

## Chapter 3 — Solving One-Step Equations

### Teacher Guide

#### Teacher Chapter-at-a-Glance

##### Materials

Student text, worksheets, pencils, balance-scale image or physical balance model, algebra tiles or counters if useful for concrete modelling.

##### Pacing

Teach balance and inverse operations before assigning mixed equation types. Give extra time to negative coefficients, negative divisors, and checking in the original equation.

##### Talk Prompt

“If an operation is done to one side of an equation, what must happen to the other side, and why?”

##### If Ready-to-Learn Reveals a Gap

If students struggle with signed multiplication or division, provide a brief numerical review before using negative coefficients. If they cannot verify a proposed solution, revisit Chapter 2 substitution before proceeding.

#### Mastery Decision Guide

What a missed Tripwire item actually means, and what to do about it before moving on.

**Missed Tripwire #1 → Changing only one side of an equation (Mistake 1).** *The student changes the left side but leaves the right side unchanged.* Review before the next chapter.

**Missed Tripwire #2 → Ignoring the sign of a negative coefficient or divisor (Mistake 3).** *Student writes  $x=7$  for  $-4x=28$ , or treats division by  $-3$  as division by  $3$ .* Review before the next chapter.

## Ready-to-Learn Check

Quick check before starting. A wrong answer below points to a specific gap worth closing first, not just a miss to shrug off.

1. Addition and subtraction as inverse operations. What operation undoes addition?

**Correct answer:** Subtraction.

**Likely wrong answer:** Division.

**Misconception:** The student may know that division is an inverse operation but may not connect each operation to its matching partner.

**Next move:** Review the inverse-operation pairs: addition and subtraction; multiplication and division.

2. Multiplication with a negative factor. Calculate:  $-6(4)$

**Correct answer:**  $-24$

**Likely wrong answer:**  $24$

**Misconception:** The student may not yet apply the sign rule for one negative factor.

**Next move:** Review signed multiplication. One negative factor gives a negative product.

3. Division with a negative quotient. Calculate:  $-42 \div 6$

**Correct answer:**  $-7$

**Likely wrong answer:**  $7$

**Misconception:** The student may be treating division as positive regardless of signs.

**Next move:** Review that one negative value in multiplication or division gives a negative result.

4. Checking a possible solution. Is  $x=5$  a solution to  $x+7=12$ ? Show the check.

**Correct answer:**  $5+7=12$ , so  $12=12$ . Yes.

**Likely wrong answer:** No, because  $5 \neq 12$ .

**Misconception:** The student may compare the proposed value directly to the total instead of substituting it.

**Next move:** Review that a solution makes the entire equation true after substitution.

## Common Mistakes

Students often run into the same kinds of trouble with this topic. Recognizing these patterns helps avoid them.

### Divide by the Complete Coefficient

$$-4x = 28$$

**Wrong: divide by 4**

$$28 \div 4 = 7$$

$$x = 7$$

**Right: divide by -4**

$$28 \div (-4) = -7$$

$$x = -7$$

Check  $-4(-7) = 28$ . The coefficient is  $-4$ , not  $4$ .

### Mistake 1: Changing only one side of an equation

**What students do:** Solving  $x+8=15$  by writing  $x+8-8=15$ , then  $x=15$

**Why this happens:** The student sees that subtracting 8 helps isolate  $x$ , but may not yet understand that an equation represents a balance.

**What to do instead:** Do the same operation to both sides:  $x+8-8=15-8$ , so  $x=7$ .

*Diagnostic trigger: The student changes the left side but leaves the right side unchanged.*

### Mistake 2: Using the original operation instead of its inverse

**What students do:** Solving  $x-6=14$  by subtracting 6 from both sides

**Why this happens:** The student focuses on the operation visible in the equation rather than the operation needed to undo it.

