

Lesson 11: “And” or “Or”

Opening Exploration

1. Determine whether each claim given below is true or false.

A. Right now, I am in math class and English class.

False

B. Right now, I am in math class or English class.

True

C. I am 14 years old or I am not 14 years old.

True

D. I am 14 years old and I am not 14 years old.

False

These are all examples of declarative compound sentences.

2. When the two declarations in the sentences above were separated by “and,” what had to be true to make the statement true?

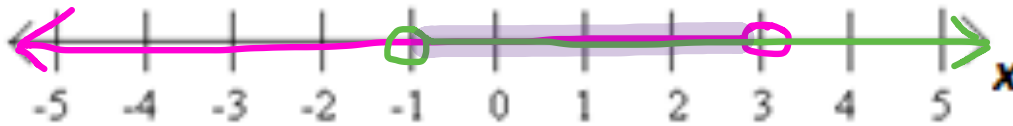
A compound sentence formed by joining statements with “and” is a conjunction.

3. When the two declarations in the sentences above were separated by “or,” what had to be true to make the statement true?

A compound sentence formed by joining statements with “or” is a disjunction.

You will need three colored pencils or highlighters.

4. A. Using a colored pencil, graph the inequality $x < 3$ on the number line below.
 B. Using a different colored pencil, graph the inequality $x > -1$ on the same number line.
 C. Using a third colored pencil, darken the section of the number line where $x < 3$ **and** $x > -1$.



D. In order for the compound sentence $x > -1$ and $x < 3$ to be true, what has to be true about x ?

E. On the graph, where do the solutions lie?

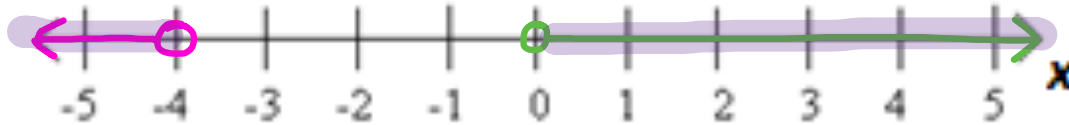
It's between -1 and 3.

F. How many solutions are there to this compound inequality?

G. Sometimes this is written as $-1 < x < 3$. Explain how this relates to the graph.

H. **Interval notation** would show the solution as $(-1, 3)$. How does this relate to the graph?

5. A. Using a colored pencil, graph the inequality $x < -4$ on the number line below.
 B. Using a different colored pencil, graph the inequality $x > 0$ on the same number line.
 C. Using a third colored pencil, darken the section of the number line where $x < -4$ or $x > 0$.



- D. In order for the compound sentence $x < -4$ or $x > 0$ to be true, what has to be true about x ?

- E. On the graph, where do the solutions lie?

$(-\infty, -4)$ or $(0, \infty)$

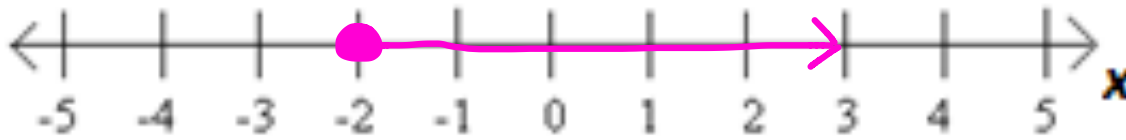
- F. How many solutions are there to this compound inequality?

Infinite

- G. Would it be acceptable to abbreviate this compound sentence as follows: $0 < x < -4$? Explain.

- H. In interval notation we would write $(-\infty, -4)$ or $(0, \infty)$. What does $-\infty$ and ∞ mean?

6. A. Graph the compound sentence $x > -2$ or $x = -2$ on the number line below.



- B. How could we abbreviate the sentence $x > -2$ or $x = -2$?

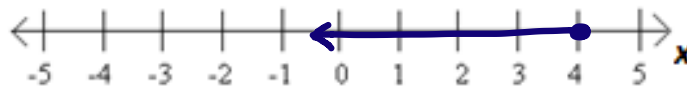
$$x \geq -2$$

- C. How could we write this in interval notation?

$$[-2, \infty)$$

7. Rewrite $x \leq 4$ as a compound sentence, and graph the solutions to the sentence on the number line below.

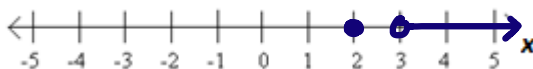
$$x < 4 \text{ or } x = 4$$



8. Graph each compound sentence on a number line. Then give the solution in interval notation.

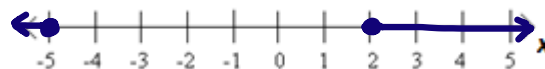
a. $x = 2$ or $x > 3$

$$[2] \text{ or } (3, \infty)$$



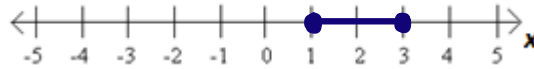
b. $x \leq -5$ or $x \geq 2$

$$(-\infty, -5] \text{ or } [2, \infty)$$



9. A. Rewrite $1 \leq x \leq 3$ as a compound sentence, and graph the sentence on a number line.

$$x \geq 1 \text{ and } x \leq 3$$



- B. Use interval notation to write the same solution.

$$[1, 3]$$

10. Consider the following two scenarios. For each, specify the variable and define what it represents, then write a compound inequality that describes the scenario given. Draw its solution set on a number line.

