# John P. Freeman Optional School

# Zone 6

# 2023 Summer
# 8th Grade 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 8th grade. Students enrolled in 8th grade Pre-Algebra 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 8th grade 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 8th Graders RESOURCES**

| WEEK | MATH TOPIC | VIDEO & TUTORIAL LINKS |
|---|---|---|
| 1 | Integer Operations | • 7.NS.A.1<br>• 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<br>• https://www.youtube.com/watch?v=0hEQL3F5mc8 |
| 2 | Order of Operations | • 7.NS.A.1<br>• https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-arithmetic-operations/cc-6th-order-of-operations/v/order-of-operations-1<br>• https://www.youtube.com/watch?v=dXvvGc9TldY |
| 3 | Laws of Exponents | • 8.EE.A.1<br>• https://www.mathwarehouse.com/algebra/exponents/laws-of-exponents.php |

| | | |
|---|---|---|
| | | • https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-numbers-operations/cc-8th-pos-neg-exponents/v/negative-exponents <br> • https://mathantics.com/lesson/laws-of-exponents |
| 4 | Pythagorean Theorem | • 8.G.B.5 <br> • https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-geometry/cc-8th-pythagorean-theorem/v/the-pythagorean-theorem <br> • https://www.youtube.com/watch?v=-jeYE99qwBY |
| 5 | Simplifying Radicals | • 8.EE.A.2 <br> • https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:rational-exponents-radicals/x2f8bb11595b61c86:simplifying-square-roots/v/simplifying-square-roots-1 <br> • https://www.youtube.com/watch?v=oB7r_kfMC6o |
| 6 | Graphing Linear Equations (slope – intercept form) | • 8.EE.B.5 <br> • https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:forms-of-linear-equations/x2f8bb11595b61c86:graphing-slope-intercept-equations/v/graphing-a-line-in-slope-intercept-form <br> • https://www.youtube.com/watch?v=mDwREDma3ro |

# Week 1:  Integer Operations

**Addition**

When addends have the same sign, add.  Use that sign when you write the sum:

$5 + 8 = 13$
$-2 + -5 = -7$

When addends have different signs, subtract.  Use the sign of the greater addend:

$-6 + 4 = -2$
$45 + -10 = 35$

**Subtraction**

To subtract an integer, add its opposite:

*The opposite of 12 is -12

$4 - 12 = 4 + -12 = -8$
$9 - -12 = 9 + 12 = 21$

*The opposite of 15 is -15

$1 - -15 = 1 + 15 = 16$
$-20 - -15 = -20 + 15 = -5$

**Multiplication**

When factors have the same sign, the product is positive:

$5 \cdot 6 = 30$
$-13 \cdot -3 = 39$

When the factors have different signs, the product is negative:

$-6 \cdot 8 = -48$
$9 \cdot -11 = -99$

**Division**

When the dividend and the divisor have the same sign, the quotient is positive:

$45 \div 5 = 9$
$-120 \div -6 = 20$

When the dividend and the divisor have different signs the quotient is negative:

$35 \div -5 = -7$
$-250 \div 10 = -25$

**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. $-7 + 2 =$

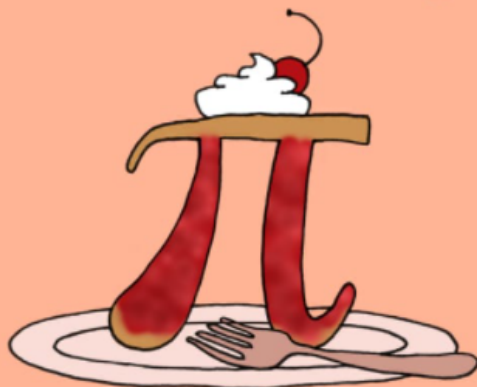20. $-21 \div (-7) =$

21. $-3 * -6$

22. $15 * -3$

23. $-4 * 9$

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

25. $-24 \div -3$
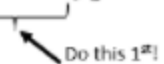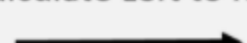
26. $40 \div -8$

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

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

Use the order of operations to solve the following problems.

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

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

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

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

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

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

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

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**

## 5. EXPANDED POWER RULE:

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

Examples:

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

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

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

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.