**What to do instead:** Use the operation that reverses subtraction. Add 6 to both sides:  $x-6+6=14+6$ , so  $x=20$ .

*Diagnostic trigger: Student writes  $x-12=8$  for  $x-6=14$  (subtracting 6 again instead of adding it).*

### Mistake 3: Ignoring the sign of a negative coefficient or divisor

**What students do:** Solving  $-4x=28$  and writing  $x=7$

**Why this happens:** The student recognizes that division undoes multiplication but overlooks the negative sign attached to the coefficient.

**What to do instead:** Divide by the complete coefficient:  $(-4x) \div (-4) = 28 \div (-4)$ , so  $x=-7$ .

*Diagnostic trigger: Student writes  $x=7$  for  $-4x=28$ , or treats division by  $-3$  as division by  $3$ .*

## Practice

### TEACHING NOTE

Practice items are grouped by skill (A-B) so a teacher can assign a subset for targeted review rather than the full set.

Teacher solutions follow this practice set.

#### 1. A. Skill Check

2. Solve:  $x+14=31$  (Hint: subtract 14 from both sides.)

3. Solve:  $y-9=18$  (Hint: add 9 to both sides.)

4. Solve:  $7m=56$  (Hint: divide both sides by 7.)

5. Solve:  $n\div 6=5$  (Hint: multiply both sides by 6.)

6. Solve:  $-3a=27$  (Hint: divide by the complete coefficient.)

7. Solve:  $b\div (-8)=-4$  (Hint: multiply both sides by -8.)

8. Solve:  $r+(-11)=6$  (Hint: add 11 to both sides.)

9. Solve:  $k-(-5)=13$  (Hint: rewrite subtraction of a negative as addition.)

#### 10. B. Equation Writing

11. A number decreased by 13 is 9. Write and solve an equation. (Hint: let  $n$  represent the number.)

12. Four friends share a prize equally. Each friend receives \$18. Write and solve an equation for the total prize. (Hint: let  $p$  represent the total prize. Equal sharing means division.)

## Practice Solutions

*Use these concise solutions to check the method as well as the final answer.*

2. Solve:  $x+14=31$  (Hint: subtract 14 from both sides.)

**Solution:**  $x + 14 = 31$ ; subtract 14 from both sides:  $x = 17$ .

3. Solve:  $y-9=18$  (Hint: add 9 to both sides.)

**Solution:**  $y - 9 = 18$ ; add 9 to both sides:  $y = 27$ .

4. Solve:  $7m=56$  (Hint: divide both sides by 7.)

**Solution:**  $7m = 56$ ; divide both sides by 7:  $m = 8$ .

5. Solve:  $n \div 6=5$  (Hint: multiply both sides by 6.)

**Solution:**  $n \div 6 = 5$ ; multiply both sides by 6:  $n = 30$ .

6. Solve:  $-3a=27$  (Hint: divide by the complete coefficient.)

**Solution:**  $-3a = 27$ ; divide both sides by  $-3$ :  $a = -9$ .

7. Solve:  $b \div (-8)=-4$  (Hint: multiply both sides by  $-8$ .)

**Solution:**  $b \div (-8) = -4$ ; multiply both sides by  $-8$ :  $b = 32$ .

8. Solve:  $r+(-11)=6$  (Hint: add 11 to both sides.)

**Solution:**  $r + (-11) = 6$  means  $r - 11 = 6$ ; add 11:  $r = 17$ .

9. Solve:  $k-(-5)=13$  (Hint: rewrite subtraction of a negative as addition.)

**Solution:**  $k - (-5) = 13$  means  $k + 5 = 13$ ; subtract 5:  $k = 8$ .

11. A number decreased by 13 is 9. Write and solve an equation. (Hint: let  $n$  represent the number.)

**Solution:** Let  $n$  be the number:  $n - 13 = 9$ , so  $n = 22$ .

12. Four friends share a prize equally. Each friend receives \$18. Write and solve an equation for the total prize. (Hint: let  $p$  represent the total prize. Equal sharing means division.)

**Solution:** Let  $p$  be the total prize:  $p \div 4 = 18$ , so  $p = 72$ . The prize is \$72.

## Tripwire Check

These questions test whether the thinking is solid — not just whether the procedure was memorized. Each wrong answer below points to a specific misconception, not just "try again."

