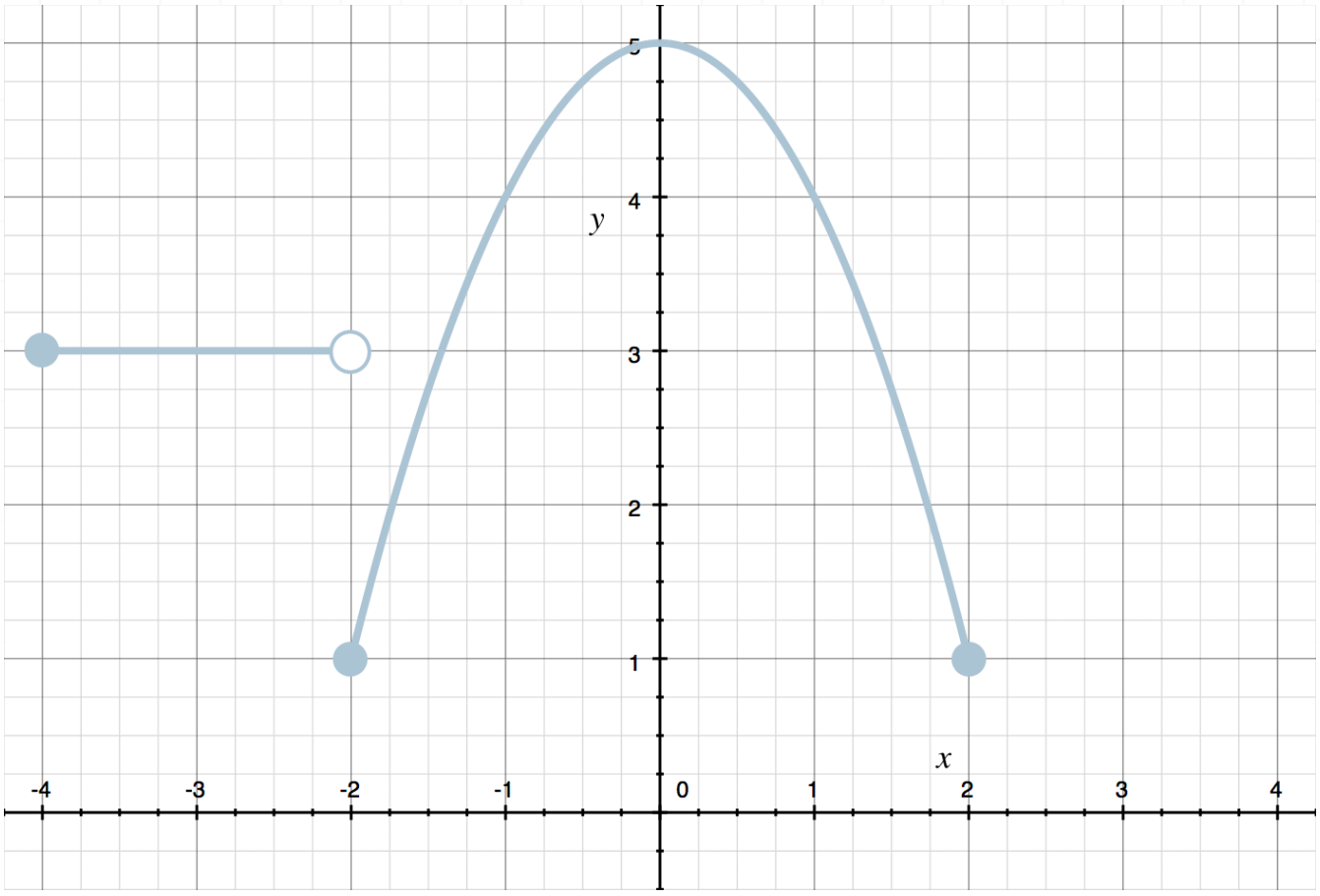
DOMAIN AND RANGE FROM A GRAPH

1. What is the domain and range of the function? Assume the graph does not extend beyond the graph shown.



2. What is the domain and range of the function?

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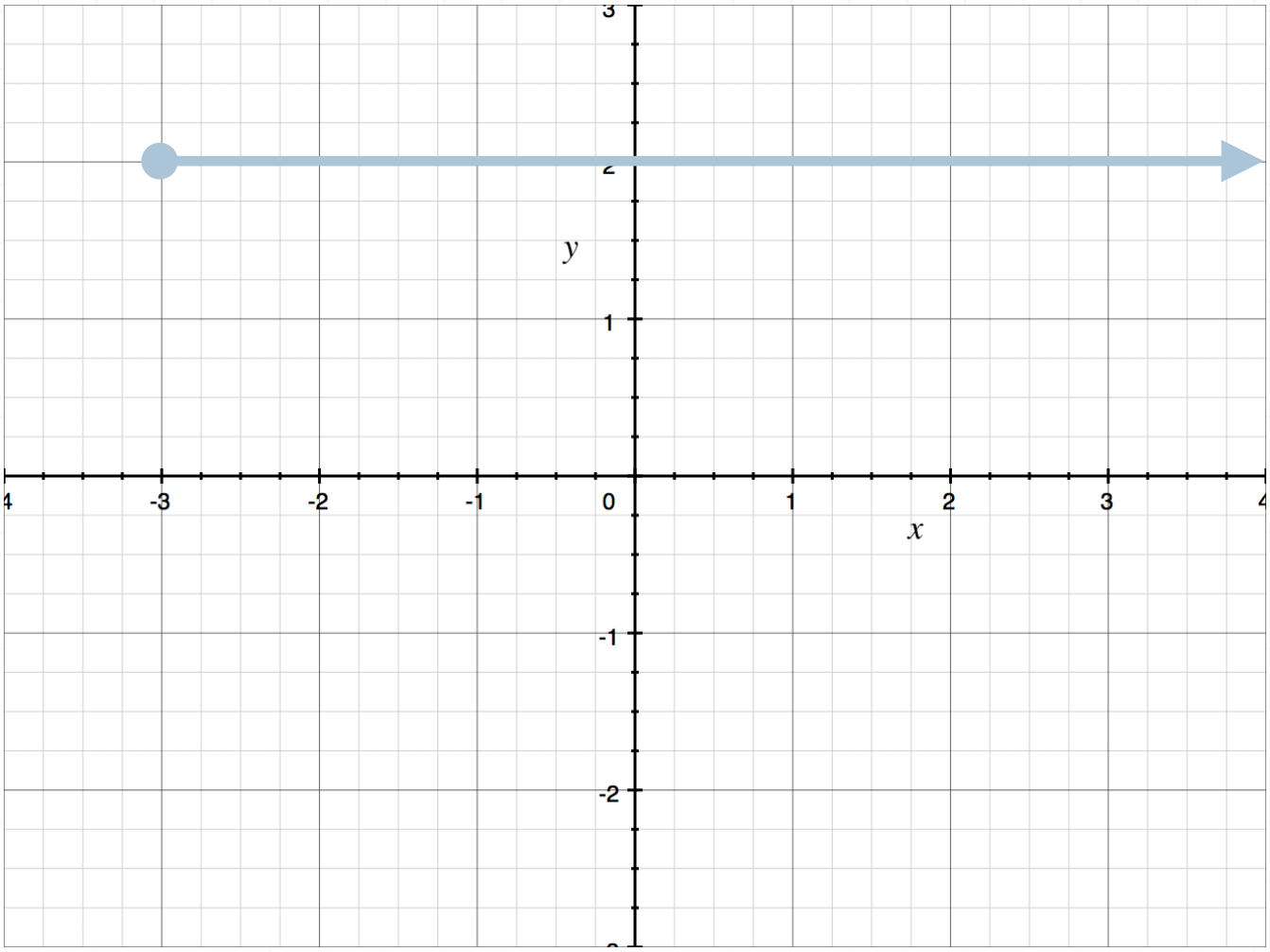