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

Examples:

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

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

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

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

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

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

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

Examples:

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

B. $-3^2 = -9$

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

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

Examples:

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

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

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

**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) $(7xy)^2$

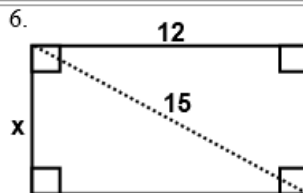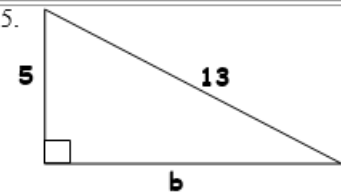49) $\frac{x^3}{x}$
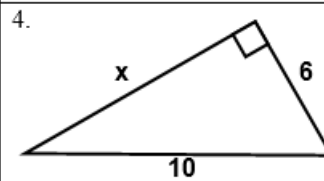
50) $\frac{18c^3}{-3c^2}$

# Week 4:  Pythagorean Theorem

## Pythagoras Theorem

c = "Hypotenuse"
Sloping Side

a = Altitude

b = Bottom Base

$$a^2 + b^2 = c^2$$

a = 6   6   10   c = 10

8

b = 8

$$a^2 + b^2 = c^2$$
$$6^2 + 8^2 = 10^2$$
$$36 + 64 = 100$$
$$100 = 100$$
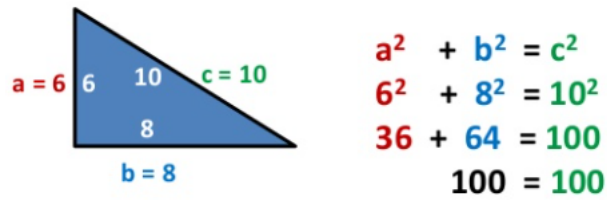
Pythagoras rule works on all Right Angled Triangles

Find the missing side lengths.

| | |
|---|---|
| 1.  8  c  6 | 2.  3  x  4 |
| 3.  a  26  24 | 4.  x  6  10 |

5.  5  13  b

6.  12  15  x
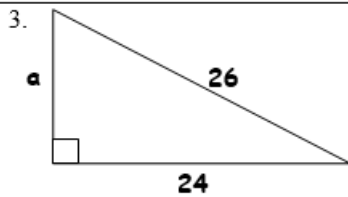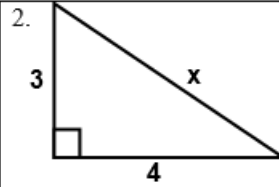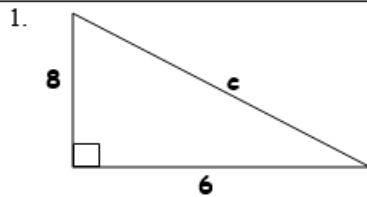
Find the missing length to the nearest tenth.

**7)**
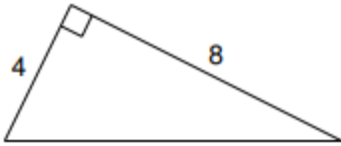


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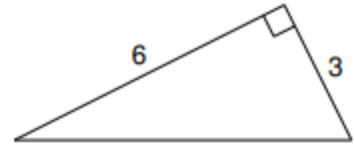


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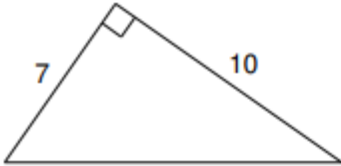


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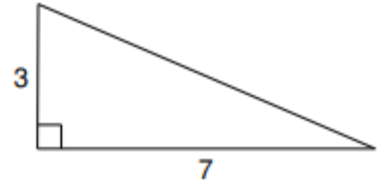


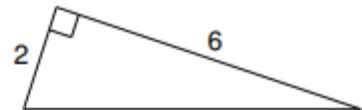**11)**
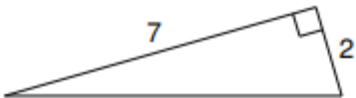


**12)**



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 | Find Prime Factors |
|---|---|
| $\sqrt{48} = \sqrt{16} \times \sqrt{3}$ | $\sqrt{48} = \sqrt{2 \times 2 \times 2 \times 2 \times 3}$ |
| $\qquad = 4 \times \sqrt{3}$ | $\qquad = \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{3}$ |
| $\qquad = 4\sqrt{3}$ | $\qquad = 2 \times 2 \times \sqrt{3}$ |
| | $\qquad = 4 \times \sqrt{3}$ |
| | $\qquad = 4\sqrt{3}$ |

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) $\sqrt{150}$

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

$$y = 2x - 1$$

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

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

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

$$y = 2x - 1$$
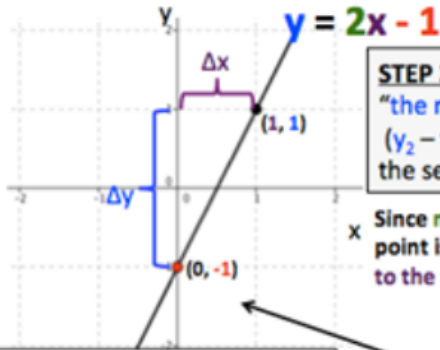


**STEP 3**: Plot the second point using the slope, m, which is "the rise over the run," or $\Delta y / \Delta x$, which equals $(y_2 - y_1) / (x_2 - x_1)$. Draw a line through the y-intercept and the second point.