1. Does the Equation Stay Balanced? A student solves  $x+7=19$  as follows:  $x+7-7=19$ ,  $x=19$ . Is the student correct? Explain what must happen to the right side of the equation.

**Correct answer:** The student is not correct. Subtract 7 from both sides:  $x+7-7=19-7$ , so  $x=12$ . Check:  $12+7=19$ .

**Likely wrong answer:**  $x=19$

**Misconception:** The student may recognize that 7 needs to be removed but may not understand that both sides must remain equal.

**Next move:** Represent the equation as a balance. Ask what happens if 7 is removed from one side but not the other.

**2. Which Number Must Undo the Division?** A student solves  $m \div (-3) = 8$  and writes  $m = 24$ . Is the student correct? Explain which number must be used to undo the division, then solve and check.

**Correct answer:** The student is not correct. Multiply both sides by -3:  $-3(m \div -3) = 8(-3)$ , so  $m = -24$ . Check:  $-24 \div -3 = 8$ .

**Likely wrong answer:**  $m = 24$

**Misconception:** The student may recognize that multiplication undoes division but may ignore the negative sign in the divisor.

**Next move:** Identify the exact divisor as -3, not 3. The inverse operation must use the complete divisor.

## Answer Key — Worksheets (Full Diagnostic)

### Worksheet A: Guided Practice

**1. A number increased by 15 is 23. Write and solve an equation.**

1.  $n + 15 = 23$ , so  $n = 8$  Likely wrong answer:  $n - 15 = 23$ , so  $n = 38$  (writes the wrong operation for 'increased by'). Misconception: The equation is built with subtraction instead of addition.

**2. Solve:  $5m = 35$**

2.  $m = 7$  Likely wrong answer:  $m = 175$  (multiplies by 5 instead of dividing). Misconception: The inverse of multiplication is applied as multiplication again instead of division.

**3. Solve:  $n \div 4 = 7$**

3.  $n = 28$  Likely wrong answer:  $n = 1.75$  (divides by 4 instead of multiplying). Misconception: The inverse of division is applied as division again instead of multiplication.

**4. Four times a number is 52. Write and solve an equation.**

4.  $4n = 52$ , so  $n = 13$  Likely wrong answer:  $n + 4 = 52$ , so  $n = 48$  (writes the wrong operation for 'four times'). Misconception: The equation is built with addition instead of multiplication.

**5. Solve:  $-3p = 18$**

5.  $p=-6$  Likely wrong answer:  $p=6$  (drops the negative sign on the coefficient).  
Misconception: The negative sign on the coefficient is not carried through the division.

**6. Solve:  $q \div (-6)=5$**

6.  $q=-30$  Likely wrong answer:  $q=-1$  (divides instead of multiplying). Misconception: The inverse of division is applied as division again instead of multiplication.

**7. Solve:  $a+(-8)=11$**

7.  $a=19$  Likely wrong answer:  $a=3$  (subtracts 8 instead of adding). Misconception: The inverse of adding a negative is treated as subtracting a positive instead of adding 8.

**8. A temperature drops by  $11^{\circ}\text{C}$  and reaches  $6^{\circ}\text{C}$ . Write and solve an equation for the starting temperature.**

8.  $T-11=6$ , so  $T=17^{\circ}\text{C}$  Likely wrong answer:  $T+11=6$ , so  $T=-5$  (writes the wrong operation for 'drops by'). Misconception: The equation is built with addition instead of subtraction for a decrease.

**9. Solve:  $x+6=14$**

9.  $x=8$  Likely wrong answer:  $x=20$  (adds 6 instead of subtracting). Misconception: The inverse of addition is applied as addition again instead of subtraction.

**10. Solve:  $y-9=4$**

10.  $y=13$  Likely wrong answer:  $y=-5$  (subtracts 9 instead of adding). Misconception: The inverse of subtraction is applied as subtraction again instead of addition.

**11. Solve:  $-7d=-49$**

11.  $d=7$  Likely wrong answer:  $d=-7$  (drops the negative sign when dividing).  
Misconception: Two negative signs dividing are not resolved to a positive result.