Scenario	Variable	Inequality Statement	Graph
a. Students are to present a persuasive speech in English class. The guidelines state that the speech must be at least 7 minutes but not exceed 12 minutes.	Let _____ represent _____		
b. Children and senior citizens receive a discount on tickets at the movie theater. To receive a discount, a person must be between the ages of 2 and 12, including 2 and 12, or 60 years of age or older.			

11. Zara solved the inequality $18 < 3x - 9$ as shown below. Was she correct?

Yes

$$18 < 3x - 9$$

$$27 < 3x$$

$$9 < x \text{ or } x > 9$$

12. Consider the compound inequality $-5 < x < 4$.

A. Rewrite the inequality as a compound statement of inequality.

$$x > -5 \text{ and } x < 4$$

B. Write a sentence describing the possible values of x .

x is between -5 and 4 .

C. Graph the solution set on the number line below.



D. Rewrite the inequality in interval notation.

$$(-5, 4)$$

13. Consider the compound inequality $-5 < 2x + 1 < 4$.

a. Rewrite the inequality as a compound statement of inequality.

$$2x+1 > -5 \quad 2x+1 < 4$$

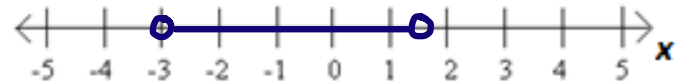
b. Solve each inequality for x . Then, write the solution to the compound inequality.

$$\begin{array}{r} 2x+1 > -5 \\ \underline{-1 \quad -1} \\ 2x > -6 \\ \underline{\quad \quad \quad \frac{2}{2}} \\ x > -3 \end{array} \quad \begin{array}{r} 2x+1 < 4 \\ \underline{-1 \quad -1} \\ 2x < 3 \\ \underline{\quad \quad \quad \frac{2}{2}} \\ x < \frac{3}{2} \end{array}$$

c. Write a sentence describing the possible values of x .

x is between -3 and $\frac{3}{2}$.

d. Graph the solution set on the number line.



e. Write the solution in interval notation.

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

14. A friend of mine suggested I could solve the inequality $-5 < 2x + 1 < 4$ as follows. Is she right? Explain your reasoning.

$$-5 < 2x + 1 < 4$$

$$-5 - 1 < 2x + 1 - 1 < 4 - 1$$

$$-6 < 2x < 3$$

$$-3 < x < \frac{3}{2}$$

Yes

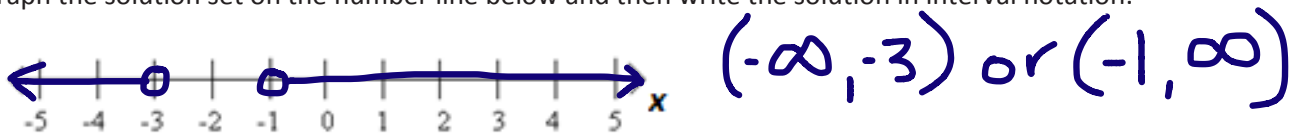
15. Given $x < -3$ or $x > -1$:

A. What must be true in order for the compound inequality to be a true statement?

B. Write a sentence describing the possible values of x .

x is either less than -3 or greater than -1 .

C. Graph the solution set on the number line below and then write the solution in interval notation.



16. Given $x + 4 < 6$ or $-2x + 2 < -6$:

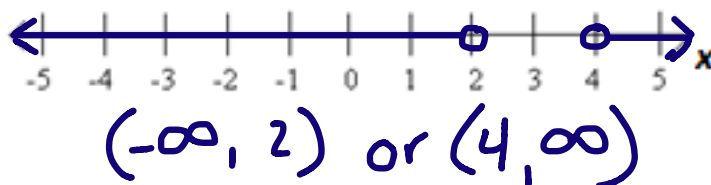
A. Solve each inequality for x . Then, write the solution to the compound inequality.

$$\begin{array}{r} x+4 < 6 \\ -4 \quad -4 \\ \hline x < 2 \end{array} \qquad \begin{array}{r} -2x+2 < -6 \\ -2 \quad -2 \\ \hline -2x < -8 \\ \frac{-2x}{-2} < \frac{-8}{-2} \\ x > 4 \end{array}$$

B. Write a sentence describing the possible values of x .

x is either less than 2 or greater than 4 .