3. Determine the domain and range of the function.

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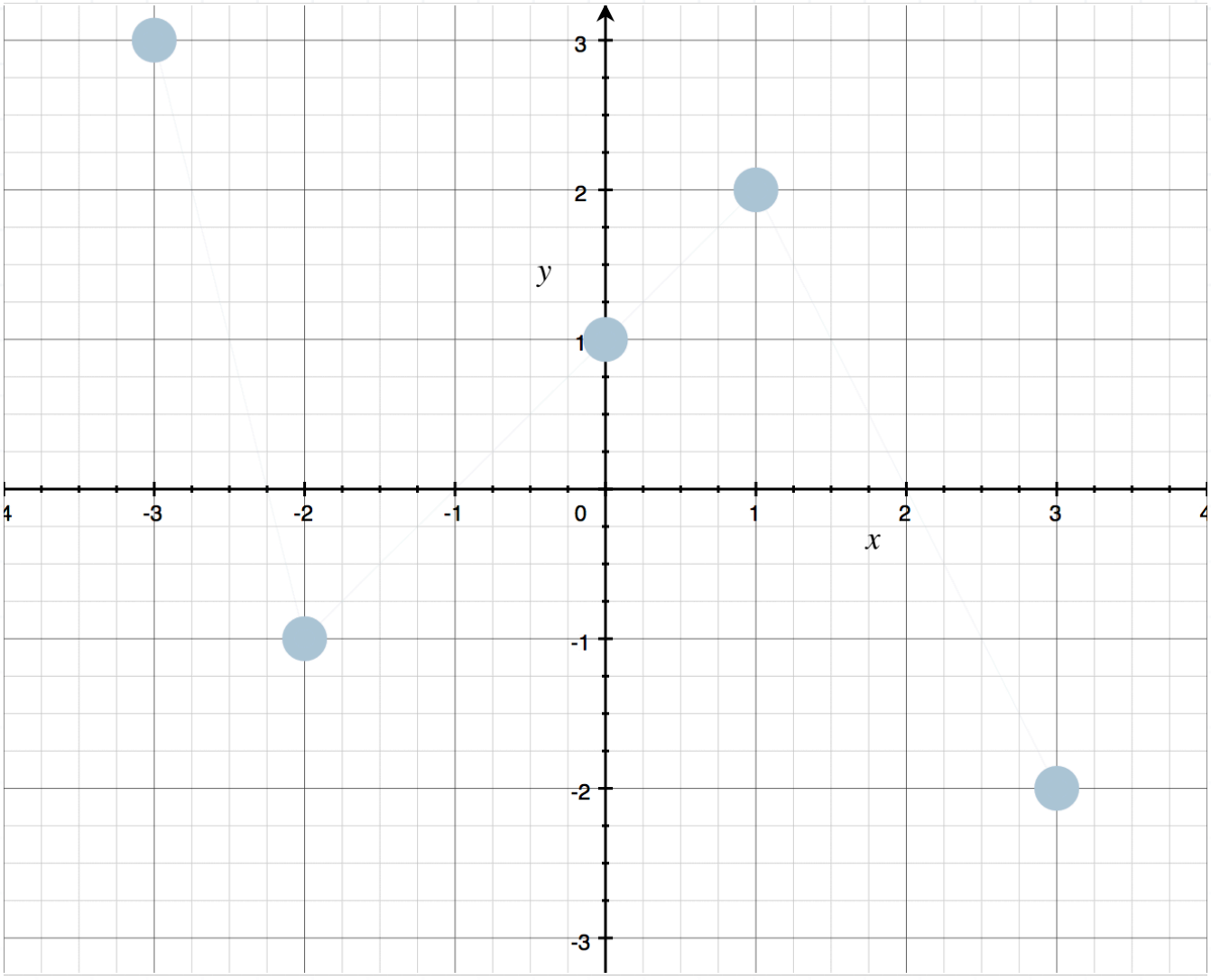

4. Fill in the blanks in the following description of the domain of a graph.

"The domain is all the values of the graph from _____ to _____."

5. What is the domain and range of the function? Assume the graph does not extend beyond the graph shown.

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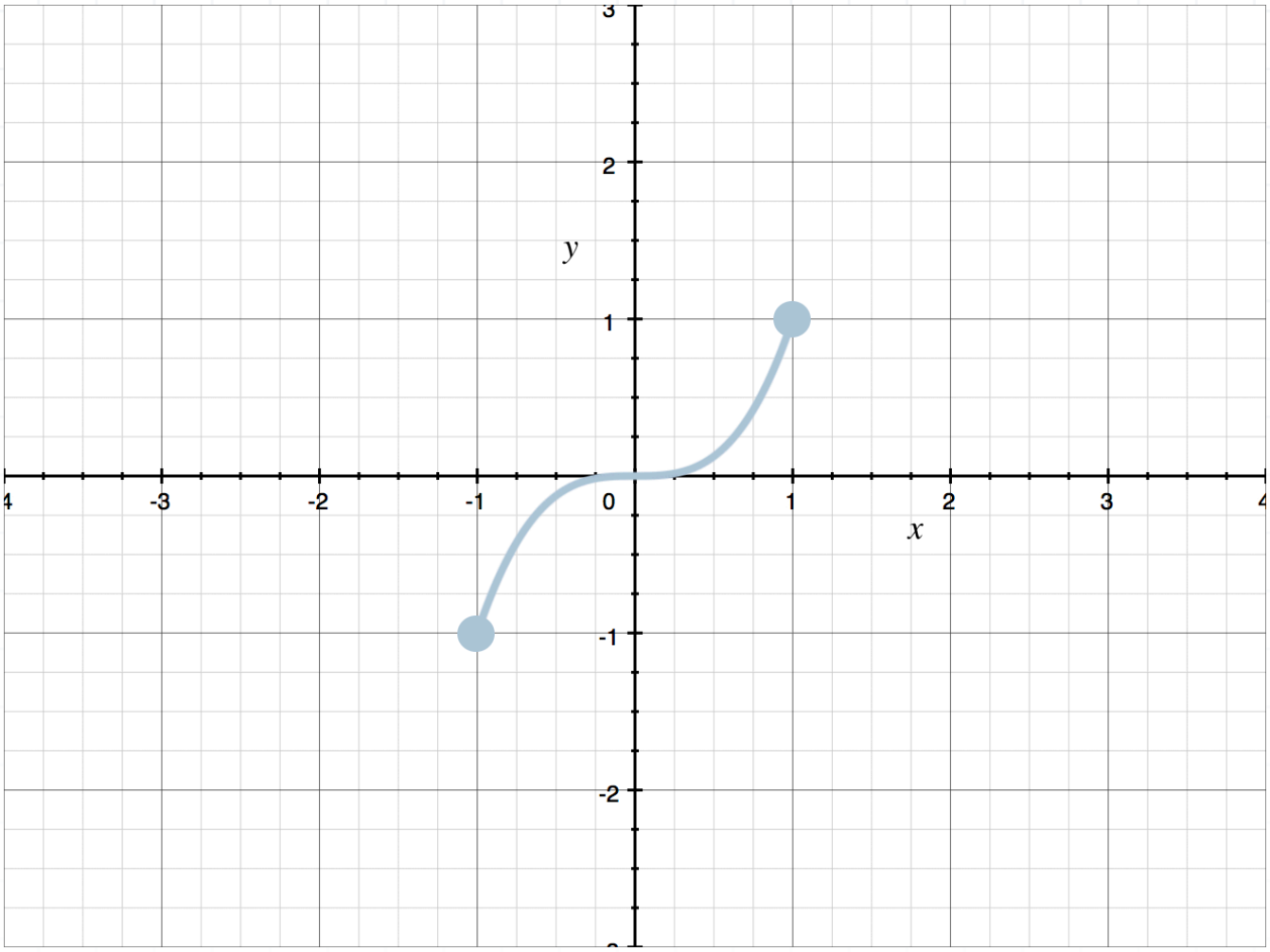