**12. Solve and check:  $x \div (-5)=-6$**

12.  $x=30$  Likely wrong answer:  $x=-1.2$  (divides by -5 instead of multiplying).  
Misconception: The inverse of division is applied as division again instead of multiplication.

**13. Solve:  $b-(-4)=10$**

13.  $b=6$  Likely wrong answer:  $b=14$  (subtracts 4 instead of recognizing subtracting a negative as adding). Misconception: Subtracting a negative is treated as an ordinary subtraction rather than rewritten as addition.

**14. Solve:  $(-c) \div 3 = 9$**

14.  $-c=27$ , so  $c=-27$  Likely wrong answer:  $c=27$  (forgets that  $-c=27$  still needs one more step). Misconception: The equation is treated as solved once the coefficient is cleared, without resolving the negative on the variable.

**15. A total amount is shared equally among 8 people. Each person receives \$12. Write and solve an equation for the total amount.**

15.  $a \div 8 = 12$ , so  $a=96$ ; \$96 Likely wrong answer:  $a=1.5$  (divides by 8 instead of multiplying). Misconception: The inverse of division is applied as division again instead of multiplication.

#### Worksheet B: Independent Practice

**1. A bank account has \$18 after a withdrawal of \$35. Write and solve an equation for the amount in the account before the withdrawal.**

1.  $b-35=18$ , so  $b=53$ ; \$53 Likely wrong answer:  $b+35=18$ , so  $b=-17$  (writes the wrong operation for a withdrawal). Misconception: The equation is built with addition instead of subtraction for money taken out.

**2. A store price is reduced by \$9 to become \$26. Write and solve an equation for the original price.**

2.  $p-9=26$ , so  $p=35$ ; \$35 Likely wrong answer:  $p+9=26$ , so  $p=17$  (writes the wrong operation for a reduction). Misconception: The equation is built with addition instead of subtraction for a decrease.

**3. Three equal groups contain 45 items altogether. Write and solve an equation for the number of items in one group.**

3.  $3g=45$ , so  $g=15$  items per group Likely wrong answer:  $g+3=45$ , so  $g=42$  (writes the wrong operation for equal groups). Misconception: Equal groups are modeled with addition instead of multiplication.

**4. Solve:  $-8n=56$**

4.  $n = -7$  Likely wrong answer:  $n = -64$  (multiplies by 8 instead of dividing by -8).

Misconception: The inverse of multiplication is applied as multiplication again instead of division.

**5. A student divides a number by 4 and gets -8. Write and solve an equation for the original number.**

5.  $n \div 4 = -8$ , so  $n = -32$  Likely wrong answer:  $n = -2$  (divides by 4 again instead of multiplying).

Misconception: The inverse of division is applied as division again instead of multiplication.

**6. A student solves  $-4x = 36$  and writes  $x = 9$ . Identify the error and write the correct solution.**

6. The student divided by 4 instead of -4.  $x = -9$ . Likely wrong answer: (already given)  $x = 9$ .

Misconception: The negative sign on the coefficient is dropped, so division is done by the positive value instead.

**7. Solve:  $3.5q = 21$**

7.  $q = 6$  Likely wrong answer:  $q = 73.5$  (adds 3.5 instead of dividing). Misconception: The inverse of multiplication is applied as addition instead of division.

**8. Solve:  $p \div 7 = -6$**

8.  $p = -42$  Likely wrong answer:  $p = -1$  (subtracts 7 instead of multiplying). Misconception: The inverse of division is applied as subtraction instead of multiplication.

**9. Solve:  $s + (-12) = -5$**

9.  $s = 7$  Likely wrong answer:  $s = -17$  (adds -12 again instead of undoing it). Misconception: The inverse of adding a negative is applied as adding the same negative again.

