8th Gr

Operations with Integers

Adding and Subtracting Integers

Adding Integers

Like Signs	Different Signs
Add the numbers & carry the sign	Subtract the numbers & carry the sign of the larger number
(+) + (+) = + 3 + 4 = 7	3 + (-2) = 1 (3 > 2 so positive answer)
(-) + (-) = - -2 + (-3) = -5	3 + (-5) = -2 (5 > 3 so negative answer)

Subtracting Integers

Don't subtract! Change the problem to addition and change the sign of the second number. Then use addition rules. (Subtracting = Adding the opposite)

$9 - 12 = 9 + -12$	$4 - (-3) = 4 + (+3)$
$-5 - 3 = -5 + -3$	$-1 - (-5) = -1 + (+5)$

Simplify. ***Do not use a calculator for this section.***

1. $9 + (-4)$
2. $-8 + 7$
3. $-14 - 6$
4. $-30 + (-9)$
5. $14 - 20$
6. $-2 + 11$
7. $20 - (-6)$
8. $7 - 10$
9. $-6 - (-7)$
10. $5 - 9$
11. $-8 - 7$
12. $1 - (-12)$

Multiplying and Dividing Integers

If the signs are the same, the product/quotient is positive.

If the signs are different, the product/quotient is negative.

LIKE SIGNS		DIFFERENT SIGNS	
(+) (+) = (+)	(3)(4) = 12	(+) (−) = (−)	(3)(-4) = -12
(−) (−) = (+)	(-3)(-4) = 12	(−) (+) = (−)	(-3)(4) = -12
(+) ÷ (+) = (+)	15 ÷ 3 = 5	(+) ÷ (−) = (−)	15 ÷ (-3) = -5
(−) ÷ (−) = (+)	(-15) ÷ (-3) = 5	(−)÷ (+) = (−)	-15 ÷ 3 = -5

Simplify. ***Do not use a calculator for this section.***

1. $(-5)(-3)$
2. $\frac{-6}{2}$
3. $(12)(4)$
4. $-12 \div (-4)$
5. $(-1)(-5)$
6. $\frac{-16}{8}$
7. $\frac{-7}{-1}$
8. $(3)(-8)$
9. $8 \div -4$
10. $(-2)(7)$
11. $\frac{-30}{-3}$
12. $(12)(-5)$

Order of Operations

To avoid having different results for the same problem when simplifying expressions that contain multiple operations, mathematicians have agreed on an order of operations.

1. Perform any operation(s) inside grouping symbols (parentheses, brackets, numerator and denominator of a fraction).
2. Simplify any exponents.
3. Multiply and divide in order from left to right.
4. Add and subtract in order form left to right.

One easy way to remember the order of operations process is to remember the acronymn GEMDAS (or PEMDAS and the saying "Please Excuse My Dear Aunt Sally.")

G – perform operations in grouping symbols
E – simplify exponents
M – multiply and divide from left to right
D
A – add and subtract from left to right
S

Example 1

$2 - 3^2 + (6 + 3 * 2)$
$= 2 - 3^2 + (6 + 6)$
$= 2 - 3^2 + (12)$
$= 2 - 9 + 12$
$= -7 + 12$
$= 5$

Example 2

$-7 + 4 + (2^3 - 8 \div -4)$
$= -7 + 4 + (8 - 8 \div -4)$
$= -7 + 4 + (8 - 2)$
$= -7 + 4 + 10$
$= -3 + 10$
$= 7$

Simplify each expression. Remember your order of operations process.

1. $6 + 4 - 2 \cdot 3$
2. $15 \div 3 \cdot 5 - 4$
3. $50 - (17 + 8)$
4. $-2(3 + 5 - 7)$