6. What is the domain and range of the function? Assume the graph does not extend beyond the graph shown.

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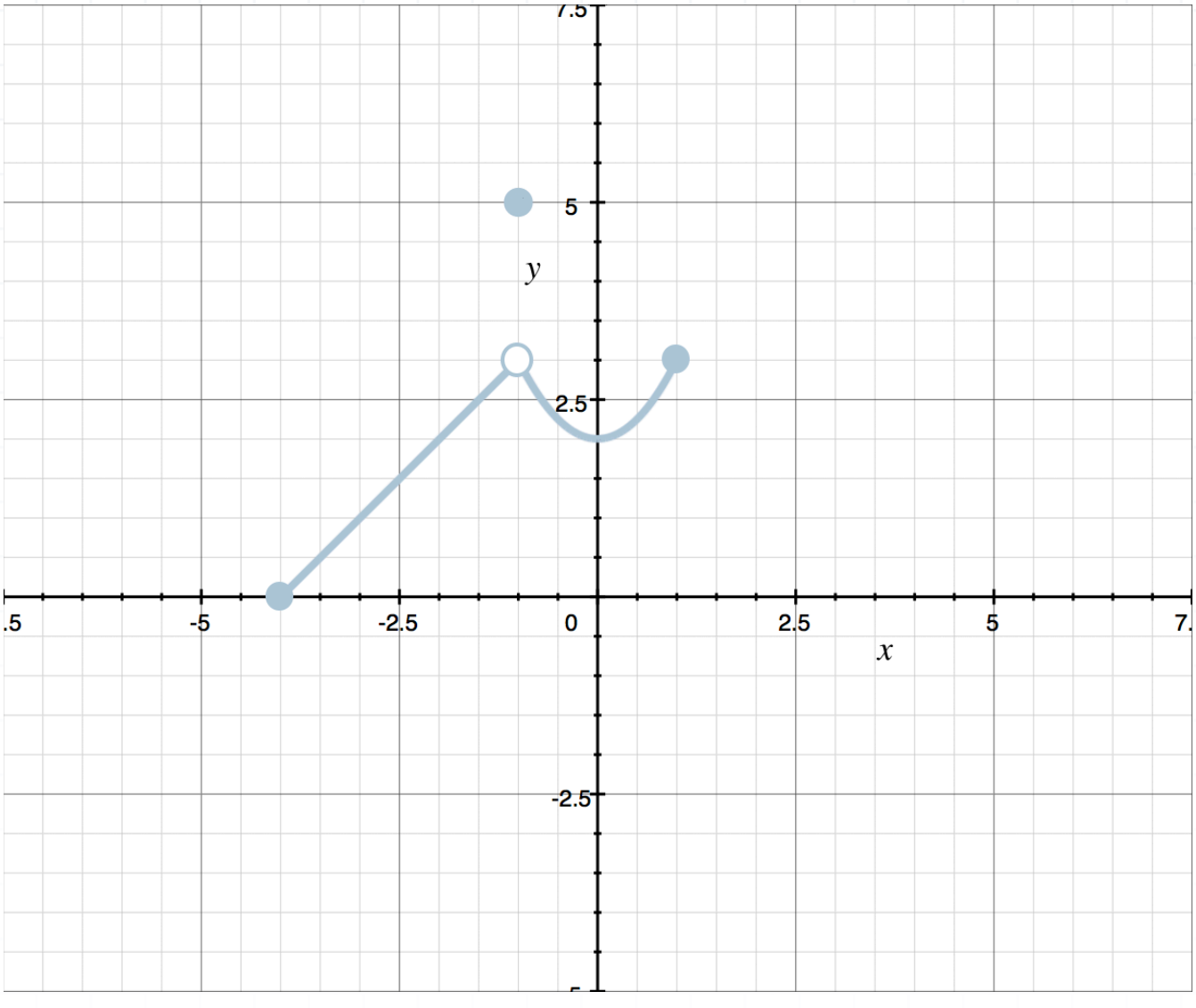

7. Fill in the blanks in the following description of the range of a graph.

"The range is all the values of the graph from _____ to _____."

8. What is the domain and range of the function?

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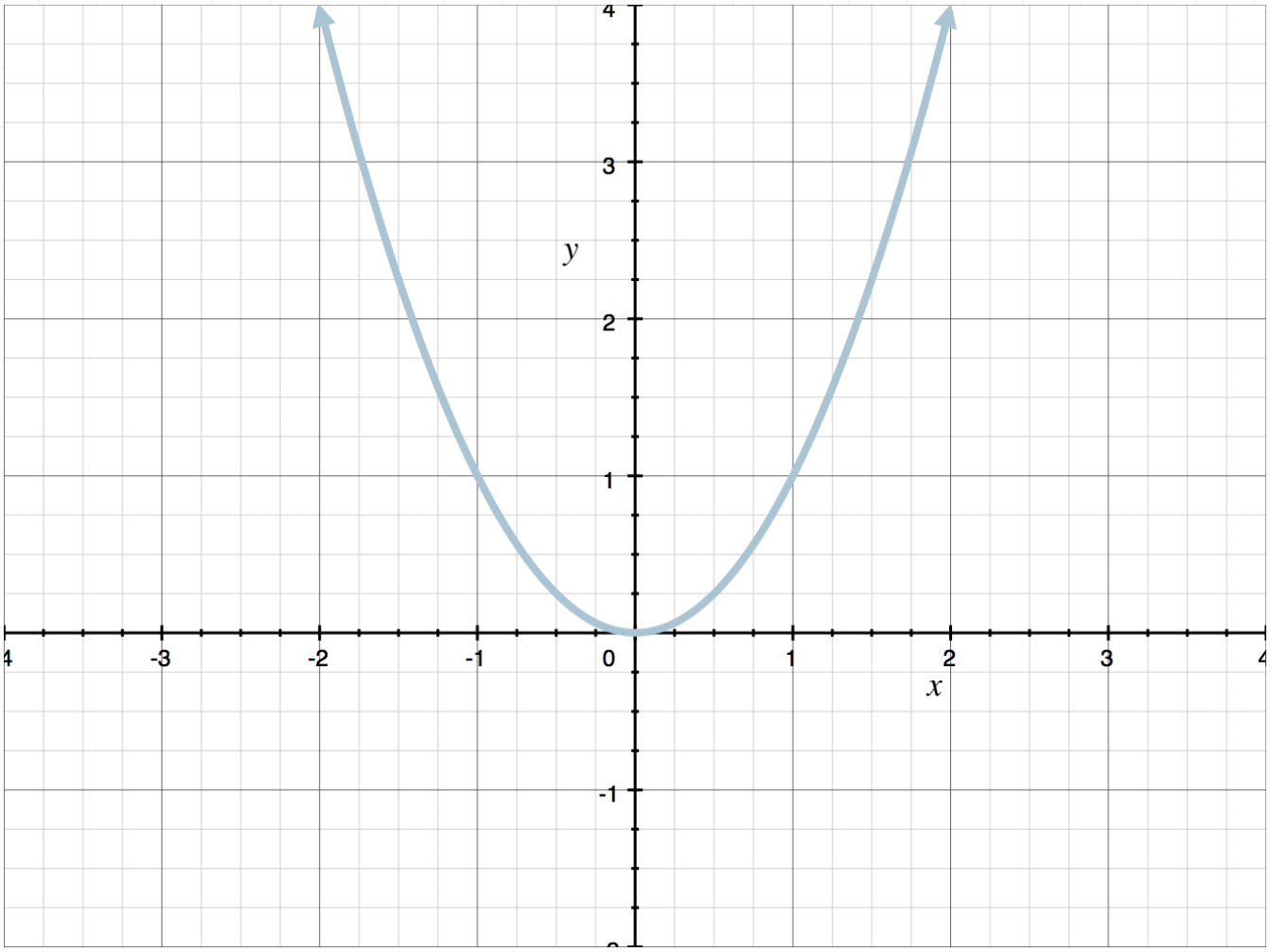

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FUNCTIONAL NOTATION

1. If $f(x) = 11 - 5x$, find $f(-2)$.

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

3. Correct what went wrong in the following set of steps.

At $x = -2$ and $f(x) = x^2 + 1$, then

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

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

$f(-2) = -3$

4. If $g(t) = t^2 - t + 3$, find $g(-1)$.

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

6. If $g(x) = x^3 - x + 1$, figure out what you need to plug into the function in order to get the following expression.

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

7. If $f(x) = x^2 + x - 1$, find $f(x+h)$ and expand as much as possible.

8. Correct what went wrong in the following set of steps.

If $f(x) = x^3 + 3x^2 - 5x + 2$, then $f(1)$ is

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

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

$$f(1) = 7$$

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TESTING FOR FUNCTIONS

1. Determine if the following represents a function. Explain your answer.

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

2. Draw a graph that represents a function. Explain why it's a function.

3. Fill in the blanks in the following definition of a function.

For every _____, there is only one unique _____.