**10. The temperature is  $-7^\circ\text{C}$  after dropping  $15^\circ\text{C}$ . Write and solve an equation for the starting temperature.**

10.  $T - 15 = -7$ , so  $T = 8^\circ\text{C}$  Likely wrong answer:  $T + 15 = -7$ , so  $T = -22$  (writes the wrong operation for a drop). Misconception: The equation is built with addition instead of subtraction for a decrease.

**11. A student solves  $y \div (-5) = 4$  and writes  $y = 20$ . Identify the error and write the correct solution.**

11. The student multiplied by 5 instead of -5.  $y = -20$ . Likely wrong answer: (already given)  $y = 20$ . Misconception: The negative sign on the divisor is dropped, so the inverse operation multiplies by the positive value instead.

**12. Solve:  $x + 17 = 29$**

12.  $x = 12$  Likely wrong answer:  $x = 46$  (adds 17 again instead of subtracting). Misconception: The inverse of addition is applied as addition again instead of subtraction.

**13. Solve:  $m - 14 = -3$**

13.  $m = 11$  Likely wrong answer:  $m = -17$  (subtracts 14 again instead of adding). Misconception: The inverse of subtraction is applied as subtraction again instead of addition.

**14. Solve:  $-1.5v = 12$**

14.  $v = -8$  Likely wrong answer:  $v = 8$  (drops the negative sign on the coefficient). Misconception: The negative sign on the coefficient is not carried through the division.

**15. Solve:  $r \div (-9) = -4$**

15.  $r = 36$  Likely wrong answer:  $r = -36$  (drops the sign when two negatives divide). Misconception: Two negative signs dividing are not resolved to a positive result.

**16. Solve:  $t - (-9) = 2$**

16.  $t = -7$  Likely wrong answer:  $t = 11$  (subtracts -9 as an ordinary subtraction). Misconception: Subtracting a negative is treated as an ordinary subtraction rather than rewritten as addition.

**17. Solve:  $(-u) \div 5 = -3$**

17.  $-u = -15$ , so  $u = 15$  Likely wrong answer:  $u = -15$  (stops after clearing the divisor, without resolving the negative on  $u$ ). Misconception: The equation is treated as solved once the coefficient is cleared, without resolving the negative on the variable.

**18. Write a one-step equation with solution  $x = 11$ . Then show a check.**

18. Answers vary. Example:  $x+5=16$ ; check  $11+5=16$ . Likely wrong answer: an equation with a different solution than 11 (miscalculates the check). Misconception: The equation is written first and the check is skipped, so a mismatch with  $x=11$  is not caught.

**19. A student says that  $x \div 8 = -5$  is not a one-step equation because division is involved. Is the student correct? Explain. Then solve and check the equation.**

19. It is a one-step equation.  $x=-40$ . Check:  $-40 \div 8 = -5$ . Likely wrong answer: agrees it is not one-step, since division 'counts differently'. Misconception: Division and multiplication are not recognized as being on the same footing as addition and subtraction for counting steps.

**20. Is  $n=-6$  a solution to  $n+10=4$ ? Show the check.**

20. Yes.  $-6+10=4$ . Likely wrong answer: No (recomputes  $4+10$  instead of substituting  $-6$ ). Misconception: The wrong value is substituted into the equation during the check.

#### Worksheet C: Mixed Application

**1. A person has \$64 after spending \$18. Write and solve an equation for the amount of money the person had before spending.**

1.  $b-18=64$ , so  $b=82$ ; \$82 Likely wrong answer:  $b+18=64$ , so  $b=46$  (writes the wrong operation for spending). Misconception: The equation is built with addition instead of subtraction for money spent.

**2. A temperature of  $T$  degrees Celsius decreases by  $9^{\circ}\text{C}$  and becomes  $-4^{\circ}\text{C}$ . Write and solve an equation for  $T$ .**

2.  $T-9=-4$ , so  $T=5^{\circ}\text{C}$  Likely wrong answer:  $T+9=-4$ , so  $T=-13$  (writes the wrong operation for a decrease). Misconception: The equation is built with addition instead of subtraction for a decrease.

