

John P. Freeman Optional School

Zone 6

2023 Summer Algebra I Packet






Student Name _____
(Please be sure to write your initials on the line at the bottom of each page.)
















This packet contains math concepts that may or may not have been taught in your previous classes but are important for Algebra I. Students enrolled in Algebra I for the 2022-2023 school year are expected to submit a completed packet during the first week of school (August 8-12). Exact due dates/procedures will be discussed on August 8th.

Algebra I Summer Math Packet Instructions

Student Name _____

1. This packet has 6 sections, and it is recommended that students work on one section each week during the summer. It is **NOT** recommended to complete this packet immediately following school dismissal **nor** the night before the packet is due. Student learning is most effective if the packet is worked on throughout the summer at a steady pace.
2. You should complete the problems without a calculator, and you should **SHOW ALL YOUR WORK**. Use additional paper is needed. No credit will be provided if your work is not shown.
3. After completing a section, rate your understanding of each week's topic by circling the image in the chart below.
 - **Smiley face** – You understand ALL the concepts for that week and would be able to teach it to another student.
 - **Neutral face** – You understand the concepts for the most part
 - **Confused face** – You do not understand these concepts and need help reviewing.

WEEK	MATH TOPIC	MY RATING
1	Integer Operations	  

2	Order of Operations	  
3	Laws of Exponents	  
4	Pythagorean Theorem	  
5	Simplifying Radicals	  
6	Graphing Linear Equations	  

What do I do if I don't understand something?

- Use your resources (online help sites, iReady, videos, parents, siblings, etc.)
- You may use the reference links in this packet to help you.
- Make a note of the topic/question on the rating chart and ask your teacher to review it during the first week of school.

What happens next?

- Concepts will be reviewed and discussed during the first week of school.
- Students will receive both a participation grade and an assessment grade, based on the packet completion. (Your teacher will discuss this with you August 8, 2022.)

We are excited about working with all of the students entering Algebra I in 2022-2023. We want all students to feel prepared, confident, and successful for all of the important new concepts they will learn next year.



Rising Algebra I RESOURCES

WEEK	MATH TOPIC	VIDEO & TUTORIAL LINKS
1	Integer Operations	<ul style="list-style-type: none">• 7.NS.A.1• https://www.khanacademy.org/math/cc-seventh-grade-math/cc-7th-negative-numbers-add-and-subtract/cc-7th-sub-neg-intro/v/adding-and-subtracting-negative-number-examples• https://www.youtube.com/watch?v=0hEQL3F5mc8
2	Order of Operations	<ul style="list-style-type: none">• 7.NS.A.1• https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-arithmetic-operations/cc-6th-order-of-operations/v/order-of-operations-1• https://www.youtube.com/watch?v=dXvvGc9TldY
3	Laws of Exponents	<ul style="list-style-type: none">• 8.EE.A.1• https://www.mathwarehouse.com/algebra/exponents/laws-of-exponents.php

		<ul style="list-style-type: none"> • https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-numbers-operations/cc-8th-pos-neg-exponents/v/negative-exponents • https://mathantics.com/lesson/laws-of-exponents
4	Pythagorean Theorem	<ul style="list-style-type: none"> • 8.G.B.5 • https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-geometry/cc-8th-pythagorean-theorem/v/the-pythagorean-theorem • https://www.youtube.com/watch?v=-jeYE99qwBY
5	Simplifying Radicals	<ul style="list-style-type: none"> • 8.EE.A.2 • https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:rational-exponents-radicals/x2f8bb11595b61c86:simplifying-square-roots/v/simplifying-square-roots-1 • https://www.youtube.com/watch?v=oB7r_kfMC6o
6	Graphing Linear Equations (slope – intercept form)	<ul style="list-style-type: none"> • 8.EE.B.5 • https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:forms-of-linear-equations/x2f8bb11595b61c86:graphing-slope-intercept-equations/v/graphing-a-line-in-slope-intercept-form • https://www.youtube.com/watch?v=mDwREDma3ro