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).

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

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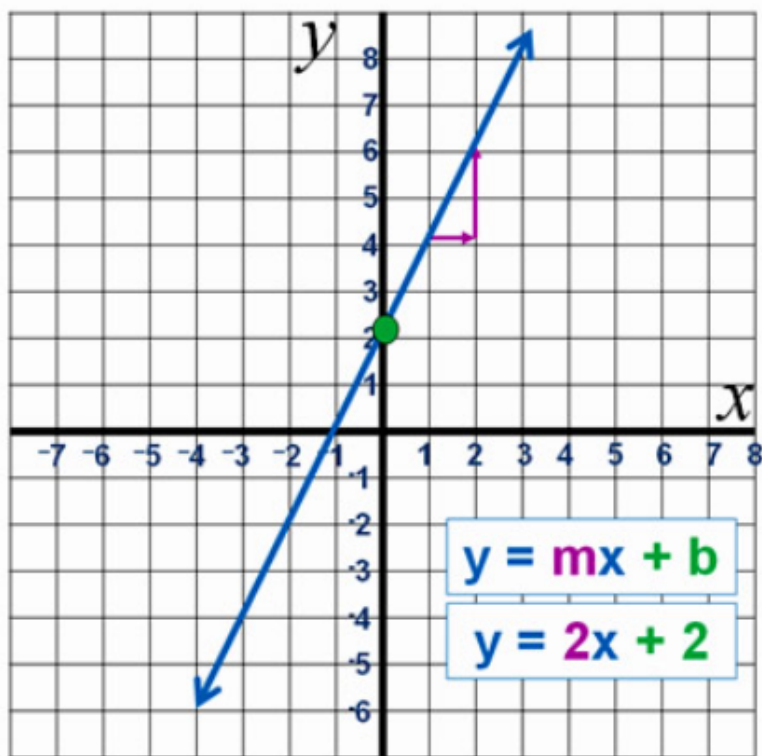
The value of b or c is the point at which the line crosses the y-axis

**b = 2**

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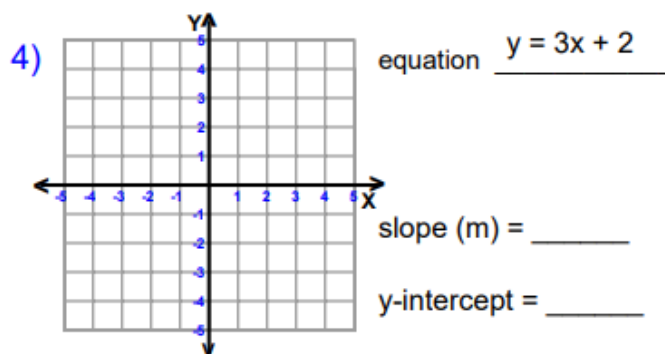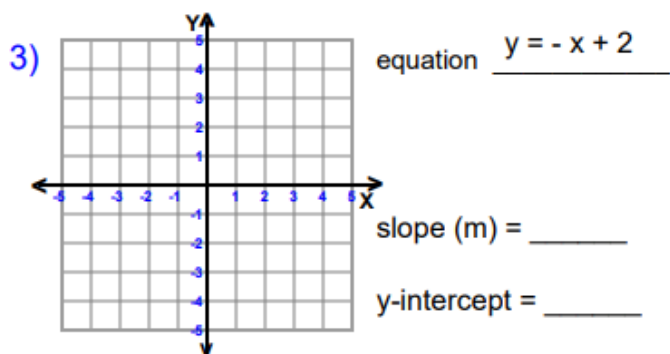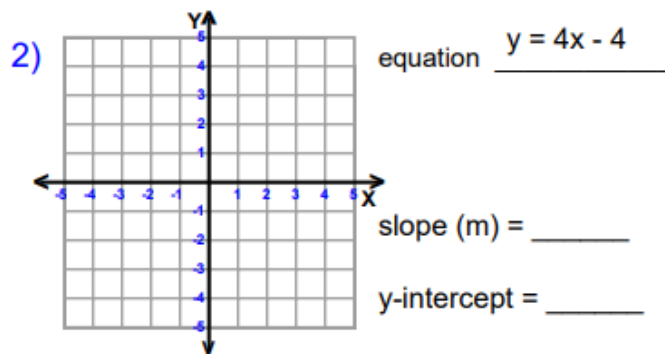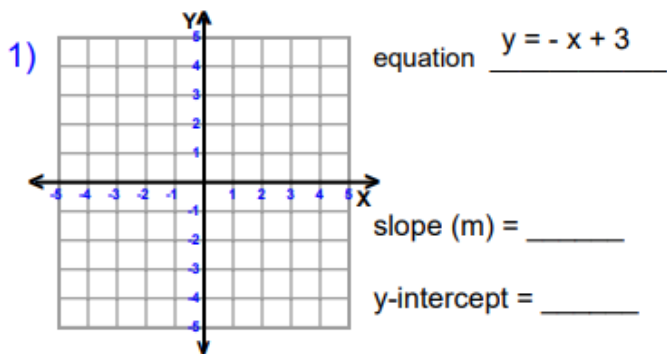
**Rise Up / Run Across**

