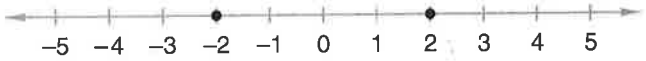
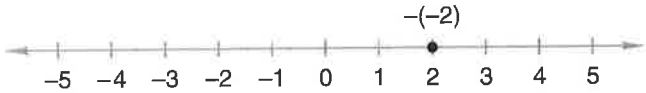
LESSON 7 *The Opposite of a Number • Simplifying More Difficult Notations*

7.A the opposite of a number

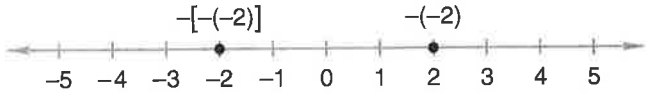
We can use the thought "opposite of a number" to help us understand and simplify expressions such as $-(-2)$, $-[-(-2)]$, $-\{-[-(2)]\}$, etc. We begin by graphing the number 2 and the number -2.



From the figure we see that the number -2 lies on the **opposite** side of the origin from 2 and is exactly the same distance from the origin. Thus we can think of $+2$ as being the **opposite of** -2, and -2 as being the opposite of $+2$. Often it is helpful to read a negative sign as "the opposite of." If we use this wording, it is easy to locate $-(-2)$, for we read this as "the opposite of the opposite of 2." Well, the opposite of 2 is -2, and the opposite of that must be 2 itself.



Thus 2 and $-(-2)$ are different numerals or symbols for the same number. If this is true, then where does $-[-(-2)]$ lie? We can read this as "the opposite of the opposite of the opposite of 2."



If we begin at 2, we can find the opposite of 2 at -2. Then the opposite of the opposite of 2 is back on the right-hand side, so the opposite of the opposite of the opposite of 2 is on the left-hand side and is another way to write -2. Of course, we could go on forever with this process, but we will not.

7.B simplifying more difficult notations

Complicated expressions such as

$$-(-4) + (-2) + [-(-6)]$$

can be simplified by using algebraic addition and the concept of opposites. We begin by noting that algebraic addition of three numbers is indicated. We emphasize this by enclosing the numbers that are to be added and writing plus signs between the enclosures.

$$\overbrace{-(-4)} + \overbrace{+(-2)} + \overbrace{+[-(-6)]}$$

The number in the first enclosure is $+4$, in the second is -2, and in the third is $+6$. So we can write

$$(+4) + (-2) + (+6) = 8$$

example 7.1 Simplify: $-(+4) - (-5) + 5 - (-3) + (-6)$

solution This problem indicates addition of five numbers.

$$\overbrace{-(+4)} + \overbrace{-(-5)} + \overbrace{(+5)} + \overbrace{-(-3)} + \overbrace{+(-6)}$$

We simplify within each enclosure and add algebraically.

$$(-4) + (+5) + (+5) + (+3) + (-6) = \mathbf{3}$$

example 7.2 Simplify: $-(-3) - [-(-2)] + [-(-3)]$

solution We see three numbers are to be added. We begin by enclosing each number and inserting the necessary plus signs.

$$\overbrace{-(-3)} + \overbrace{-[-(-2)]} + \overbrace{+[-(-3)]}$$

Now we simplify within each enclosure and then add.

$$(+3) + (-2) + (+3) = \mathbf{4}$$

example 7.3 Simplify: $-(-4) + (-2) - [-(-6)]$

solution This time we will picture the enclosures mentally but we will not write them down. If we do this, we can simplify the given expression as

$$(+4) + (-2) + (-6) = \mathbf{-4}$$

example 7.4 Simplify: $-(+4) - (-5) + 5 - (-3) + (-6)$

solution This time we will not even use parentheses but will write the simplification directly as

$$-4 + 5 + 5 + 3 - 6 = \mathbf{3}$$

It might take a lot of practice to become adept in doing simplifications such as this one. Do not get discouraged if you find these problems troublesome.

practice

Use the concept of opposites and algebraic addition to simplify the following. Use additional plus signs and brackets as required.

a. $-(-3) - (-4)$

b. $+(-5) + [-(-6)]$

c. $-(+6) - (-8) + 7 - (-3) + (-5)$

d. $-(-3) - [-(-4)] + [-(-6)]$

problem set 7

1. (6,7) (a) What is the opposite of 2?