Week 1: Integer Operations

<p>Addition</p> <p>When addends have the same sign, add. Use that sign when you write the sum:</p> $5 + 8 = 13$ $-2 + -5 = -7$ <p>When addends have different signs, subtract. Use the sign of the greater addend:</p> $-6 + 4 = -2$ $45 + -10 = 35$	<p>Subtraction</p> <p>To subtract an integer, add its opposite:</p> <p>*The opposite of 12 is -12</p> $4 - 12 = 4 + -12 = -8$ $9 - -12 = 9 + 12 = 21$ <p>*The opposite of 15 is -15</p> $1 - -15 = 1 + 15 = 16$ $-20 - -15 = -20 + 15 = -5$	<p>Multiplication</p> <p>When factors have the same sign, the product is positive:</p> $5 \cdot 6 = 30$ $-13 \cdot -3 = 39$ <p>When the factors have different signs, the product is negative:</p> $-6 \cdot 8 = -48$ $9 \cdot -11 = -99$	<p>Division</p> <p>When the dividend and the divisor have the same sign, the quotient is positive:</p> $45 \div 5 = 9$ $-120 \div -6 = 20$ <p>When the dividend and the divisor have different signs the quotient is negative:</p> $35 \div -5 = -7$ $-250 \div 10 = -25$
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Solve:

1. $-2 + (+3) =$

2. $-3(-4) =$

3. $45 - (-27) =$

4. $-5 + (+4) =$

5. $24 \div (-6) =$

6. $19(-4) =$

7. $5 - (-3) =$

8. $5(-18) =$

8. $-42 \div (-6) =$

9. $-7 - (-3) =$

10. $-8 \div (-4) =$

11. $-21 + -19 =$

12. $-14 - 6 =$

13. $17(-4) =$

14. $32 \div (-4) =$

15. $6 + (-8) =$

16. $81 \div (-9) =$

17. $14 - (-7) + (-2) =$

18. $93 - -21 =$

19. $-7 + 2 =$

20. $-21 \div (-7) =$

21. $-3 * -6$

22. $15 * -3$

23. $-4 * 9$

24. $-3 * -5 * -6$

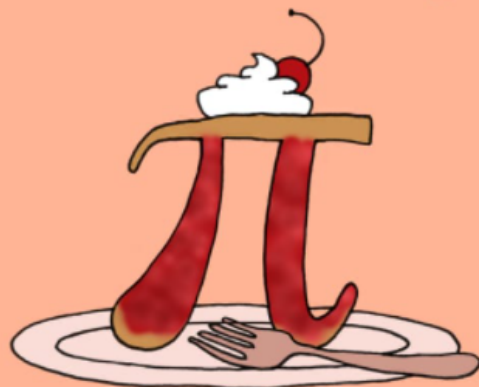
25. $-24 \div -3$

26. $40 \div -8$

27. $10 * -9$

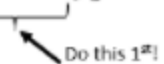



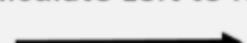
28. $-98 \div 7$

Why shouldn't you let advanced math intimidate you?



It's really as easy as *pi*!

Week 2: Order of Operations

Order of Operations			
1 st	Grouping Symbols	$\frac{4+2}{8 \cdot 7} = \frac{(4+2)}{(8 \cdot 7)}$ $\sqrt{50-1}$ $50 - [3 \cdot (15 - 5)] + 23$ 	Grouping Symbols include: $()$, $\{\}$, $[\]$, $ \ $ ← absolute value bars. In addition, complete all operations grouped by the <u>numerator</u> or <u>denominator</u> in a fraction & operations located underneath a radical symbol.
2 nd	Radicals & Exponents	3^2 $3^{\frac{1}{2}}$ $\sqrt{3}$ $\sqrt[4]{81}$	Rational Exponents & Roots are included
3 rd	Division & Multiplication	$30 \div 2 \cdot 5 = 75$ versus $30 \cdot 2 \div 5 = 12$ 	Calculate Left to Right 
4 th	Subtraction & Addition	$-2 + 6 - 8 = -4$ 	Calculate Left to Right 

Use the order of operations to solve the following problems.