5. $18 - 4^2 + 7$

6. $3(2 + 7) - 9 \cdot 7$

7. $10(3 - 6^2) + 8 \div 2$

8. $180 \div [2 + (12 \div 3)]$

9. $3 + 8(2^2) - 4$

10. $[10 + (2 \cdot 8)] \div 2$

11. $\frac{1}{4}[3(8)] + 2(-12)$

12. $\frac{5+[30-(8-1)^2]}{11-2^2}$

13. $\frac{3(10-27\div 9)}{4-7}$

14. $162 \div [6(7 - 4)^2] \div 3$

15. $[8(2) - (3 + 9)] + [8 - 2(3)]$

16. $4^2 - 5(4 - 5)^2$

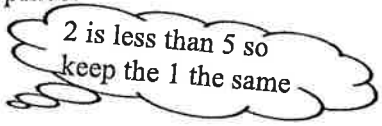
Rounding Numbers

Step 1: Underline the place value to which you want to round.
Step 2: Look at the digit to the right of that place value.
→ If the number to the right is less than 5, keep the number the same and drop all other numbers.
→ If the number to the right is 5 or more, round up and drop the rest of the numbers.

Examples

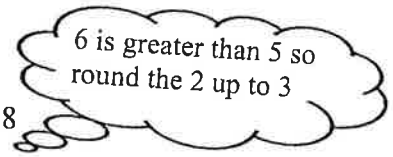
1. Round to the tenths place.

   a. 23.1246

   23.1

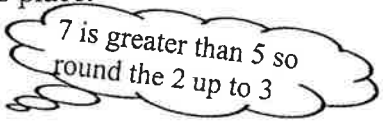
   b. 164.268

   164.3

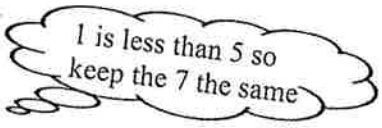
2. Round to the hundredths place.

   a. 3.9271

   3.93

   b. 10.0719

   10.07

1. Round the following numbers to the tenths place.

   a. 18.623 _____

   b. 25.0543 _____

   c. 3.921 _____

   d. 36.9913 _____

   e. 0.591 _____

   f. 0.705 _____

2. Round the following numbers to the hundreths place.

   a. 19.9816 _____

   b. 100.915 _____

   c. 0.268513 _____

   d. 17.108 _____

   e. 0.6701 _____

   f. 1.997023 _____

Simplifying Fractions

To simplify a fraction, divide the numerator and the denominator by the greatest common factor.

example: Simplify the fraction $\frac{18}{27}$

The greatest common factor of 18 and 27 is 9.

Divide the numerator and the denominator by 9.

$$\frac{18}{27} \div \frac{9}{9} = \frac{2}{3}$$

Reduce each fraction as much as possible.

Ex) $\frac{8}{16} = \frac{1}{2}$

1) $\frac{21}{30} =$ ____

2) $\frac{12}{16} =$ ____

3) $\frac{5}{10} =$ ____

4) $\frac{25}{35} =$ ____

5) $\frac{4}{14} =$ ____

6) $\frac{4}{40} =$ ____

7) $\frac{10}{45} =$ ____

8) $\frac{18}{30} =$ ____

9) $\frac{4}{36} =$ ____

10) $\frac{8}{18} =$ ____

11) $\frac{5}{35} =$ ____

Simplify each fraction. Leave it as an improper fraction. The first one is done for you.

1. $\frac{16}{6} = \frac{8}{3}$
2. $\frac{16}{12} =$ _____
3. $\frac{40}{15} =$ _____
4. $\frac{33}{12} =$ _____
5. $\frac{102}{36} =$ _____

Evaluating Expressions

Evaluate means "find the value of." To evaluate an expression first replace any variables with given equivalents then follow order of operations to arrive at a numerical answer.

Examples

A) Evaluate the following expressions when $x = 5$.

$5x - 15$

$5(5) - 15$

$= 25 - 15$

$= 10$

$(x - 8)^2 + 2x$

$(5 - 8)^2 + 2(5)$

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

$= 9 + 10$

$= 19$

B) Evaluate the following expression when $a = -2, b = 4$, and $c = -1$.

$\frac{a+2(a-b)}{c^3}$

$\frac{-2+2(-2-4)}{(-1)^3} = \frac{-2+2(-6)}{-1} = \frac{-2+(-12)}{-1} = \frac{-14}{-1} = 14$

Evaluate each expression given that $x = 5$, $y = -4$, $z = 6$.