(b) What is the opposite of –2?

(c) What is the sum of a real number and its opposite?

2. (6) What is another name for the opposite of a number?

3. (5) (a) Designate the set of natural numbers.

(b) Designate the set of whole numbers.

(c) Designate the set of integers.

Use the concept of opposites to simplify:

4. (7) $-(+4)$

5. (7) $-(-4)$

6. (7) $-[-(-4)]$

7. (7) $-\{-[-(-4)]\}$

8. (4) Use one unit multiplier to convert 2200 centimeters to meters (100 cm = 1 m).

9. (4) Use two unit multipliers to convert 3000 inches to miles. (Go from inches to feet to miles.)

10. (3) The length of a rectangle is 32 inches. The width of the rectangle is 16 inches. Find the perimeter of the rectangle.

11. (3) The radius of a circle is 12 feet. Find the circumference of the circle.

Use the concept of opposites and algebraic addition to simplify the following. Use additional plus signs and brackets as required.

12. (7) $+7 - (-3) + (-2)$

13. (7) $-3 + (-2) - (-3)$

14. (7) $-(-3) - [-(-4)] - 2 + 7$

15. (7) $-2 - (-3) - \{-[-(-4)]\}$

16. (7) $-(-2) - |-2|$

17. (7) $-|-10| - (-10)$

18. (7) $-3 - (-3) + |-3|$

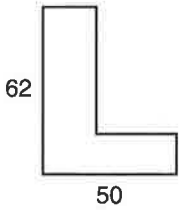
19. (7) $-2 - [-(-6)] + |-5|$

20. (7) $-|-3 - 2| - (-3) - 2 - 5$

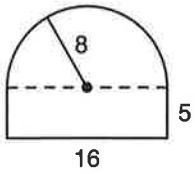
21. (7) $|-2 - 5 - 7| - (-4)$

Find the perimeter of each figure. Corners that look square are square. Dimensions are in yards.

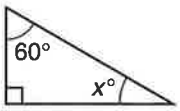
22. (3)



23. (3)



24. (2) Find x.



Add, subtract, multiply, or divide as indicated:

25. (1) $5\frac{1}{2} + 7\frac{3}{8} - 1\frac{1}{4}$

26. (4) $1\frac{3}{5} \times 12\frac{1}{2}$

27. (4) $4\frac{1}{4} \div 3\frac{2}{5}$

28. (4) $0.00143 + 0.012 + 443.6 + 0.0007$

29. (4) 3.628×0.0404

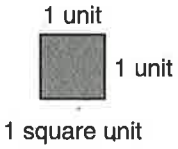
30. (1) The length of $\overline{XY}$ is $16\frac{2}{3}$ centimeters. The length of $\overline{YZ}$ is $5\frac{5}{6}$ centimeters. Find XZ.

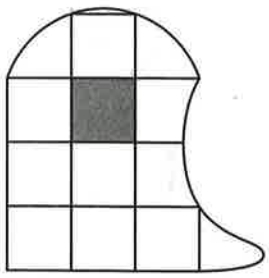


LESSON 8 *Area*

8.A the concept of area

The **area** of a closed figure is the number of square units contained in the figure. A **square unit** is a square having sides that measure one unit in length. Any shape that fills a closed figure without overlapping can be used to measure area, but the square is used because of its simplicity.





Closed figure with irregular boundary

For many closed figures with irregular boundaries, we must "break up" some of the square units to fill the figure. Therefore, it is not uncommon to have closed figures whose areas contain fractional square units. We can see that counting square units is not the easiest or the best way to find the area of a closed figure. Therefore, in the following sections we will develop formulas for computing the areas of some common geometrical figures.