1. $18 - (-12 - 3) =$

2. $-19 + (7 + 4)3 =$

3. $18 + (-7) \cdot (32 - 6) =$

4. $-19 - (-3) + -2(8 + -4) =$

5. $20 + -4(32 - 6) =$

6. $-3 + 2(-6 \div 3)2$

7. $3 \cdot (-4) + (52 + -4 \cdot 2) - (-9.82) =$

8. $23 + (-16) \div 42 \cdot 5 - (-3) =$

9. $-6(12 - 15) + 23 =$

10. $-50 \div (-10) + (5 - 3)^4 =$

11 $-4.5 \cdot (-0.53) + (-1)$

12. $5 - 2 + 8$

13. $85 / 5 + (8+9) \times 2 =$

Week 3: Laws of Exponents

1. **PRODUCT RULE:** To multiply when two bases are the same, write the base and ADD the exponents.

$$x^m \cdot x^n = x^{m+n}$$

Examples:

A. $x^3 \cdot x^8 = x^{11}$

B. $2^4 \cdot 2^2 = 2^6$

C. $(x^2y)(x^3y^4) = x^5y^5$

2. **QUOTIENT RULE:** To divide when two bases are the same, write the base and SUBTRACT the exponents.

$$\frac{x^m}{x^n} = x^{m-n}$$

Examples:

A. $\frac{x^5}{x^2} = x^3$

B. $\frac{3^5}{3^3} = 3^2$

C. $\frac{x^2y^5}{xy^3} = xy^2$

3. **ZERO EXPONENT RULE:** Any base (except 0) raised to the zero power is equal to one.

$$x^0 = 1$$

Examples:

A. $y^0 = 1$

B. $6^0 = 1$

C. $(7a^3b^{-1})^0 = 1$

4. **POWER RULE:** To raise a power to another power, write the base and MULTIPLY the exponents.

$$(x^m)^n = x^{m \cdot n}$$

Examples:

A. $(x^3)^2 = x^6$

B. $(3^2)^4 = 3^8$

C. $(z^5)^2 = z^{10}$

5. **EXPANDED POWER RULE:**

$$(xy)^m = x^m y^m \quad \left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$$

Examples:

A. $(2a)^3 = 2^3 a^3 = 8a^3$

C. $\left(\frac{x^2}{y}\right)^4 = \frac{(x^2)^4}{y^4} = \frac{x^8}{y^4}$

B. $(6x^3)^2 = 6^2 (x^3)^2 = 36x^6$

D. $\left(\frac{2x}{3y^2}\right)^3 = \frac{(2x)^3}{(3y^2)^3} = \frac{2^3 x^3}{3^3 (y^2)^3} = \frac{8x^3}{27y^6}$

6. **NEGATIVE EXPONENTS:** If a factor in the numerator or denominator is moved across the fraction bar, the sign of the exponent is changed.

$$x^{-m} = \frac{1}{x^m} \quad \frac{1}{x^{-m}} = x^m \quad \left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^n$$

Examples:

A. $x^{-3} = \frac{1}{x^3}$

B. $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$

C. $-4x^5y^{-2} = \frac{-4x^5}{y^2}$

D. $\left(\frac{x^2}{y}\right)^{-3} = \left(\frac{y}{x^2}\right)^3 = \frac{y^3}{x^6}$

E. $(3x^{-2}y)(-2xy^{-3}) = -6x^{-1}y^{-2} = \frac{-6}{xy^2}$

F. $\frac{a^{-2}b^3}{c^{-4}d^{-1}} = \frac{b^3c^4d}{a^2}$

G. $(-2x^2y^{-4})^{-2} = \left(\frac{-2x^2}{y^4}\right)^{-2} = \left(\frac{y^4}{-2x^2}\right)^2 = \frac{y^8}{4x^4}$

CAUTION: $-x \neq \frac{1}{x}$ For example: $-3 \neq \frac{1}{3}$

REMEMBER: An exponent applies to only the factor it is directly next to *unless* parentheses enclose other factors.

Examples:

A. $(-3)^2 = (-3)(-3) = 9$

B. $-3^2 = -9$

Simplify each of the following.