1. $3x$
2. $2x^2$
3. $3x^2 + y$
4. $2(x + z) - y$
5. $xy + z$
6. $2x + 3y - z$

Evaluate each expression given that $a = -2,\ b = 12,\ c = 3.$

7. $\frac{b}{a}$

8. $5a + (b - c)$

9. $(c - a)^2$

10. $\frac{b-3a}{2c}$

11. $2a^2 + b^2 + c$

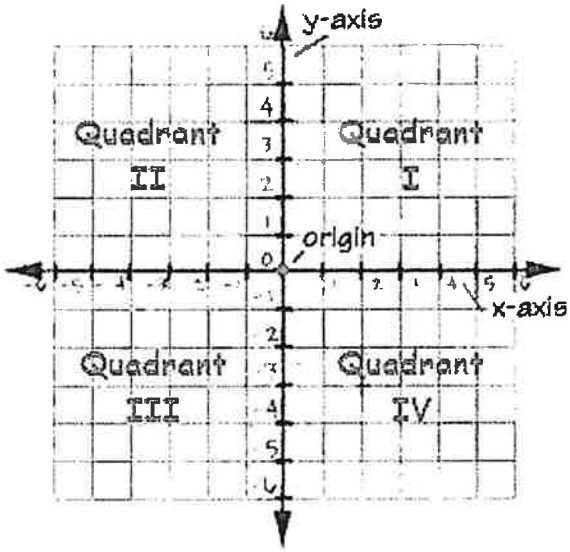
12. $\frac{ac}{b}$

13. $\left(\frac{b}{4}\right)^2 - 2a$

14. $a^3 - 2c$

Graphing

Points in a coordinate plane are named using two numbers (x, y), called an ordered pair. The first number is called the x-coordinate. The x-coordinate is positive if the point is to the right of the origin and negative if the point is to the left of the origin. The second number is called the y-coordinate. The y-coordinate is poistive if the point is above the origin and negative if the point is below the origin.
The coordinate plane is divided into four quadrants (regions) by the x-axis (horizontal axis) and y-axis (vertical axis). The origin is the point where the axes intersect.



Plot each point on the coordinate plane. Label each point with the given letter. Then identify which Quadrant the point belongs to or on which axis it lies.