4. Give two different y-values that have the same output value for x.

$y^2 = x$

5. Draw a graph that does not represent a function. Explain why it's not a function.

6. Determine whether or not the following set of points represents a function. Explain your answer.

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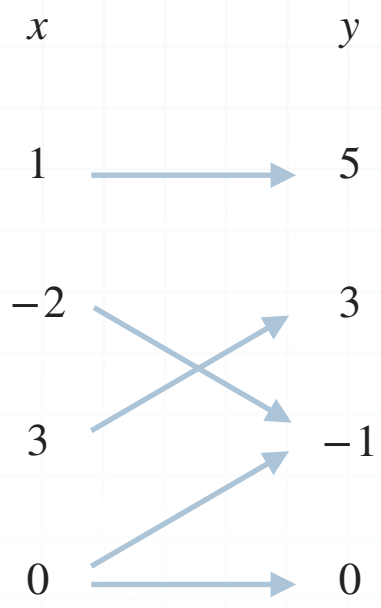
$(1,2),\ (-1,5),\ (1,-3),\ (0,1)$

7. Determine if the following represents a function. Explain your answer.



8. Determine if the following represents a function. Explain your answer.

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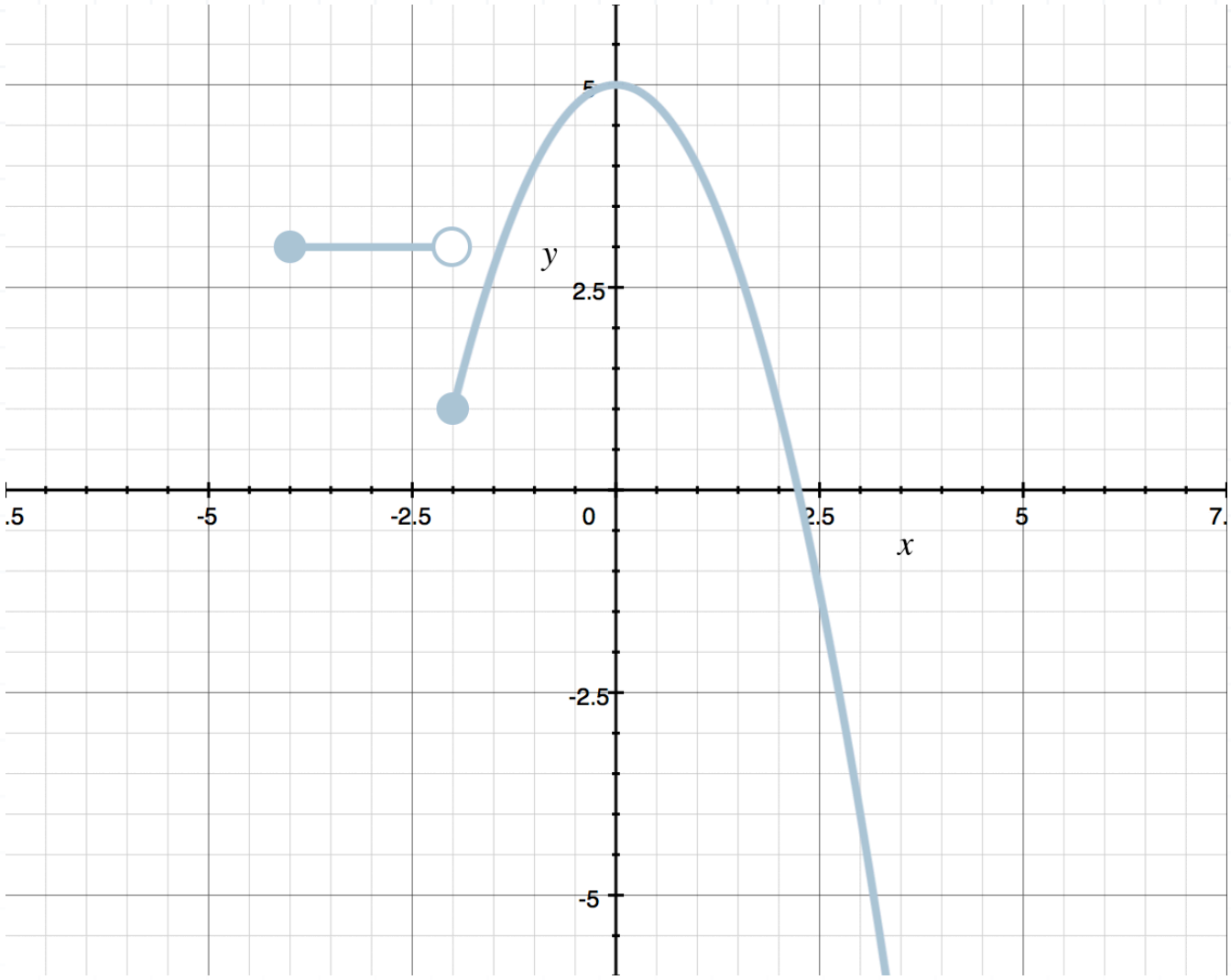

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VERTICAL LINE TEST

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

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

2. Fill in the blanks in the following statement using “equations,” and “functions.”

All _____ are _____.

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

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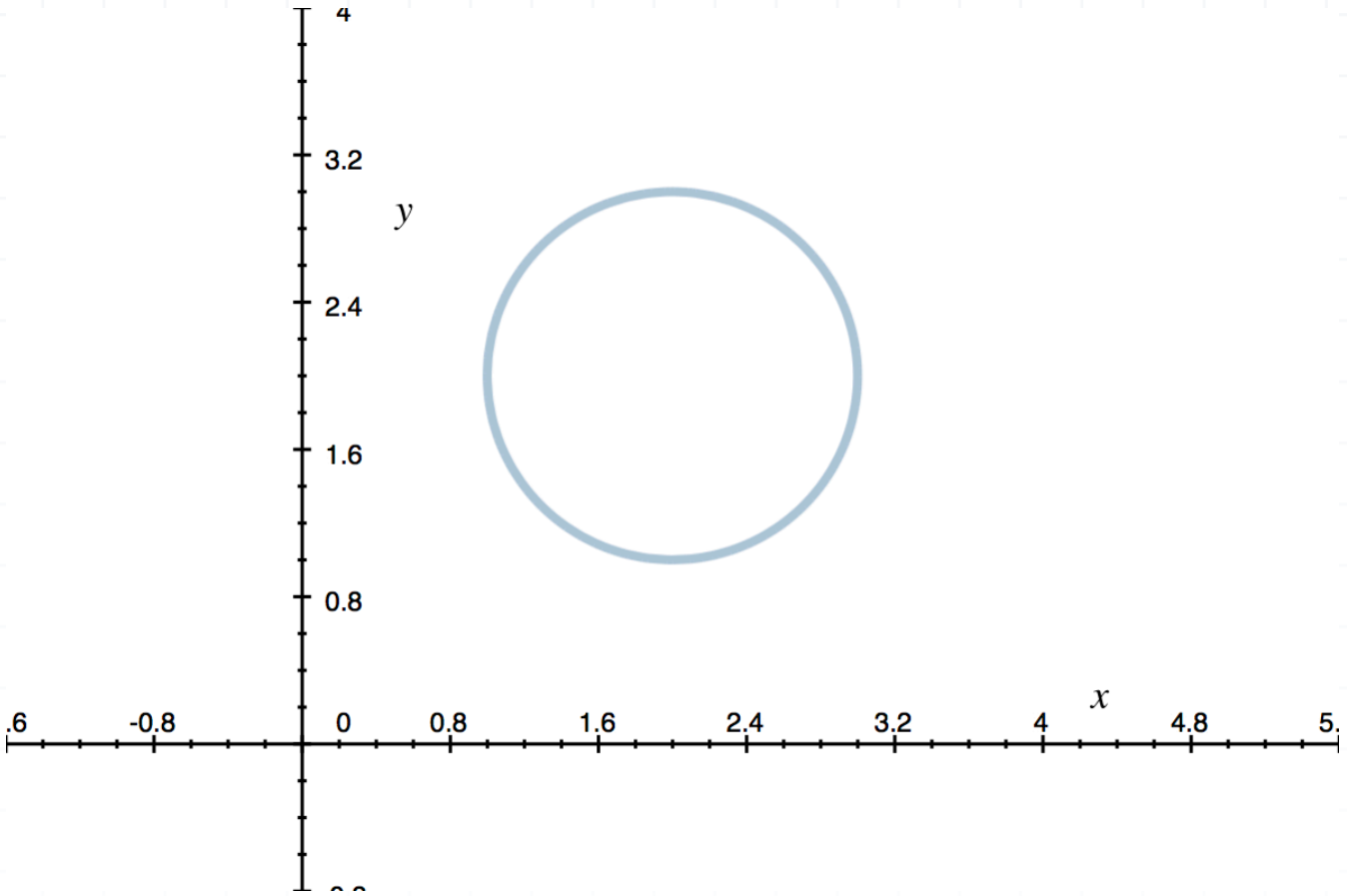