1. $3 \cdot 4^3$

2. $4x^3 \cdot 2x^3$

3. $x^5 \cdot x^3$

4. $2x^3 \cdot 2x^2$

5. $\frac{6^5}{6^3}$

6. $\frac{x^4}{x^7}$

7. 8^0

8. $-(9x)^0$

9. $(y^4)^3$

10. $(x^2y)^4$

11. $\frac{6x^7}{2x^4}$

12. $\frac{8x^5}{4x^2}$

13. $(2cd^4)^2(cd)^5$

14. $(2fg^4)^4(fg)^6$

15. $\frac{x^5y^6}{xy^2}$

16. $\frac{x^2y^5}{xy^4}$

17. $\left(\frac{4x^5y}{16xy^4}\right)^3$

18. $\left(\frac{5x^3y}{20xy^5}\right)^4$

19. y^{-7}

20. 7^{-2}

21. $\frac{1}{x^{-5}}$

22. $\frac{1}{2^{-4}}$

23. $x^5 \cdot x^{-1}$

24. x^{-6}

25. $x^9 \cdot x^{-7}$

26. $(j^{-13})(j^4)(j^6)$

27. $\frac{x^{-1}}{x^{-8}}$

28. $\frac{52x^6}{13x^{-7}}$

29. $f^{-3}(f^2)(f^{-3})$

30. $\frac{x^{-4}}{x^{-9}}$

31. $\frac{24x^6}{12x^{-8}}$

32. $\frac{3x^2y^{-3}}{12x^6y^3}$

33. $(2x^3y^{-3})^{-2}$

34. $\frac{2x^4y^{-4}}{8x^7y^3}$

35. $(4x^4y^{-4})^3$

36. $5x^2y(2x^4y^{-3})$

37. $\left(\frac{-7a^2b^3c^0}{3a^3b^4c^3}\right)^{-4}$

38. $\left(\frac{-2a^3b^2c^0}{3a^2b^3c^7}\right)^{-2}$

39) $a \cdot a^2 \cdot a^3$

40) $(2a^2b)(4ab^2)$

41) $(6x^2)(-3x^5)$

42) $b^3 \cdot b^4 \cdot b^7 \cdot b$

43) $(3x^3)(3x^4)(-3x^2)$

44) $(2x^2y^3)^2$

45) $(5x^2y^4)^3$

46) $(6x^4y^6)^3$

47) $(4x^3y^3)^3$

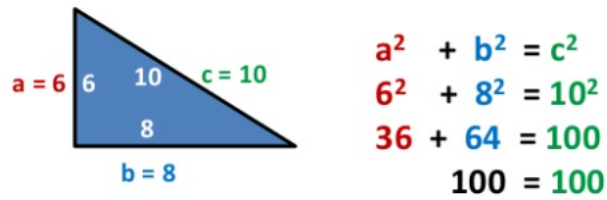
48) $(7xy)^2$

49) $\frac{x^3}{x}$

50) $\frac{18c^3}{-3c^2}$

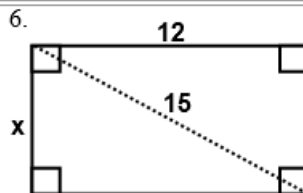
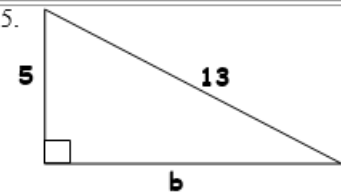
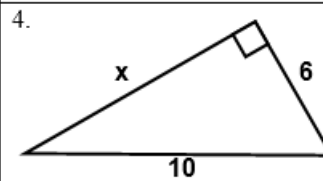
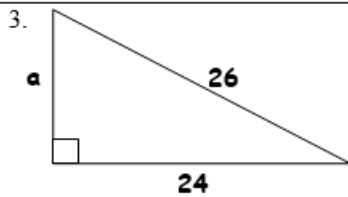
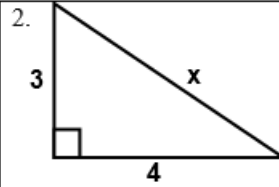
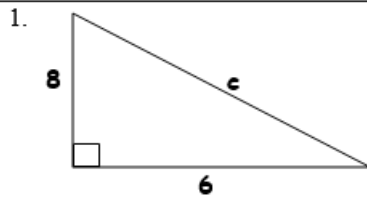
Week 4: Pythagorean Theorem

Pythagoras Theorem



Pythagoras rule works on all Right Angled Triangles

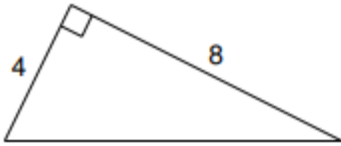
Find the missing side lengths.



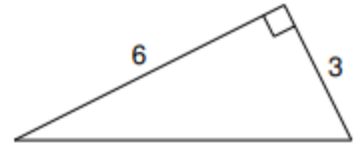
length to the nearest tenth.