C. Graph the solution set on the number line below and then write the solution in interval notation.



Lesson Summary

In mathematical sentences, like in English sentences, a compound sentence separated by

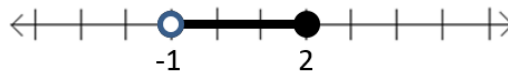
AND is true if _____.

OR is true if _____.

Interval Notation

Interval notation describes a set of solutions with a pair of numbers. The numbers are the endpoints of the interval. Parentheses and/or brackets are used to show whether the endpoints are included or not.

$(-1, 2]$ represents the interval from -1 to 2 but does not include -1 . On the number line this is represented as



Homework Problem Set

1. Consider the inequality $0 < x < 3$.

A. Rewrite the inequality as a compound sentence and in interval notation.

B. Graph the inequality on a number line.



C. How many solutions are there to the inequality? Explain.

D. What are the largest and smallest possible values for x ? Explain.

E. If the inequality is changed to $0 \leq x \leq 3$, then what are the largest and smallest possible values for x ?

Write a compound inequality for each graph. Then write it in interval notation.



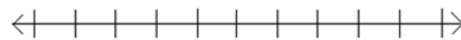
Write a single or compound inequality for each scenario. Then write it in interval notation.

4. The scores on the last test ranged from 65% to 100%.
5. To ride the roller coaster, one must be at least 4 feet tall.
6. Unsafe body temperatures are those lower than 96°F or above 104°F.

Graph the solution(s) to each of the following on a number line.

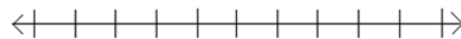
7. $x \leq -8$ or $x \geq -1$

8. $3(x - 6) = 3$ or $5 - x = 2$



9. $x < 9$ and $x > 7$

10. $x + 5 < 7$ or $x = 2$



11. $x - 4 = 0$ and $3x + 6 = 18$

12. $x < 5$ and $x \neq 0$



Solve each compound inequality for x , and graph the solution on a number line. Then write the solution in interval notation.

13. $x + 6 < 8$ and $x - 1 > -1$

14. $-1 \leq 3 - 2x \leq 10$

15. $5x + 1 < 0$ or $8 \leq x - 5$

16. $10 > 3x - 2$ or $x = 4$

Solve each compound inequality for x , and graph the solution on a number line.

17. $x - 2 < 4$ or $x - 2 > 4$

18. $x - 2 \leq 4$ and $x - 2 \geq 4$

Solve each compound inequality for x , and graph the solution on a number line. Pay careful attention to the inequality symbols and the “and” or “or” statements as you work.

19. $1 + x > -4$ or $3x - 6 > -12$

20. $1 + x > -4$ or $3x - 6 < -12$

21. $1 + x > 4$ and $3x - 6 < -12$

22. A. Solve the inequality $4x + 8 > 2x - 10$ or $\frac{1}{3}x - 3 < 2$ for x , and graph the solution on a number line.

B. If the inequalities in Part A were joined by “and” instead of “or,” what would the solution set become?

23. A. Solve the inequality $7 - 3x < 16$ and $x + 12 < -8$ for x , and graph the solution on a number line.

B. If the inequalities in Part A were joined by “or” instead of “and,” what would the solution set become?

24. A. Is it possible to write a problem separated by “or” that has no solution? Explain or give an example.

B. Is it possible to have a problem separated by “and” that has a solution set consisting of all real numbers? Explain or give an example.

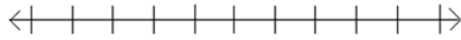
Determine if each sentence is true or false. Explain your reasoning.

25. $8 + 6 \leq 14$ and $\frac{1}{3} < \frac{1}{2}$

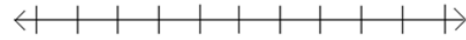
26. $5 - 8 < 0$ or $10 + 13 \neq 23$

Solve each system, and graph the solution on a number line.

27. $x - 9 = 0$ or $x + 15 = 0$



28. $5x - 8 = -23$ or $x + 1 = -10$

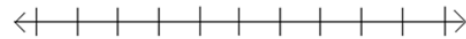


Graph the solution set to each compound inequality on a number line.

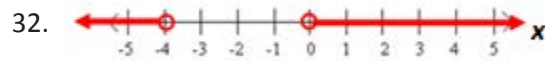
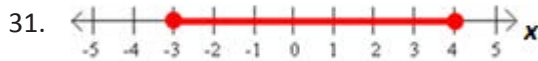
29. $x < -8$ or $x > -8$



30. $0 < x \leq 10$



Write a compound inequality for each graph.



33. A poll shows that a candidate is projected to receive 57% of the votes. If the margin for error is plus or minus 3%, write a compound inequality for the percentage of votes the candidate can expect to get.

34. Mercury is one of only two elements that are liquid at room temperature. Mercury is non-liquid for temperatures less than -38.0°F or greater than 673.8°F . Write a compound inequality for the temperatures at which mercury is nonliquid.