4. Determine algebraically whether or not the equation represents a function.

$$y^2 = x + 1$$

5. Use the Vertical Line Test to determine whether or not the graph represents a function.

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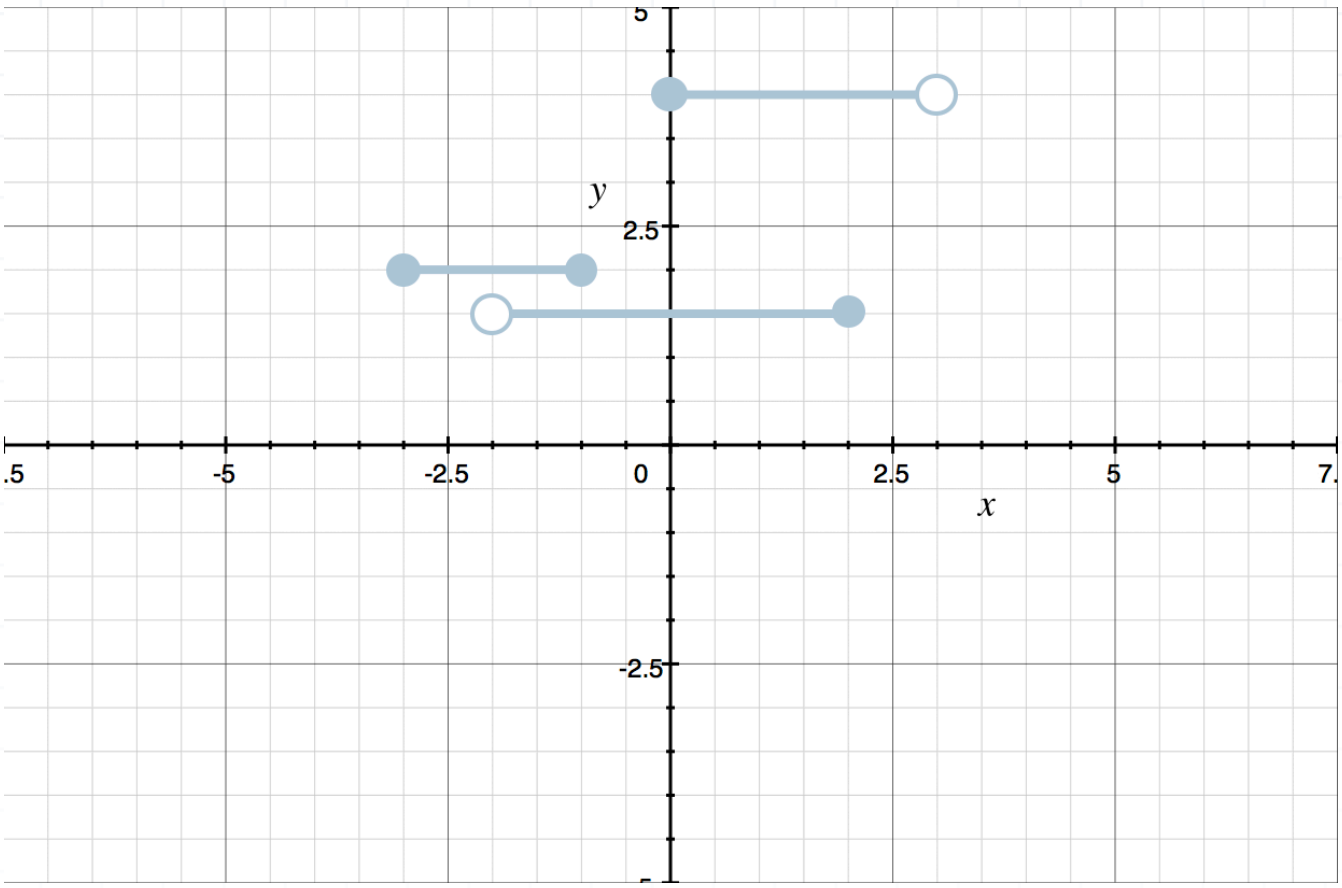

6. Explain why the Vertical Line Test determines whether or not a graph represents a function.

7. Fill in the blanks in the following statement using: equations, functions.

Not all _____ are _____.

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

$$x^3 + y = 5$$

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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. Describe two ways you can add two functions together.

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

6. Given the expression below, determine $f(x)$ and $g(x)$.

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

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

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8. What went wrong in the following set of steps?

$(x^2 + x - 9) + (x - 1)$

$(3x - 9) + (x - 1)$

$3x - 9 + x - 1$

$4x - 10$

9. If $g(1) = 5$ and $h(1) = -3$, find $(g + h)(1)$.

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

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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. What went wrong in the following set of steps?

$(x + 1)(x + 2)$

$x \cdot x + 2 \cdot x + 2$

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

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

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

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7. Describe two different ways that you can multiply two functions together and evaluate the product at a particular point.

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

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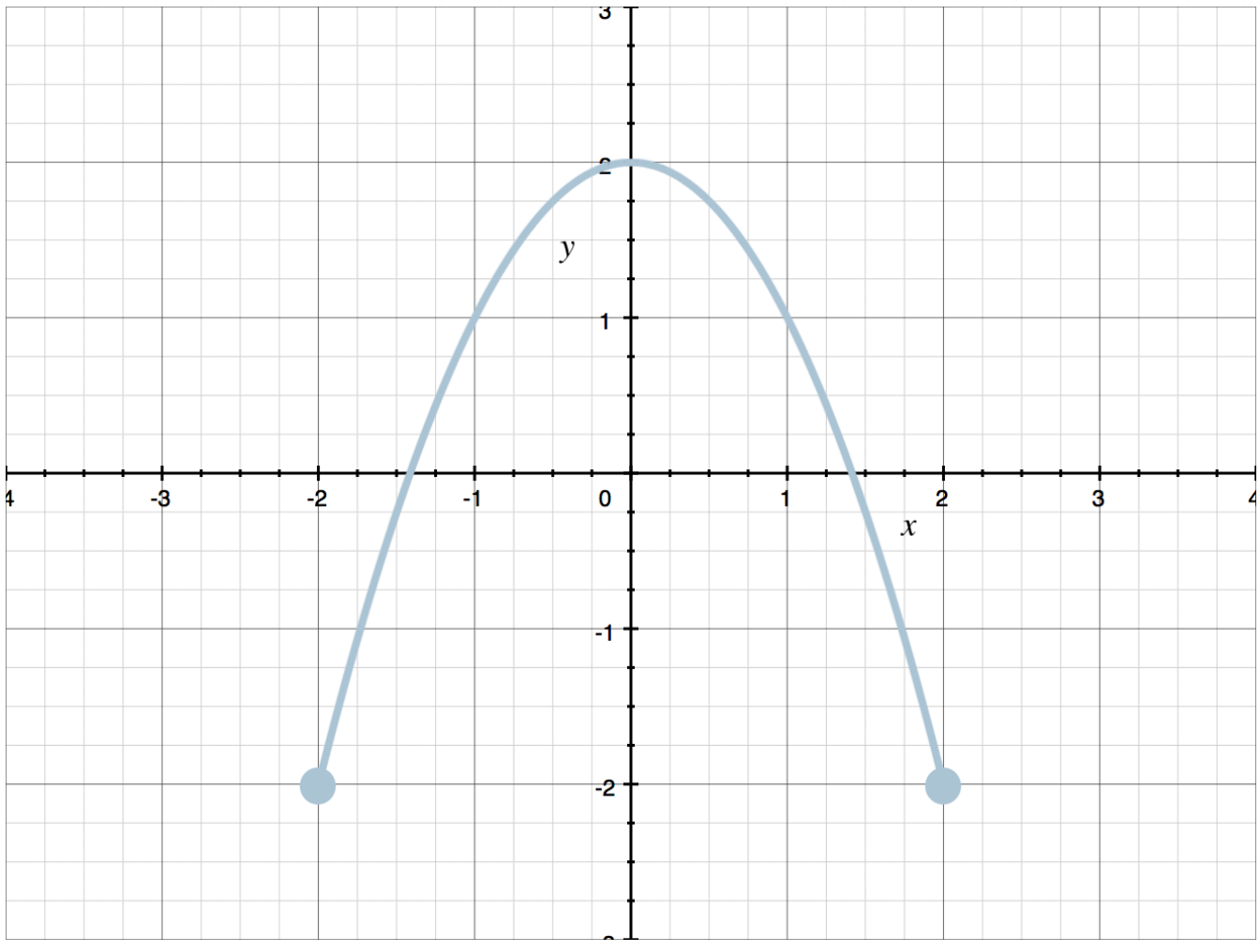
EVEN, ODD, OR NEITHER

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 if the graph is the graph of a function that is even, odd, or neither.