Find the missing

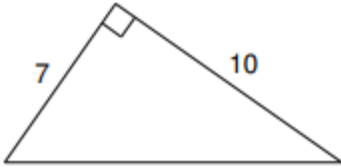
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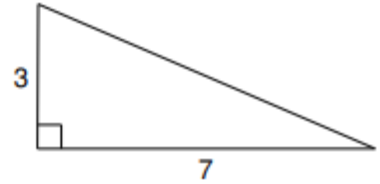
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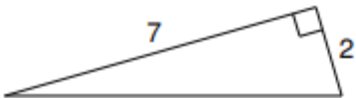
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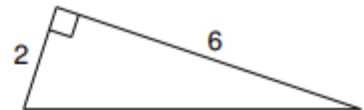
10)



11)



12)



What is the missing side length? Show your work.

13) $a = 7, b = 24, c = ?$

14) $a = ?, b = 34, c = 37$

15) $a = 11, b = ?, c = 61$

16) $a = 5, b = 12, c = ?$

Week 5: Simplifying Radicals

Simplify Square Roots

Find Perfect Square

$$\begin{aligned}\sqrt{48} &= \sqrt{16} \times \sqrt{3} \\ &= 4 \times \sqrt{3} \\ &= 4\sqrt{3}\end{aligned}$$

Find Prime Factors

$$\begin{aligned}\sqrt{48} &= \sqrt{2 \times 2 \times 2 \times 2 \times 3} \\ &= \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{3} \\ &= 2 \times 2 \times \sqrt{3} \\ &= 4 \times \sqrt{3} \\ &= 4\sqrt{3}\end{aligned}$$

Simplify completely.

1. $\sqrt{9} =$

2. $\sqrt{32}$

3. $\sqrt{50}$

4. $\sqrt{80}$

5. $\sqrt{72}$

6. $\sqrt{120}$

7. $\sqrt{68}$

8. $\sqrt{200}$

9. $\sqrt{180}$

10. $\sqrt{33}$

11. $3\sqrt{12}$

12. $5\sqrt{48}$

13. $2\sqrt{76}$

14. $-3\sqrt{32}$

15. $5\sqrt{80}$

16) $\sqrt{28}$

17) $\sqrt{45}$

18) $\sqrt{72}$

19) $\sqrt{20}$

20) $\sqrt{150}$

Week 6: Graphing Linear Equations (Slope – Intercept Form)

Step-by-Step Method to Graph a Line when in Slope-Intercept Form

STEP 1: Find the **slope** & **y-intercept** from the equation

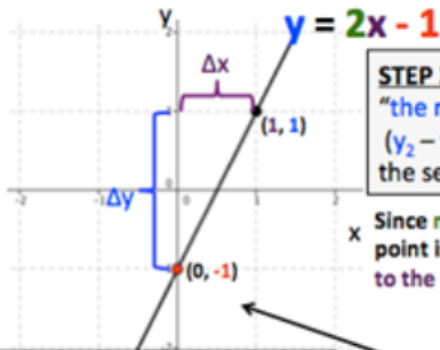
For $y = 2x - 1$, $m = 2$, $b = -1$

$$y = 2x - 1$$

Note that $y = 2x - 1$ can be rewritten as $y = 2x + (-1)$, where $b = -1$

The **slope** is always the change in the **y-values** divided by the change in the **x-values** between **two points** on a line

The **y-intercept** is always at the point $(0, b)$ on an (x, y) graph



STEP 3: Plot the second point using the **slope**, m , which is "the rise over the run," or $\frac{\Delta y}{\Delta x}$, which equals $(y_2 - y_1) / (x_2 - x_1)$. Draw a line through the **y-intercept** and the second point.