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

**m = 2/1 = 2**

y = mx + b
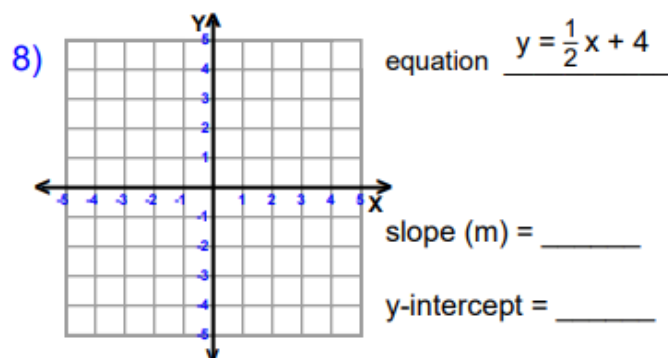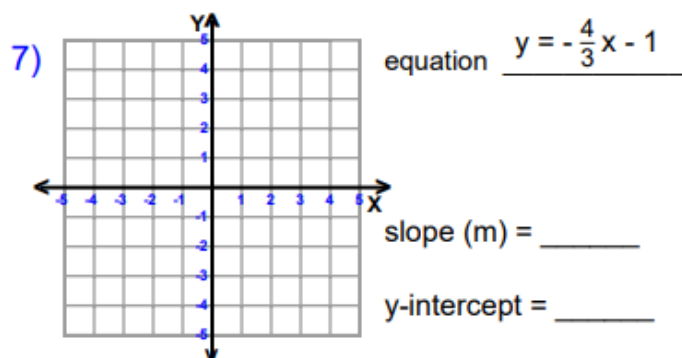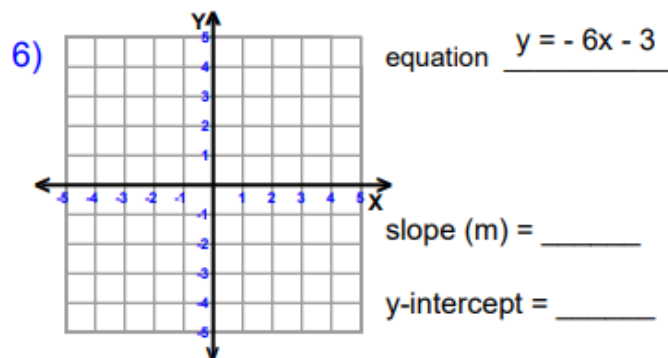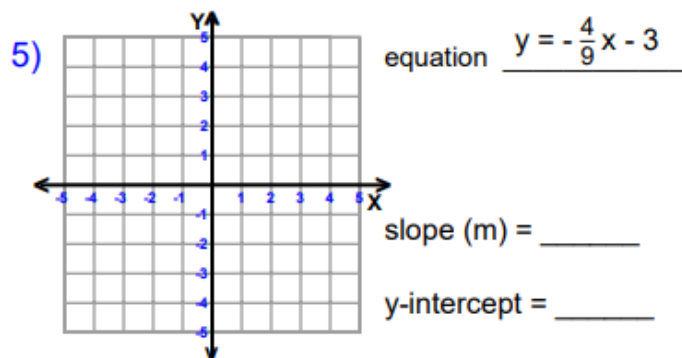
y = 2x + 2

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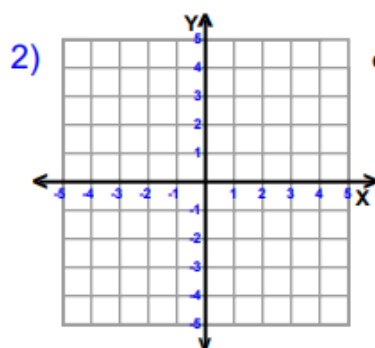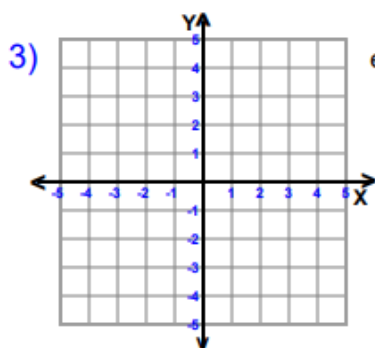Graph each line with a straight edge or ruler.  Then tell the slope and y-intercept.

