

# Two-Step Equations

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**Undo** the adding or subtracting first, then the multiplying. **Check** your answer.

**Example:  $3x + 4 = 19$** 

Subtract 4 from both sides:  $3x = 15$

Divide both sides by 3:  $x = 5$

Check:  $3(5) + 4 = 19$  ✓

**1.  $2x + 3 = 7$**

**2.  $3x - 4 = 11$**

**3.  $4x + 1 = 25$**

**4.  $5x - 7 = 8$**

**5.  $2x + 9 = 23$**

**6.  $6x - 5 = 19$**

**7.  $3x + 8 = 35$**

**8.  $7x + 2 = 23$**

**9.  $4x - 9 = 23$**

**10.  $5x + 6 = 16$**

# Two-Step Equations: Key

| Problem           | Answer  |
|-------------------|---------|
| 1. $2x + 3 = 7$   | $x = 2$ |
| 2. $3x - 4 = 11$  | $x = 5$ |
| 3. $4x + 1 = 25$  | $x = 6$ |
| 4. $5x - 7 = 8$   | $x = 3$ |
| 5. $2x + 9 = 23$  | $x = 7$ |
| 6. $6x - 5 = 19$  | $x = 4$ |
| 7. $3x + 8 = 35$  | $x = 9$ |
| 8. $7x + 2 = 23$  | $x = 3$ |
| 9. $4x - 9 = 23$  | $x = 8$ |
| 10. $5x + 6 = 16$ | $x = 2$ |

# Learn From Examples

Study the first example. Each box gives you a little less help until you solve it on your own.

## FROM WORKED EXAMPLE TO ON YOUR OWN

### 1. Watch me

$$2x + 5 = 19$$

$$2x + 5 - 5 = 19 - 5$$

Undo +5 by subtracting 5 from both sides.

$$2x = 14$$

$$2x \div 2 = 14 \div 2$$

Undo  $\times 2$  by dividing both sides by 2.

$$x = 7$$

$$\text{Check: } 2(7) + 5 = 19 \checkmark$$

Why subtract 5 first?

\_\_\_\_\_

### 2. Finish it

$$4x - 20 = 4$$

$$4x - 20 + 20 = 4 + 20$$

Undo  $-20$  by adding 20.

$$4x = \underline{\hspace{2cm}}$$

$$4x \div \underline{\hspace{1cm}} = \underline{\hspace{2cm}}$$

$$x = \underline{\hspace{2cm}}$$

$$\text{Check: } 4(\underline{\hspace{1cm}}) - 20 = 4 \checkmark$$

### 3. Your turn

$$3x + 7 = 31$$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

$$x = \underline{\hspace{2cm}}$$

### 4. On your own

$$6x - 18 = 12$$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

$$x = \underline{\hspace{2cm}}$$

### Steps checklist

- ☐ Usually undo + or - first
- ☐ Then undo  $\times$  or  $\div$
- ☐ Same thing to both sides
- ☐ Check by putting it back in

## QUICK REMINDER (IF YOU NEED IT)

**Bridge: signs** Subtracting a number = adding its opposite:  $12 - 5 = 12 + (-5) = 7$ . Dividing two negatives gives a positive:  $-12 \div -3 = 4$ . Positive  $\div$  negative is negative:  $14 \div -2 = -7$ .

# Find the Mistake

Each student made ONE mistake. Find the line, explain it, and fix it. Mistakes are how we learn what to watch for.

**Jordan solved  $x/3 + 4 = 10$**

line 1  $x/3 + 4 + 4 = 10 + 4$

line 2  $x/3 = 14$

line 3  $x = 42$

The mistake is in line \_\_\_ because

Fix it:

**Sam solved  $2(x + 5) = 18$**

line 1  $2x + 5 = 18$

line 2  $2x = 13$

line 3  $x = 6.5$

The mistake is in line \_\_\_ because

Fix it:

**Riley solved  $-2x = 14$**

line 1  $-2x \div 2 = 14 \div 2$

line 2  $x = 7$

The mistake is in line \_\_\_ because

Fix it:

## COMPARE TWO WAYS

**Way A: distribute first**

$$4(x - 3) = 20$$

$$4x - 12 = 20$$

$$4x = 32$$

$$x = 8$$

**Way B: divide first**

$$4(x - 3) = 20$$

$$x - 3 = 5$$

$$x = 8$$

Both are right. Which way is faster here? Why?

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# Spiral Review: Do Now

Mixing old and new problems helps you remember. Cut in half: one Do Now per day.

## Do Now • Monday

4 mixed review problems • 5 minutes

### INTEGERS

a)  $-3 + 8 = \underline{\hspace{1cm}}$  b)  $-5 - 4 = \underline{\hspace{1cm}}$  c)  $(-2)(-6) = \underline{\hspace{1cm}}$

### FRACTIONS

$\frac{3}{4} + \frac{1}{8} = \underline{\hspace{1cm}}$

### TODAY'S SKILL

Solve:  $5x - 2 = 23$

### EARLIER UNIT

Find the slope through (2, 3) and (6, 11).