Examples: N (-4, 7) *Quadrant II* P (2, 0) *x-axis*

A (8, 4) _____

B (-2, -8) _____

C (0, -5) _____

D (-7, -1) _____

E (-2, 3) _____

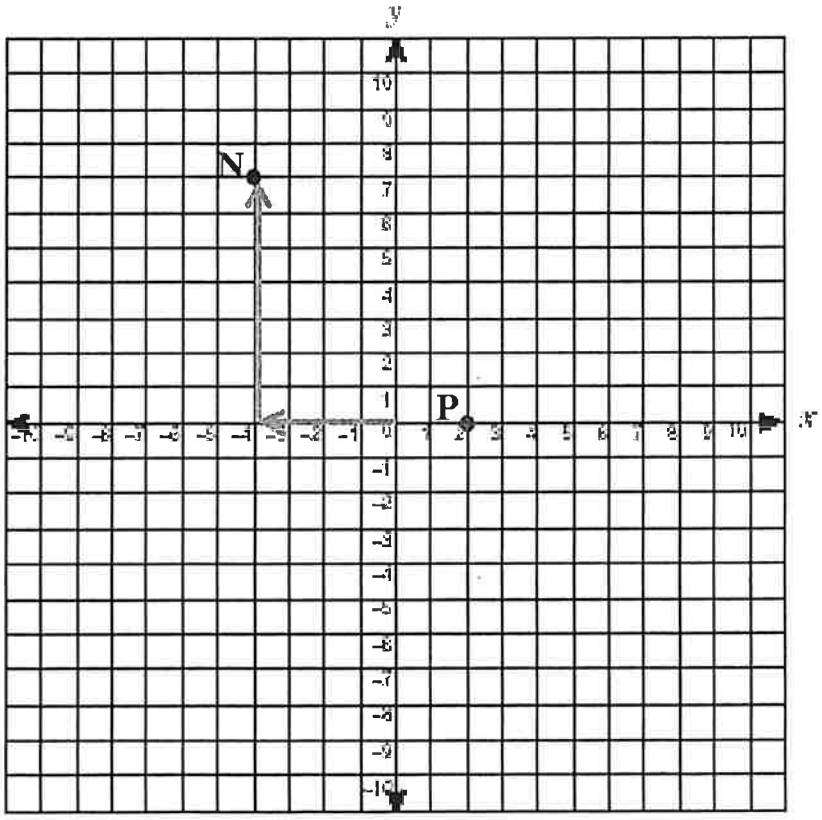
F (6, -3) _____

G (0, 10) _____

H (-5, 0) _____

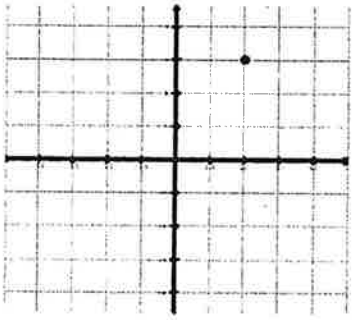
J (3, 7) _____

K (7, -7) _____

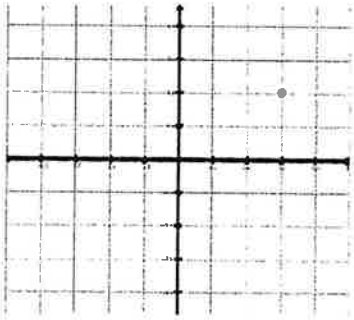


Write an ordered pair for each point graphed below.

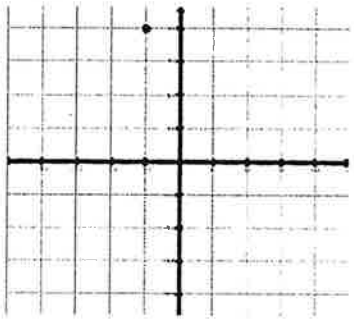
Example: (2, 3)



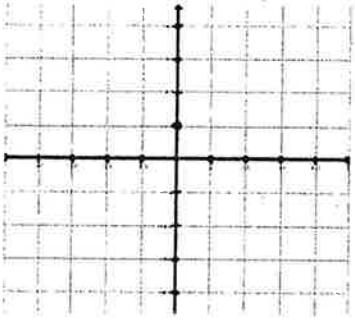
1. (___, ___)



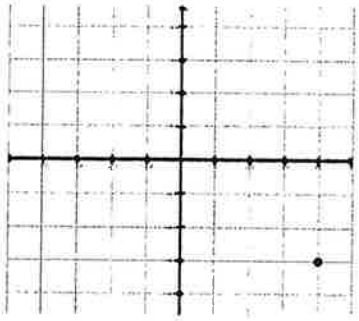
2. (___, ___)



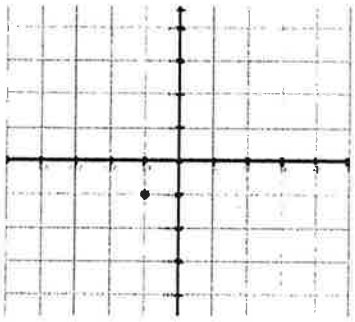
3. (___, ___)



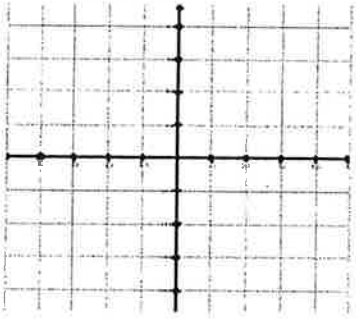
4. (___, ___)



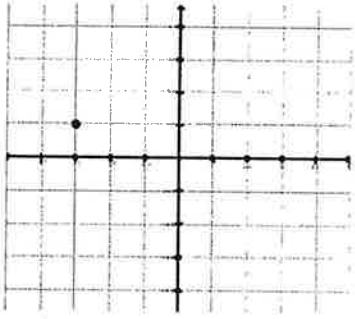
5. (___, ___)