**3. A delivery driver travels the same distance each day for 7 days and travels 154 km in total. Write and solve an equation for the distance travelled each day.**

3.  $7d=154$ , so  $d=22$  km per day Likely wrong answer:  $7+d=154$ , so  $d=147$  (writes the wrong operation for equal daily amounts). Misconception: Equal repeated amounts are modeled with addition instead of multiplication.

**4. A student says  $r-8=20$  can be solved by subtracting 8 from both sides. Explain why this does not undo the operation attached to  $r$ . Then solve correctly.**

4. Add 8 to both sides.  $r=28$ . Likely wrong answer: (already given, explanatory item). Misconception: Subtracting the same number again does not undo a subtraction; the inverse operation (adding) is needed instead.

**5. A student earns the same number of points in each of 5 rounds and earns 65 points total. Write and solve an equation for the number of points earned each round.**

5.  $5p=65$ , so  $p=13$  points per round Likely wrong answer:  $p+5=65$ , so  $p=60$  (writes the wrong operation for equal rounds). Misconception: Equal repeated amounts are modeled with addition instead of multiplication.

**6. A number divided by -6 equals 4. Write and solve an equation.**

6.  $n \div (-6)=4$ , so  $n=-24$  Likely wrong answer:  $n \times (-6)=4$ , so  $n=-24$  miswritten, or  $n=-24$  with the equation set up as  $n \div 6=-4$ . Misconception: The direction of the division in the word problem is reversed when writing the equation.

**7. Solve and check:  $x-13=21$**

7.  $x=34$  Likely wrong answer:  $x=8$  (subtracts 13 again instead of adding). Misconception: The inverse of subtraction is applied as subtraction again instead of addition.

**8. Solve and check:  $-9m=-72$**

8.  $m=8$  Likely wrong answer:  $m=-8$  (drops the negative sign when two negatives divide). Misconception: Two negative signs dividing are not resolved to a positive result.

**9. Solve and check:  $n \div (-4)=9$**

9.  $n=-36$  Likely wrong answer:  $n=-2.25$  (divides by -4 instead of multiplying). Misconception: The inverse of division is applied as division again instead of multiplication.

**10. Solve and check:  $p+(-15)=-2$**

10.  $p=13$  Likely wrong answer:  $p=-17$  (adds -15 again instead of undoing it). Misconception: The inverse of adding a negative is applied as adding the same negative again.

**11. Solve and check:  $(-q) \div 6=5$**

11.  $-q=30$ , so  $q=-30$  Likely wrong answer:  $q=30$  (drops the negative sign when clearing the divisor). Misconception: The negative sign attached to the variable is not carried through to the final answer.

**12. A movie theatre sells 9 identical tickets for \$117. Write and solve an equation for the cost of one ticket.**

12.  $9t=117$ , so  $t=13$ ; \$13 per ticket Likely wrong answer:  $9+t=117$ , so  $t=108$  (writes the wrong operation for identical tickets). Misconception: Equal repeated amounts are modeled with addition instead of multiplication.

**13. A student says  $s \div (-3) = -7$  has solution  $s = -21$ . Is the student correct? Explain and check.**

13. No. Multiply by  $-3$ .  $s=21$ . Likely wrong answer: agrees  $s=-21$  is correct without checking. Misconception: The proposed solution is accepted without substituting it back into the original equation.

**14. Non-Routine: A student solves  $-5x=35$  and writes  $x=-7$ . Another student says the answer must be positive because 35 is positive. Who is correct? Use a check in the original equation to explain.**

14. Correct answer: The first student is correct. Divide both sides of  $-5x=35$  by  $-5$  to get  $x=-7$ . Check:  $-5(-7)=35$ . Likely wrong answer:  $x=7$  Misconception: The student may focus on the positive value 35 and ignore the negative coefficient. Next move: Test both possibilities:  $-5(7)=-35$ , but  $-5(-7)=35$ .