## Do Now • Tuesday

4 mixed review problems • 5 minutes

### INTEGERS

a)  $7 - 12 = \underline{\hspace{1cm}}$  b)  $-18 \div 3 = \underline{\hspace{1cm}}$

### FRACTIONS

$\frac{2}{3}$  of 9 =  $\underline{\hspace{1cm}}$

### TODAY'S SKILL

Solve:  $x/4 + 3 = 9$

### EARLIER UNIT

Evaluate  $2a^2$  when  $a = 3$ .

# Teacher Notes

**What this set shows:** one skill (two-step equations) in the three ways SCAFLI can help. Answers are on the next page.

| Page                       | Mode                       | Why (research)                                                                                                                                                       |
|----------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Learn From Examples        | Whole class                | Worked examples that fade (watch → finish → try → on your own). In the AlgebraByExample study, struggling students learned more while solving half as many problems. |
| Find the Mistake + Compare | Whole class Barriers       | Studying incorrect examples and comparing two strategies (IES Algebra Practice Guide, grades 6–12).                                                                  |
| Bridge strip + checklist   | Barriers                   | Keeps the grade-level task and adds a just-in-time prerequisite reminder (integer signs) and a self-check list, instead of a separate remedial worksheet.            |
| Spiral Do Now              | Whole class<br>Adapt yours | Mixed review beats blocked practice: 61% vs 38% on a delayed test (Rohrer et al., 2019). Each includes integers and fractions, the gaps teachers report most.        |

## ADAPT YOUR OWN (IN SCAFLI)

Upload a worksheet or test and choose: add worked examples · add find-the-mistake · add a bridge strip for a prerequisite · turn it into spiral Do Nows · make tiered versions · modify for an IEP (labeled accommodation vs. modification) · Regents format.

## MAKE IT EASIER / HARDER

**Easier:** start with column 2 done together; allow the checklist and bridge strip on quizzes if the IEP allows. **Harder:** variables on both sides; students write their own “find the mistake” for a partner to solve.

# Answers

## LEARN FROM EXAMPLES

Finish it ( $4x - 20 = 4$ ):  $4x = 24$ , so  $x = 6$ . Your turn ( $3x + 7 = 31$ ):  $x = 8$ . On your own ( $6x - 18 = 12$ ):  $x = 5$ . (Watch me:  $x = 7$ .)

## FIND THE MISTAKE

**Jordan: line 2.** Jordan added 4 to both sides, which leaves  $x/3 + 8$  on the left, then wrote  $x/3$  as if the extra 4 were gone (to undo + 4, subtract 4). Correct:  $x/3 + 4 - 4 = 10 - 4$ , so  $x/3 = 6$  and  $x = 18$ .

**Sam: line 1.** Sam did not distribute the 2 to the 5. Correct:  $2x + 10 = 18$ , so  $2x = 8$  and  $x = 4$ .

**Riley: line 2.** Riley divided by 2, which leaves  $-x = 7$ , then wrote  $x = 7$  (to undo  $\times -2$ , divide by  $-2$ ). Correct:  $-2x \div (-2) = 14 \div (-2)$ , so  $x = -7$ .

**Compare two ways:** both give  $x = 8$ ; dividing first is faster when the number outside the parentheses divides the right side evenly.

## SPIRAL DO NOW

### Do Now • Monday

4 mixed review problems • 5 minutes

#### INTEGERS

a)  $-3 + 8 = \underline{\hspace{1cm}}$  b)  $-5 - 4 = \underline{\hspace{1cm}}$  c)  $(-2)(-6) = \underline{\hspace{1cm}}$

**a) 5 b) -9 c) 12**

#### FRACTIONS

$3/4 + 1/8 = \underline{\hspace{1cm}}$

**7/8**

#### TODAY'S SKILL

Solve:  $5x - 2 = 23$

**$x = 5$**

#### EARLIER UNIT

Find the slope through (2, 3) and (6, 11).

**slope = 2**

### Do Now • Tuesday

4 mixed review problems • 5 minutes

#### INTEGERS

a)  $7 - 12 = \underline{\hspace{1cm}}$  b)  $-18 \div 3 = \underline{\hspace{1cm}}$

**a) -5 b) -6**

#### FRACTIONS

$2/3$  of 9 =  $\underline{\hspace{1cm}}$

**6**

#### TODAY'S SKILL

Solve:  $x/4 + 3 = 9$

**$x = 24$**

#### EARLIER UNIT

Evaluate  $2a^2$  when  $a = 3$ .

**18**