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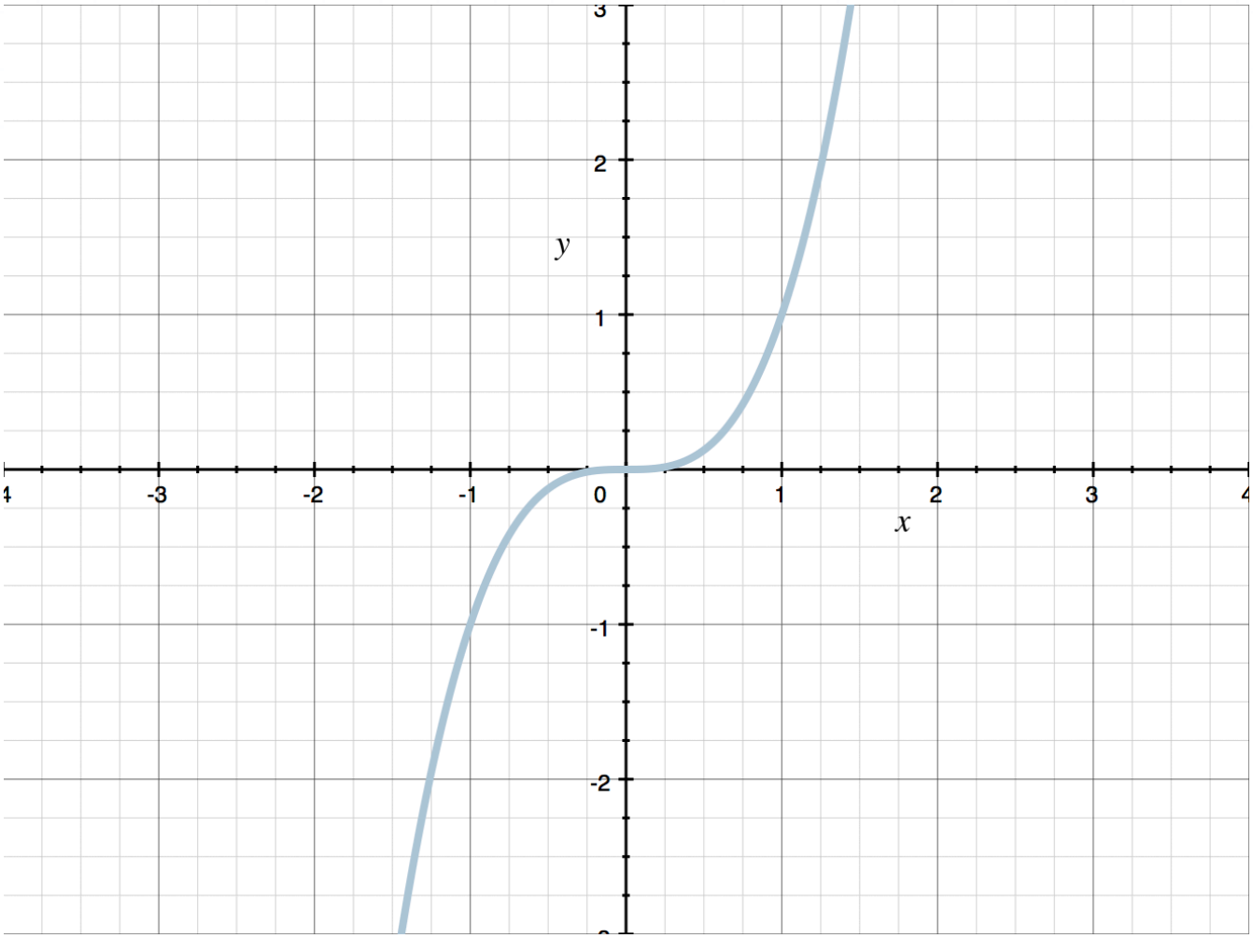
4. Is the function even, odd, or neither?

$$g(x) = -3x^2 + 5x^6$$

5. Show that the function is neither even nor odd.

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

6. Determine if the graph is the graph of a function that is even, odd, or neither.



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

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

8. Describe the symmetry of an odd function, and give an example of an odd function.

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TRICHOTOMY

1. Solve the inequality.

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

2. If $x \nless y$ and $x \ngtr y$, by the law of trichotomy, what do we know about the relationship between x and y?

3. Give two ways to write the following sentence in mathematical notation.

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

4. Solve the inequality.

$$x(3x-2) \ngeq 3(x+x^2)+10$$

5. Give the three possible relationships in the law of trichotomy.

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

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$x^2 + x \not< 2$ and $x^2 + x \not> 2$

7. Give two ways to write the following statement in mathematical notation.

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

8. Solve the following statement.

$-3(1 - x) \not> 3(7 - x) - 2x$ and $-3(1 - x) \not< 3(7 - x) - 2x$

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INEQUALITIES AND NEGATIVE NUMBERS

1. Solve the inequality.

$$-3x + 4 < 22$$

2. What is the only difference between solving inequalities and solving equations? Give an example.

3. What went wrong in the following set of steps?

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

$$-3x < 3$$

$$x < -1$$

4. Solve the inequality.

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

5. Of $<$, $>$, or $=$, which sign is unaffected when solving inequalities? Give an example.

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6. Solve the inequality.

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

7. What went wrong in the following set of steps?

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

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

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

8. Solve the inequality.

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

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GRAPHING INEQUALITIES ON A NUMBER LINE

1. Give two expressions that, when graphed, have open circles at 3.

2. Graph the inequality on a number line.

$$-2x < 4$$

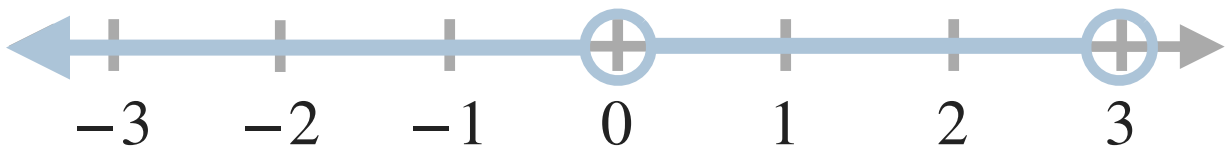
3. Graph the values of x that satisfy the following expressions.

$x \leq 3$ and $x \neq -2$

4. Give two expressions that, when graphed, have closed circles at -1.

5. What is wrong with the graph of the following inequality?

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



6. Graph the inequality on a number line.

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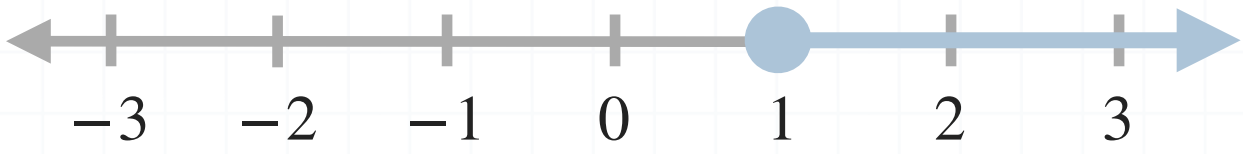
$x - 1 \geq 3$

7. What is wrong with the graph of the following inequality?

$x > 1$



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GRAPHING CONJUNCTIONS ON A NUMBER LINE

1. Write the inequality that takes away the absolute value sign.

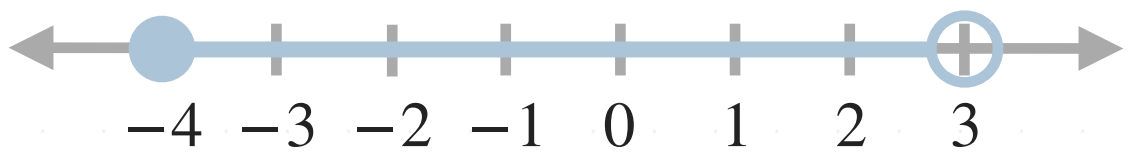
$$|3x - 7| \geq 2$$

2. Graph the inequality.

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

3. What is wrong with the graph of the following inequality?

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



4. Graph the inequality.

$$x < 5 \text{ and } x \geq -3$$

5. Give an example of a conjunction for which the graph is a line segment connecting two points.

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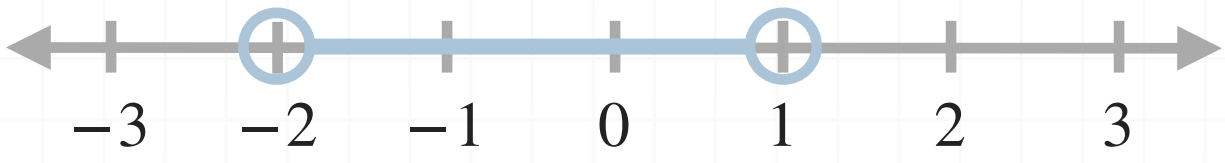
6. What is wrong with the graph of the following inequality?

