Grade 8 Mathematics
Algebra: Lesson 7

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol () by them.

Purpose of Lesson 7:

- In this lesson, the tutor and the students will
  - ✓ solve multi-step equations, and
  - ✓ graph solutions sets on a number line.

Equipment/Materials Needed:

- Copies of Student Sheet 93
- Paper and pencils
- Chalkboard

Preparations before beginning Lesson 7:

- Run one copy of Student Sheet 93 for each student.
- Have paper and pencils available.

Lesson 7: Algebra

Say:

In Lesson 2 of Algebra, you solved simple one-step equations. You used the idea that addition and subtraction are inverse operations. Multiplication and division are also inverse operations. Addition "undoes" subtraction, and subtraction "undoes" addition. Multiplication "undoes" division, and division "undoes" multiplication. You also learned that you must keep an equation balanced. If you do something to one side of an equation, you must do the same thing to the other side of the equation. In this lesson, you will solve equations involving more than one operation. If an equation involves two operations, you need to use inverse operations one at a time.

- Write this problem on the board.

$$3x + 10 = 40$$

Say:

How are three and *x* related? (They are multiplied.) **How are *x* and 10 related?** (They are added.) **You need to use the inverse operations of division and subtraction, but which should you do first?** (Subtraction.) **When you build an equation, you use order of operations. So you multiply and divide first; then you perform any addition and subtraction. In solving, or "undoing" an equation, you begin with addition and subtraction; then you perform any multiplication and division. In the equation, $3x + 10 = 40$, undo the addition first.**

- Write these steps on the board.

$$\begin{aligned} 3x + 10 &= 40 \\ 3x + 10 - 10 &= 40 - 10 \quad \text{(undo the addition)} \\ 3x &= 30 \\ \frac{3x}{3} &= \frac{30}{3} \quad \text{(undo the multiplication)} \\ x &= 10 \end{aligned}$$

Say:

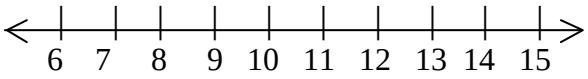
Always check your solution.

$$3x + 10 = 40$$
$$3\,(10) + 10 = 40$$
$$30 + 10 = 40$$
$$40 = 40$$

Say:

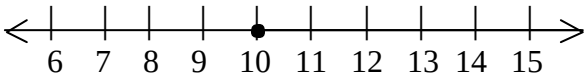
Sometimes, you will be asked to graph a solution. To graph $x = 10$, draw a number line. Choose some points around 10, on both sides of 10.

- Draw this line on the board.



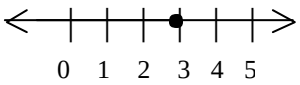
Say:

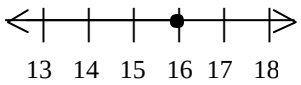
Since $x = 10$, draw a darkened circle at the point 10. This point shows $x = 10$ and that x is equal to no other numbers.

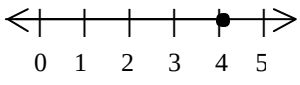


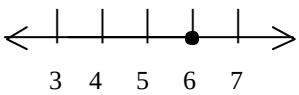
- Give students Student Sheet 93.

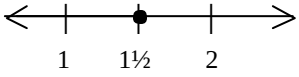
Answers:

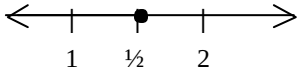
1. $y = 3$ 

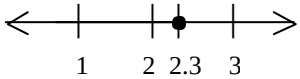
2. $d = 16$ 

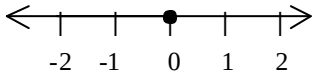
3. $m = 4$ 

4. $p = 6$ 

5. $k = \frac{3}{2}$ or $1\frac{1}{2}$ or 1.5 

6. $t = \frac{1}{2}$ or 0.5 

7. $a = 2.3$ 

8. $x = 0$ 

9. a. 10 miles b. 3 miles

10. 17 ft.

11. a. $34 b. 93 minutes

Have one student summarize today's lesson. Students need to understand graphing the solution of an equation, so they can apply that knowledge to graphing the solution of an inequality.

Student Sheet 93 (Algebra: Lesson 7)

Solve the following equations. Graph the solution sets.

1. $20 = 6y + 2$
2. $\frac{d}{2} - 5 = 3$
3. $4m - 8 = 8$
4. $3p - 8 = 10$
5. $2k + 2\frac{1}{2} = 5\frac{1}{2}$
6. $10t + 26 = 31$
7. $2a - 0.5 = 4.1$
8. $\frac{1}{2}x + \frac{1}{4} = \frac{1}{4}$

Solve the following equations.

9. The fine for a speeding ticket in some states can be shown by the formula $F = 20 + 4m$. F stands for the fine and m stands for the miles per hour over the speed limit.

    a. If Teddy got a fine of $60, how many miles was he driving over the speed limit?
    b. If Julie got a fine of $32, how many miles was she driving over the speed limit?

10. If the perimeter of a rectangle is 52 feet and the width is nine feet, what is the length of the rectangle?

11. The cost of one particular cell phone is 20 cents a minute, plus a flat fee of $22 a month.

    a. If Bianca talks for 60 minutes one month, what will be her cell phone bill?
    b. If Una's cell phone bill for one month was $40.60, how many minutes did she use that month?