**15. Non-Routine: A student says that  $-4n=28$  has solution  $n=7$ . The student explains, "I divided 28 by 4." Is the student correct? Identify the missing sign, solve the equation, and check the correct solution in the original equation.**

15. Correct answer: The student is not correct. The coefficient is  $-4$ , not 4. Divide both sides of  $-4n=28$  by  $-4$ :  $n=-7$ . Check:  $-4(-7)=28$ . Likely wrong answer:  $n=7$  Misconception: The student may identify division as the inverse operation but ignore the negative sign attached to the coefficient. Next move: Circle the full coefficient before dividing. The equation contains  $-4n$ , so both sides must be divided by  $-4$ .

### Answer Key — Exit Ticket

1.  $x=21$
2.  $m=-7$

3.  $n \div 5 = -7$ , so  $n = -35$

## Worksheet 1: Guided Practice

1.  $n + 15 = 23$ , so  $n = 8$

2.  $m = 7$

3.  $n = 28$

4.  $4n = 52$ , so  $n = 13$

5.  $p = -6$

6.  $q = -30$

7.  $a = 19$

8.  $T - 11 = 6$ , so  $T = 17^\circ\text{C}$

9.  $x = 8$

10.  $y = 13$

11.  $d = 7$

12.  $x = 30$

13.  $b = 6$

14.  $-c = 27$ , so  $c = -27$

15.  $a \div 8 = 12$ , so  $a = 96$ ; \$96

## Worksheet 2: Independent Practice

1.  $b - 35 = 18$ , so  $b = 53$ ; \$53

2.  $p - 9 = 26$ , so  $p = 35$ ; \$35

3.  $3g = 45$ , so  $g = 15$  items per group

4.  $n = -7$

5.  $n \div 4 = -8$ , so  $n = -32$

6. The student divided by 4 instead of -4.  $x = -9$ .

7.  $q = 6$

8.  $p = -42$

9.  $s = 7$

10.  $T - 15 = -7$ , so  $T = 8^\circ\text{C}$

11. The student multiplied by 5 instead of -5.  $y = -20$ .

12.  $x = 12$

13.  $m = 11$

14.  $v = -8$
15.  $r = 36$
16.  $t = -7$
17.  $-u = -15$ , so  $u = 15$
18. Answers vary. Example:  $x + 5 = 16$ ; check  $11 + 5 = 16$ .
19. It is a one-step equation.  $x = -40$ . Check:  $-40 \div 8 = -5$ .
20. Yes.  $-6 + 10 = 4$ .

## Worksheet 3: Mixed Practice & Application

### Item 14 (Non-Routine)

**Correct answer:** The first student is correct. Divide both sides of  $-5x = 35$  by  $-5$  to get  $x = -7$ . Check:  $-5(-7) = 35$ .

**Likely wrong answer:**  $x = 7$

**Misconception:** The student may focus on the positive value 35 and ignore the negative coefficient.

**Next move:** Test both possibilities:  $-5(7) = -35$ , but  $-5(-7) = 35$ .

### Item 15 (Non-Routine)

**Correct answer:** The student is not correct. The coefficient is  $-4$ , not 4. Divide both sides of  $-4n = 28$  by  $-4$ :  $n = -7$ . Check:  $-4(-7) = 28$ .

**Likely wrong answer:**  $n = 7$

**Misconception:** The student may identify division as the inverse operation but ignore the negative sign attached to the coefficient.

**Next move:** Circle the full coefficient before dividing. The equation contains  $-4n$ , so both sides must be divided by  $-4$ .

1.  $b - 18 = 64$ , so  $b = 82$ ; \$82
2.  $T - 9 = -4$ , so  $T = 5^\circ\text{C}$
3.  $7d = 154$ , so  $d = 22$  km per day
4. Add 8 to both sides.  $r = 28$ .
5.  $5p = 65$ , so  $p = 13$  points per round
6.  $n \div (-6) = 4$ , so  $n = -24$
7.  $x = 34$
8.  $m = 8$
9.  $n = -36$
10.  $p = 13$
11.  $-q = 30$ , so  $q = -30$

- 12.  $9t=117$ , so  $t=13$ ; \$13 per ticket
- 13. No. Multiply by -3.  $s=21$ .
- 14. (see diagnostic above)
- 15. (see diagnostic above)