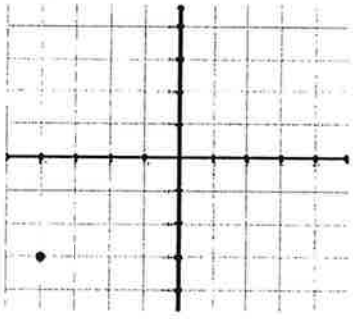
6. (___, ___)



7. (___, ___)



8. (___, ___)



Graphing Functions

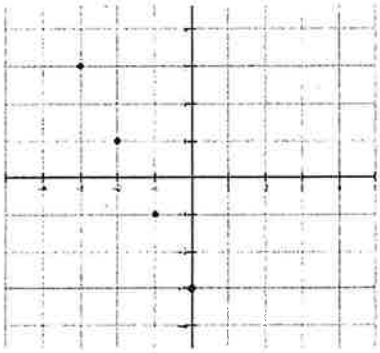
Complete the table. Then graph the data on the coordinate plane.

Example: $y = -2x - 3$

X	Y
-3	3
-2	1
-1	-1
0	-3

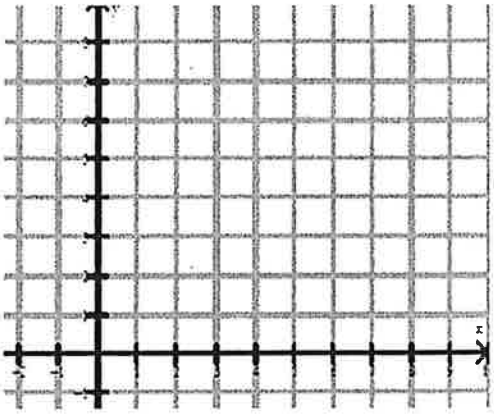
Work:

$x = -3$
$y = -2(-3) - 3 = 6 - 3 = 3$
Therefore $(x, y) = (-3, 3)$
$x = -2$
$y = -2(-2) - 3 = 4 - 3 = 1$
Therefore $(x, y) = (-2, 1)$
$x = -1$
$y = -2(-1) - 3 = 2 - 3 = -1$
Therefore $(x, y) = (-1, -1)$
$x = 0$
$y = -2(0) - 3 = 0 - 3 = -3$
Therefore $(x, y) = (0, -3)$