1)



equation  y = - x + 3

slope (m) = _____

y-intercept = _____

2)



equation  y = 4x - 4

slope (m) = _____

y-intercept = _____

3)



equation  y = - x + 2

slope (m) = _____

y-intercept = _____

4)



equation  y = 3x + 2

slope (m) = _____

y-intercept = _____

5) 

equation $y = -\frac{4}{9}x - 3$

slope (m) = _____

y-intercept = _____

6) 

equation $y = -6x - 3$

slope (m) = _____

y-intercept = _____

7) 

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

slope (m) = _____

y-intercept = _____

8) 

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

slope (m) = _____

y-intercept = _____

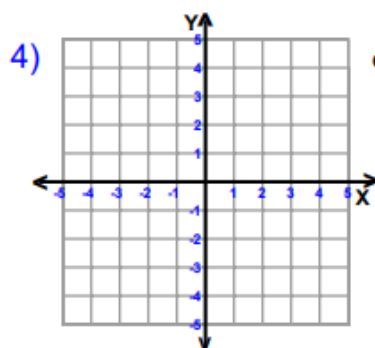Graph each line with a straight edge or ruler.
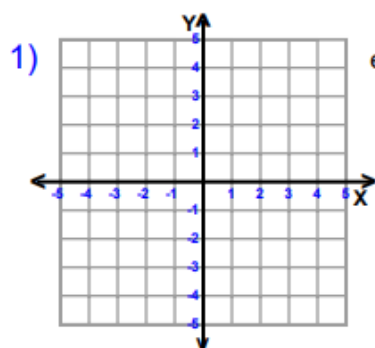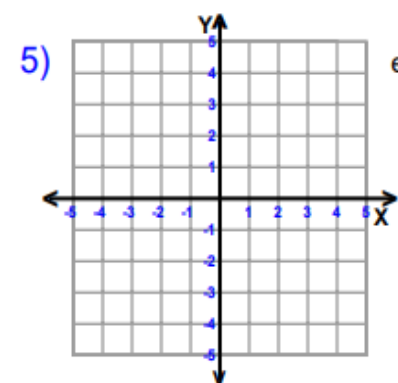
1) 

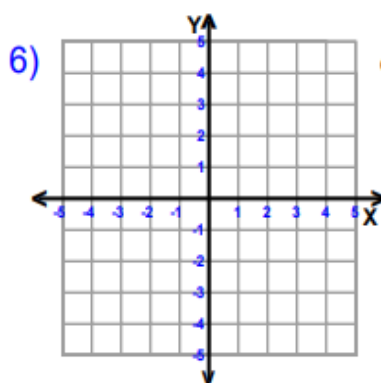equation $y = -x + 4$

2) 

equation $y = \frac{5}{2}x - 4$
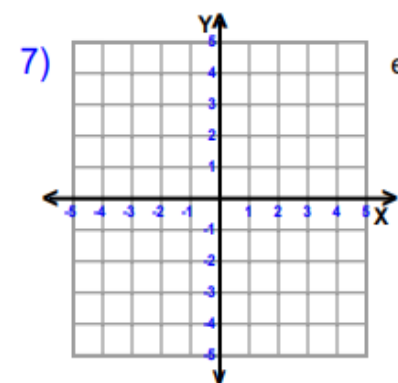
3) 

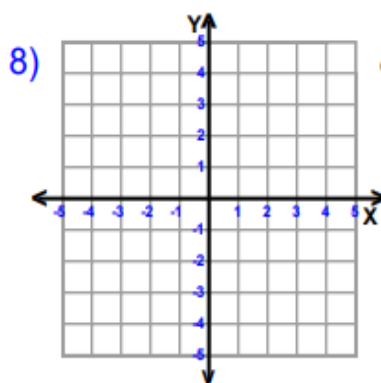equation $y = \frac{2}{3}x + 1$

4) 

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

5) 

equation $y = -2x + 2$

6) 

equation $y = -6x - 3$

7) 

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

8) 

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

You did it!