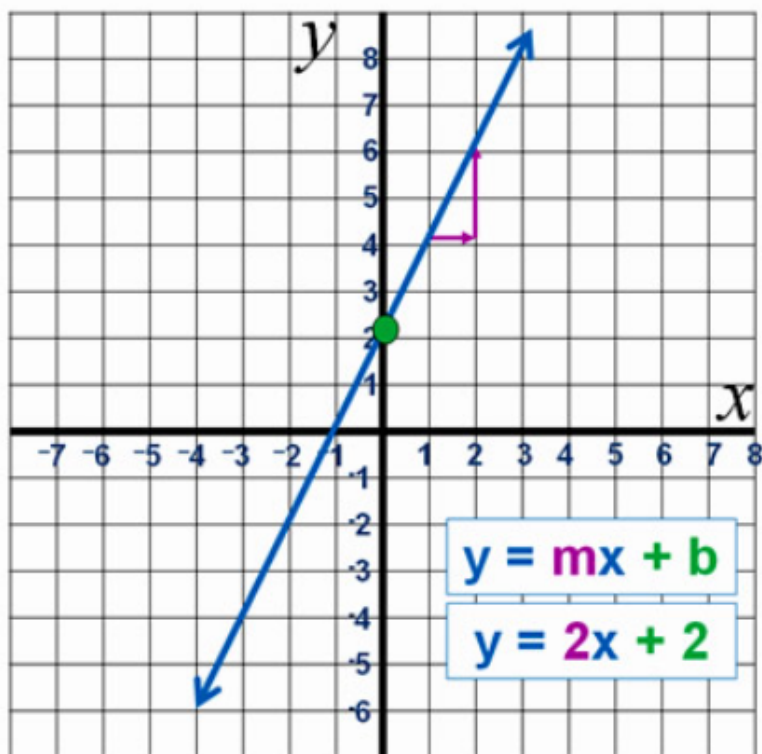
Since $m = 2$, and the **y-intercept** is at the point $(0, -1)$, the second point is located **two up**, "the rise," from the **y-intercept**, and **one to the right**, "the run," which is the point $(1, 1)$.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{2}{1} = 2$$

STEP 2: Plot the **y-intercept** as the point $(0, -1)$

Since $b = -1$ for $y = 2x - 1$, the **y-intercept** is at the point $(0, -1)$, which is one of the **TWO POINTS** needed to graph a line

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The value of b or c is the point at which the line crosses the y -axis

$$b = 2$$

m is the gradient slope which is the Rise Up / Run Across

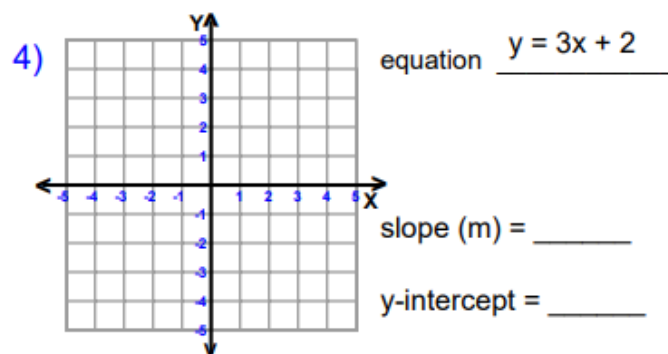
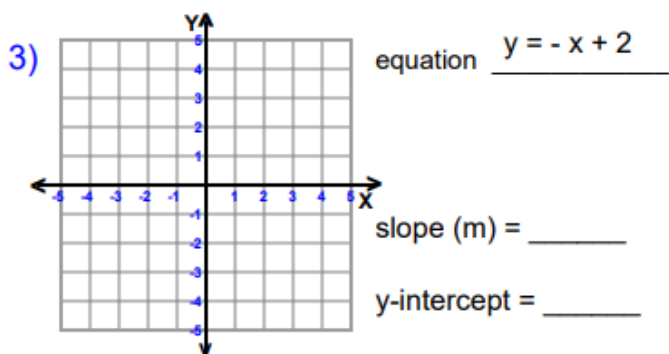
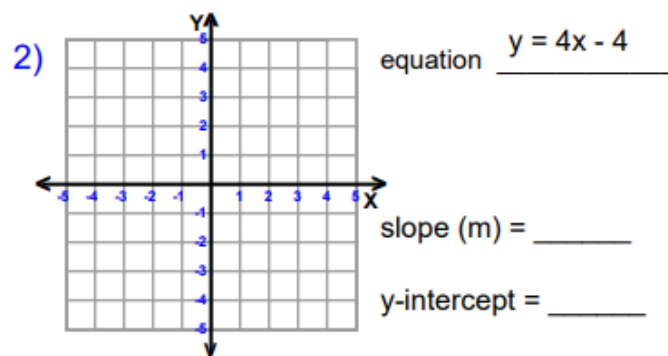
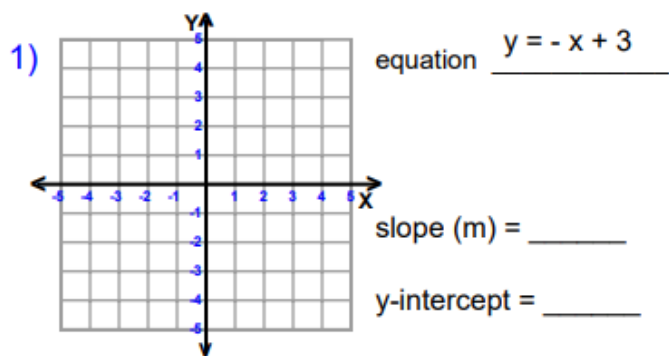
Each time the line moves 1 place to the right, it goes UP by 2 places.