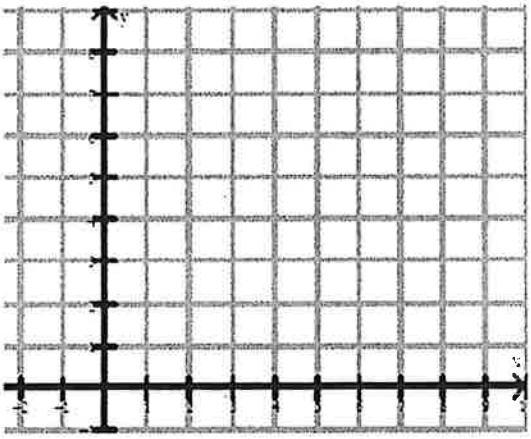
1. $y = x + 2$

X	Y
0	
1	
2	



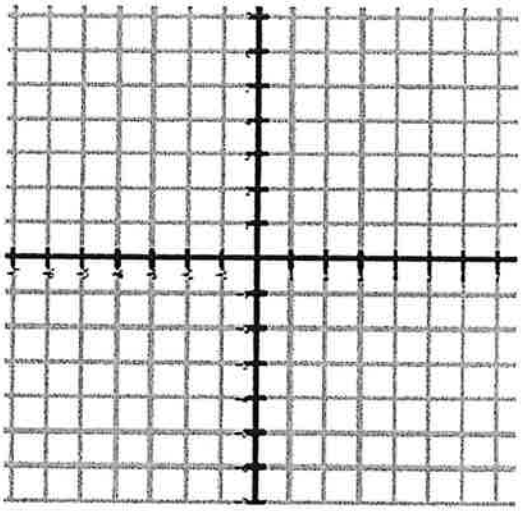
2. $y = 2x$

X	Y
0	
1	
2	
3	



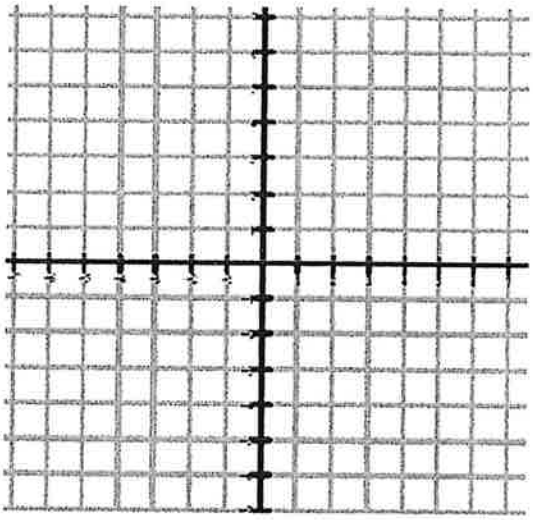
3. y = -x

X	Y
-3	
-1	
1	
3	



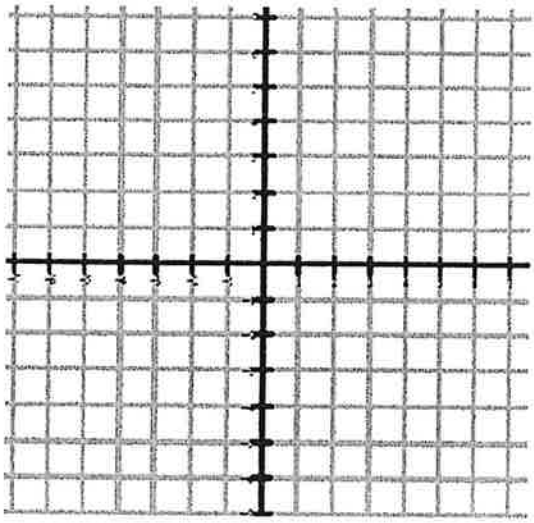
4. $y = \frac{1}{2}x$

X	Y
-6	
-2	
0	
2	
4	



5. $y = 2x - 1$

X	Y
-2	
-1	
0	
1	
3	



Solving Equations

To solve an equation means to find the value of the variable that makes the equation true. We solve equations by isolating the variable using inverse operations.

Inverse Operations
Addition (+) & Subtraction (−)
Multiplication (×) & Division (÷)

Example
Solve.

$3x - 2 = 10$
$+2 \quad +2$ Isolate $3x$ by adding 2 to each side.

$\frac{3x}{3} = \frac{12}{3}$ Simplify
Isolate x by dividing each side by 3.

$x = 4$ Simplify

Remember the Golden Rule of Algebra
Whatever you do to one side of an equation you must do to the other.

Check your answer:

$3(4) - 2 = 10$ Substitute the value in for the variable
$12 - 2 = 10$ Simplify
$10 = 10$ Is the equation true? If yes, you solved it correctly!

Always check your work by substitution!

Use substitution to determine if the solution is correct.

1. $-2x + 5 = 13 \quad x = 4$

2. $8 = 6 - x \quad x = 2$

3. $1 - x = 9 \quad x = -8$

Solve each equation. Circle your solution

4. $-5 = x + 3$

5. $w - 4 = 10$

6. $-7k = 14$

7. $-x = -11$

8. $\frac{h}{3} = 5$

9. $\frac{4}{5}d = 12$

Solve each equation. Show your work in the left column and circle your answer. Check your answer in the right column.

Check

10. $2x - 5 = 11$

11. $2x + 11 = 9$

12. $-3n + 4 = -8$

13. $-9 = -6x - 3$

14. $\frac{f}{3} + 10 = 2$

15. $2 = \frac{a}{7} - 4$

Inequalities

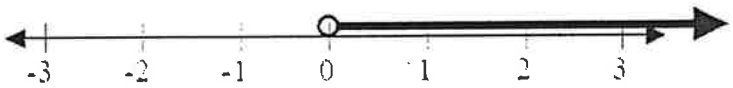
An inequality is a statement containing one of the following symbols:

$<$ is less than $>$ is greater than $\leq$ is less than or equal to $\geq$ is greater than or equal to

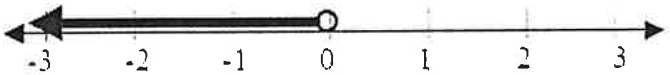
An inequality has many solutions (often called a solution set) and we can represent the solutions by graphing on a number line.
When graphing an inequality, $<$ and $>$ use an open circle ○ $\leq$ and $\geq$ use a closed circle ●

Examples:

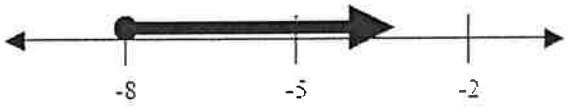
$x > 0$



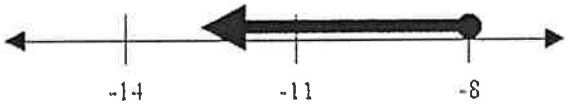
$x < 0$



$x \geq -8$

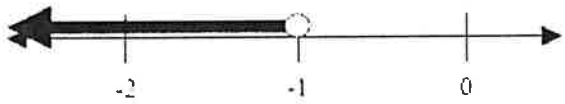


$x \leq -8$



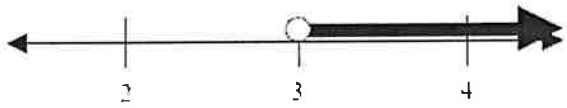
Write an inequality to represent the solution set that is shown in the graph.

1.



_____

2.

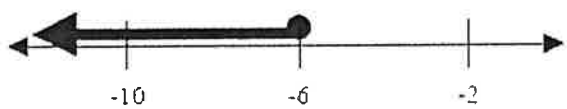


_____

3.

_____

4.



_____

Graph each inequality on a number line. (If needed flip the inequality so the variable is on the left.)

1. $4 < x$ (flip) $x > 4$

2. $k \leq -6$

3. $5 > y$

4. $j < -\frac{1}{2}$

5. $-2 \leq t$

6. $15 \geq w$

Algebraic Translations

Translating from English to Mathematics

Key Words for Translations

Add	Subtract	Multiply	Divide	Variable	Inequalities	=
sum more than plus increased by greater than	difference less than minus decreased by minus less	product multiplied by times of per for each twice	quotient divided by split equally	a number some number quantity	< is less than > is greater than ≤ is less than or equal to (at most) ≥ is greater than or equal to (at least)	same as equals is result total

Examples

A. Translate into a mathematical expression: 3 less than 5 times a number

3	**less than**	5	**times**	**a number**
to subtract from			multiply	use a variable

Translation: $\mathbf{5n - 3}$

Careful! Pay attention to subtraction. The order makes a difference

B. Translate into a mathematical statement: 4 plus 3 times a number is less than or equal to 18

4	**plus**	3	**times**	**a number**	is less than or equal to	18
add			multiply	use a variable	≤	

Translation: $\mathbf{4 + 3x \leq 18}$

C. Translate into a mathematical statement:
the difference of 8 and the quotient of a number and -4 is 1

the difference of	8 and the	**quotient of**	**a number** and	-4	**is**	1
subtraction		division	use a variable		=	

Translation: $\mathbf{8 - \frac{a}{-4} = 1}$

Practice: Translate each phrase into a mathematical statement.

1. seven plus five times a number is greater than or equal to -9

2. eight times a number increased by 6 is 62

3. one half of a number is equal to 14

4. 6 less than 8 times some number

5. a number divided by 9

6. p decreased by 5

7. twice a number decreased by 15 is equal to -27

8. 9 less than 7 times some number is -6

9. the sume of a number and eight is less than 2

10. eleven increased by a number is -12

Matching: On the line put the letter of the algebraic expression that best matches the phrase

_____1. two more than a number

_____2. two less than a number

_____3. half of a number

_____4. twice a number

_____5. two decreased by a number

_____6. the quotient of 2 and a number

a. $2x$

b. $x + 2$

c. $2 - x$

d. $x - 2$

e. $\frac{x}{2}$

f. $\frac{2}{x}$