$x < -2$ and $x > 1$



7. Graph the inequality.

$|6 - 2x| \leq 4$

8. Graph the inequality.

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

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CARTESIAN COORDINATE SYSTEM

1. What is the coordinate point of the origin?

2. Give a coordinate point that lies in Quadrant III.

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

4. In which quadrant would you plot the point $(1,6)$?

5. What is the y-coordinate of the points that lie on the x-axis? Give an example of a coordinate point that lies on the x-axis.

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

7. Give a coordinate point that lies in Quadrant II.

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

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9. In which quadrant would you plot $(3, -7)$?

10. What is the x-coordinate of the points that lie on the y-axis? Give an example of a coordinate point that lies on the y-axis.

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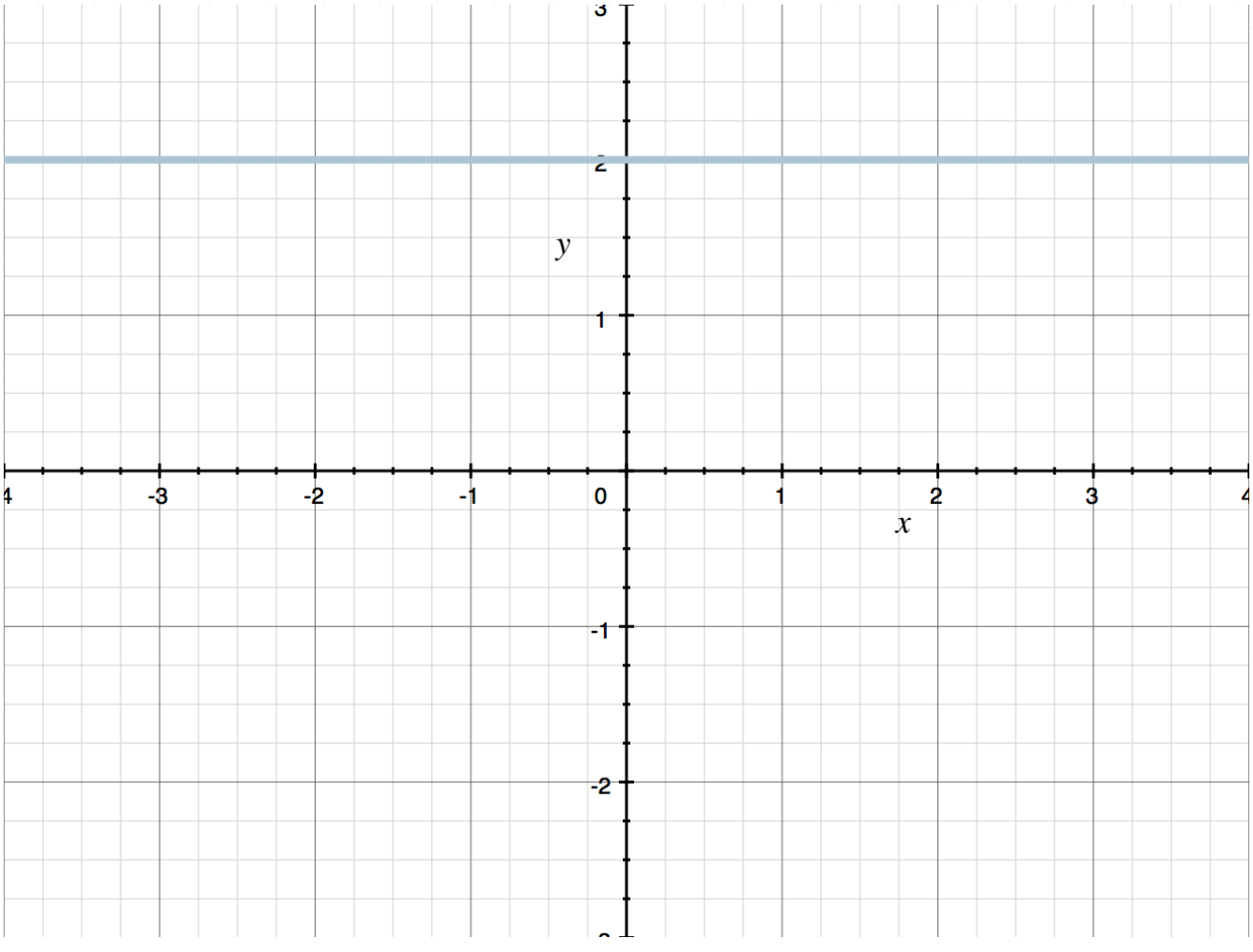
SLOPE

1. In terms of vertical and horizontal movement, define the slope of a line.

2. What is the slope of the line?



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

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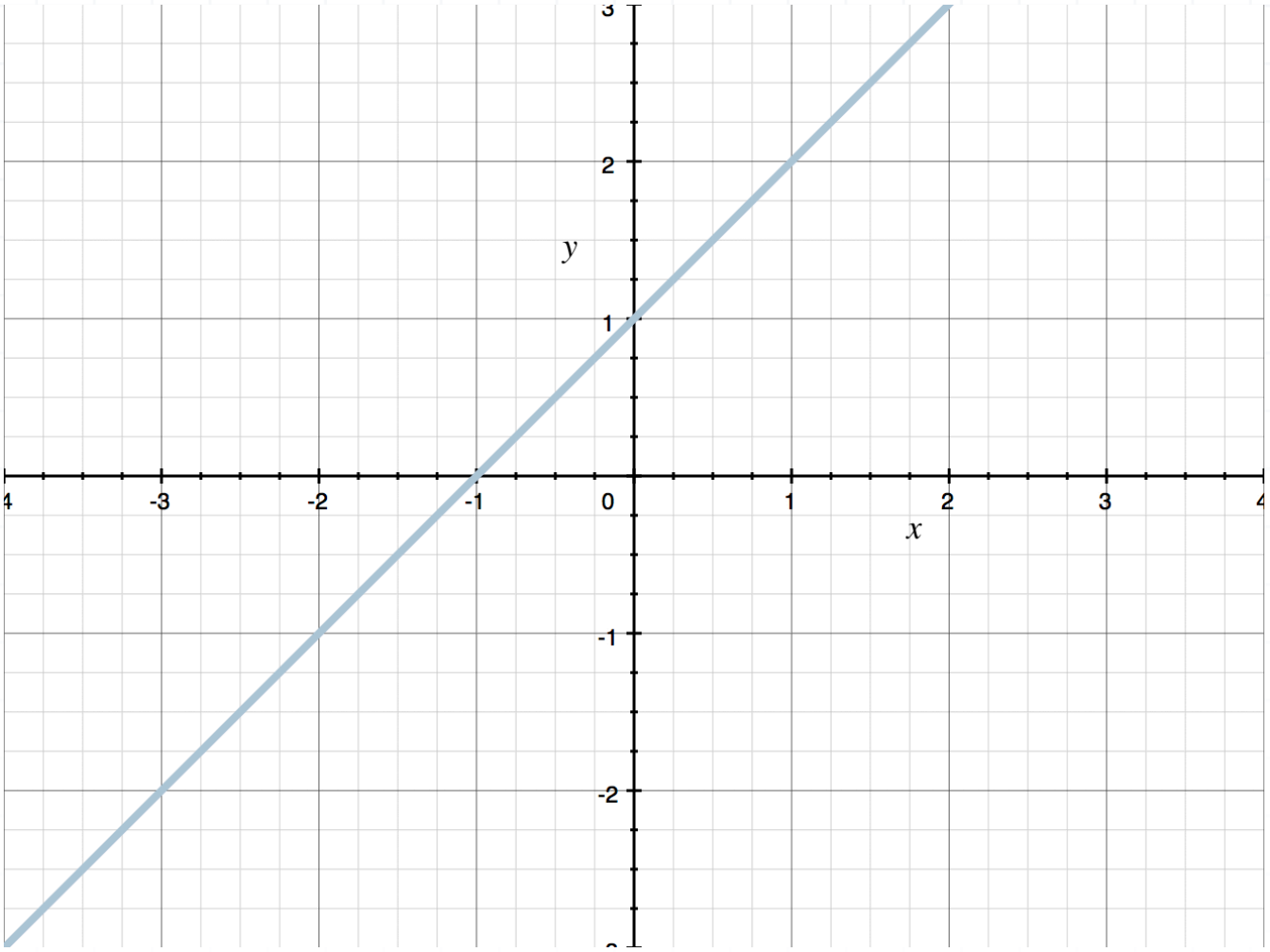
4. What is the slope of the line?