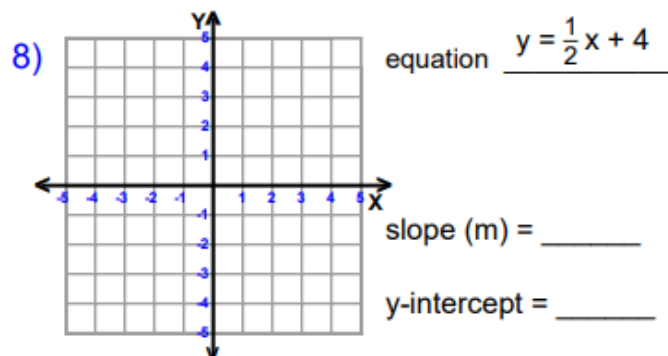
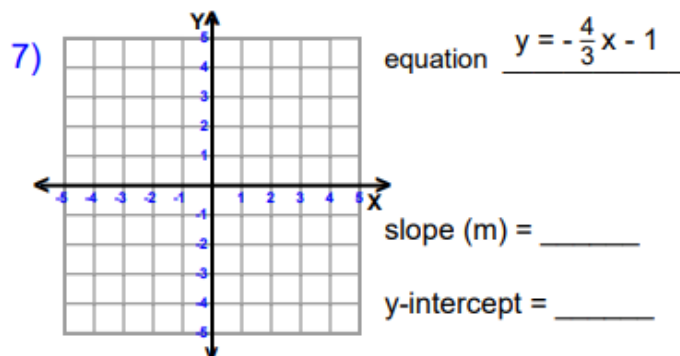
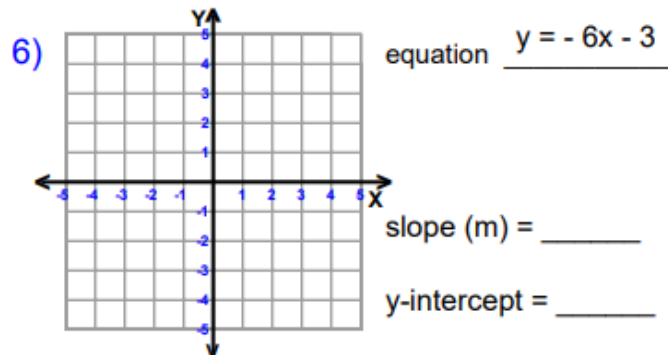
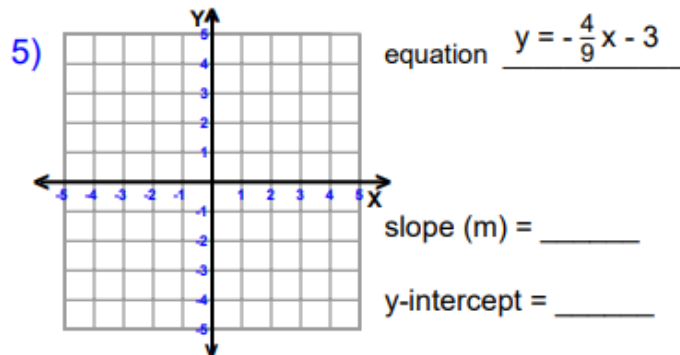
$$m = 2/1 = 2$$

Image Copyright 2013 by Passy's World of Mathematics

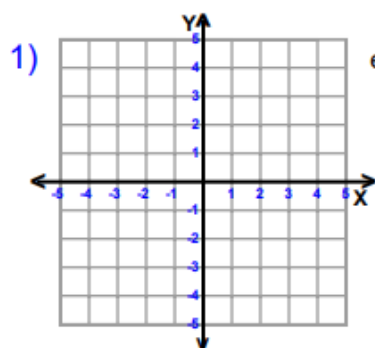
Graph each

line with a straight edge or ruler. Then tell the slope and y -intercept.

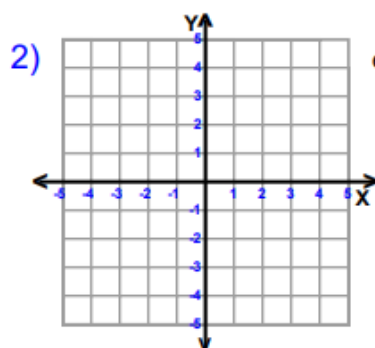




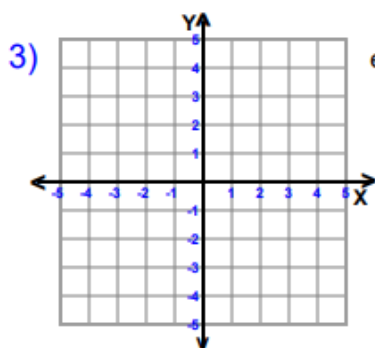
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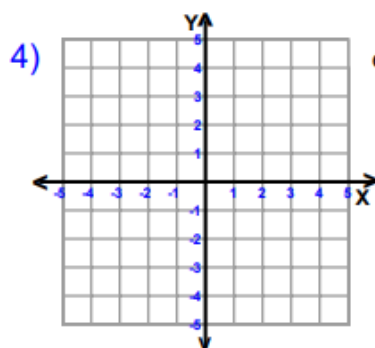
equation $y = -x + 4$



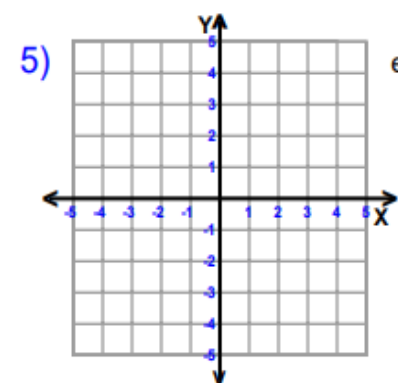
equation $y = \frac{5}{2}x - 4$



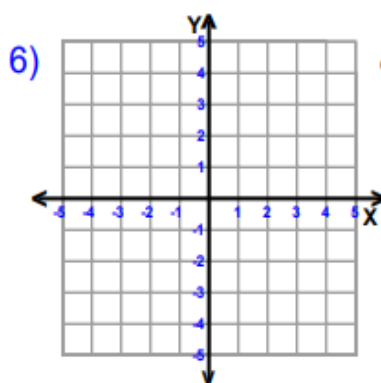
equation $y = \frac{2}{3}x + 1$



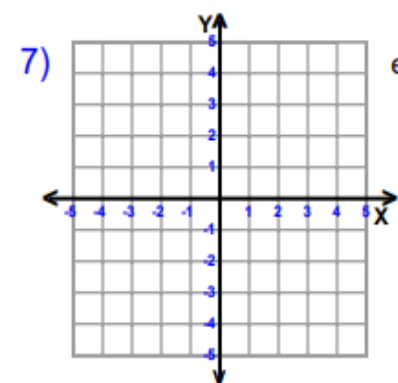
equation $y = \frac{1}{2}x - 1$



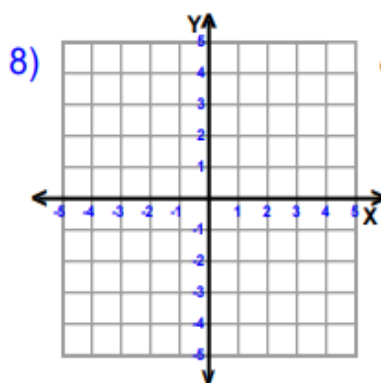
equation $y = -2x + 2$



equation $y = -6x - 3$



equation $y = \frac{3}{2}x + 3$



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

 **You did it!**