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

6. What is the slope of the line?

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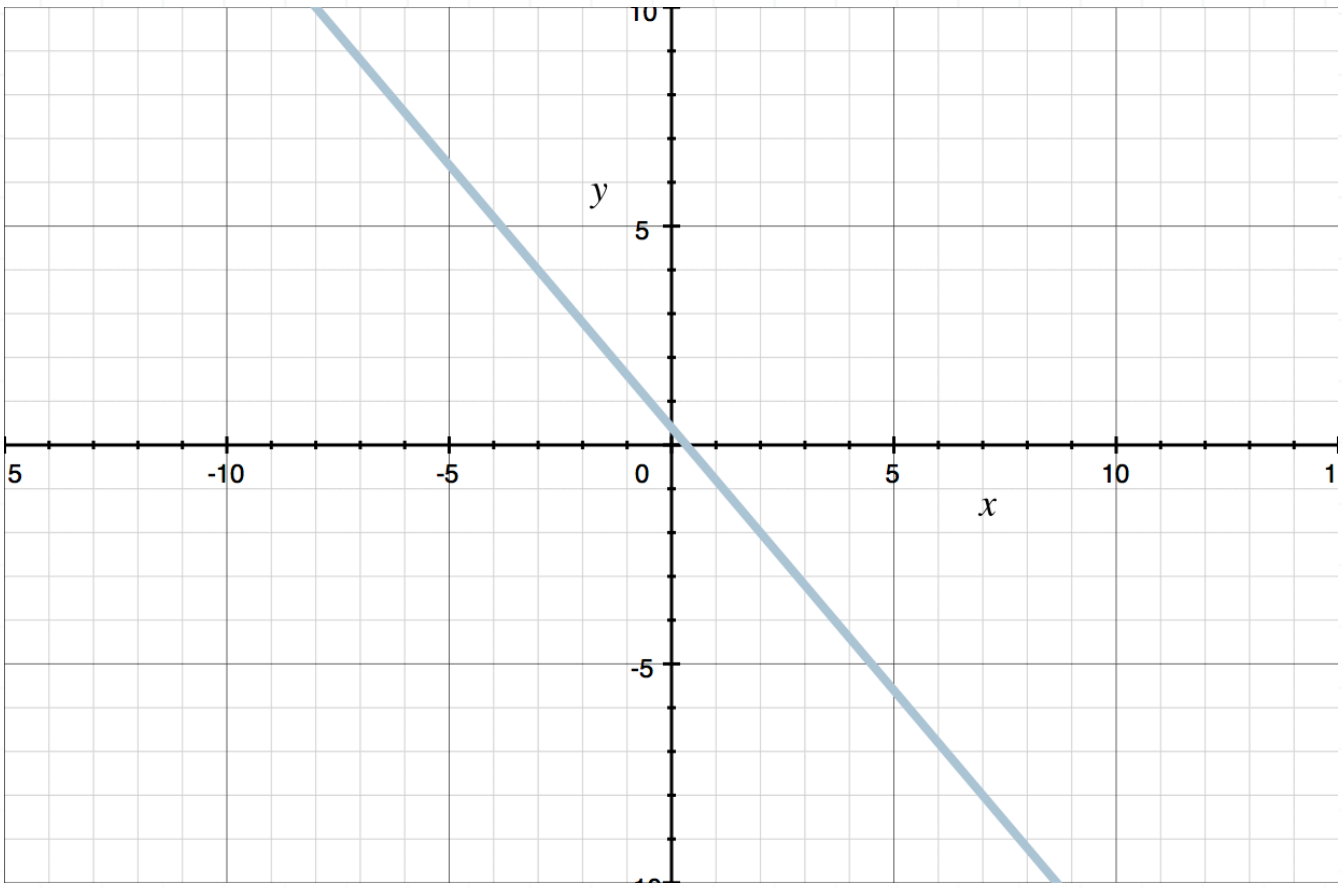

7. Find the slope of the line that passes through $(10,1)$ and $(5,2)$.

8. Give two points that make a line with a slope of $-2/3$.

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

10. What is the slope of the line through the points (x_1, y_1) and (x_2, y_2)?

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EQUATION OF A LINE IN POINT-SLOPE FORM

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

2. Name two (of four possible) pieces of information about a line that are required to write an equation of the line in point-slope form.

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

4. Find the equation of the line that passes through $(-2,-5)$ with a slope 6.

5. Identify the point (x_1, y_1) and slope m in the equation of the line.

$$y + 3 = \frac{1}{4}(x - 6)$$

6. Write the following equation in point-slope form.

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

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

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EQUATION OF A LINE IN SLOPE-INTERCEPT FORM

1. Find the equation of a line through the point $(0,5)$ with slope -2. Write the solution in slope-intercept form.

2. Identify the y-intercept and slope m defining the line.

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

3. Convert the following point-slope equation into a slope-intercept equation.

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

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

5. Determine the y-intercept of a line with slope -3 that passes through the point $(1,1)$. Write your solution as a coordinate point.

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6. Name two (of four possible) pieces of information about a line that are required to write an equation of the line in point-slope form.

7. Find the equation of a line that passes through the points $(-3, -2)$ and $(2, -4)$. Write the solution in slope-intercept form.

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GRAPHING LINEAR EQUATIONS

1. Graph the line.

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

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

3. What is the best way to write the equation of a line when graphing?

4. Graph the line.

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

5. Give two points that lie on the line.

$$y = -x - 6$$

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6. Use the slope $m = 1/3$ to find two more points on the line passing through $(1,2)$. Go forward to determine one point and backwards to determine another.

7. Graph the line.

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

8. Give two points that lie on the following line.

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

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GRAPHING LINEAR INEQUALITIES

1. Graph the inequality in the cartesian coordinate plane.

$$y < -2$$

2. Graph the inequality in the cartesian coordinate plane.

$$x \leq 5$$

3. Graph the inequality in the cartesian coordinate plane.

$$y < -2x + 4$$

4. Graph the inequality in the cartesian coordinate plane.

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

5. Graph the inequality in the cartesian coordinate plane.

$$y \leq x - 1$$

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6. Graph the inequality in the cartesian coordinate plane.

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

7. Graph the inequality in the cartesian coordinate plane.

$$y \geq 3x - 2$$

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2-STEP PROBLEMS

1. Why can't you solve the following 2-step problem?

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

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

3. Describe in words how you would solve the following 2-step problem.

   If $x-3=5$, what is $x+5$?

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

5. What are the two steps of a 2-step problem?

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

7. What went wrong in solving the following 2-step problem?

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

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$$2x + 3 = 7$$

$$2x = 4$$

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

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

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SOLVING 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.

$$3 - y = 2x$$

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

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5. Fill in the blanks with the correct variables x and y if the solution to the system of equations is $(-1, 3)$.

$$-2\_ + \_ = 5$$

$$2\_ = 7 - 3\_$$

6. What went wrong in the following substitution?

$$y = x - 2$$

$$2y - x = 7$$

Substitution: $2x - 2 - x = 7$

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

$$5y = 6 - 2x$$

$$6x + 15y = 18$$

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SOLVING WITH ELIMINATION

1. What is 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. Would it be easier to solve the system of equations using the substitution method or the elimination method?

$$7x - 3y = 2$$

$$3y - x = 11$$

4. What went wrong in the following elimination?

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

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$-4x - y = 4$

Elimination: $2y = 3$

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

$x = 2y - 5$

$-3x + 6y = 15$

6. Fill in the blanks with the correct variables x and y if the solution to the system of equations is $(2/7, -18/7)$.

$3\_\_\_ - \_\_\_ = -8$

$-\_\_\_ = 10 + 4\_\_\_$

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

$4 - 2x = 6y$

$7 = x + 3y$

8. Would it be easier to solve the system of equations using the substitution method or the elimination method?

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$5y - x = 3$

$x = 7y - 10$

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

$x = 2y - 8$

$3y = x + 5$

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SOLVING THREE WAYS

1. Explain why using the graphing method would make the following system of equations 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.

$$5y + x = 4$$

$$3y - 3x = 6$$

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5. Explain why using the substitution method would make the system of equations easy to solve.

$$2y = 6 - 4x$$

$$7 - y = 3x$$

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

7. Explain why using the elimination method would make the system of equations easy to solve.

$$3y - 2x = 7$$

$$2x = 4 - 6y$$

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

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

$$y = x + 1$$

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