LESSON 6

Adding and Subtracting Square Roots

Review It! If square roots are the same, you can add and subtract them.

Add: $11\sqrt{7} + 13\sqrt{28}$

Step 1 Simplify each square root.

$11\sqrt{7}$ cannot be simplified.

REMEMBER Look for perfect-square factors.

$13\sqrt{28} = 13 \times \sqrt{\square \times 7}$

THINK This is a perfect-square factor.

$= 13 \times \sqrt{\square} \times \sqrt{7}$

$= 13 \times \_\_\_\_ \times \sqrt{7}$

$= 26\sqrt{7}$

Step 2 Add the square roots.

$11\sqrt{7} + 26\sqrt{7} = (\_\_\_\_ + \_\_\_\_)\sqrt{7}$

THINK The square roots are the same.

$= \_\_\_\_\sqrt{7}$

So, $11\sqrt{7} + 13\sqrt{28} = \_\_\_\_$.

Try It! Simplify each expression.

Ask Yourself

1. $3\sqrt{12}$ $4 \cdot 3$ $6\sqrt{3}$
2. $5\sqrt{18}$ $9 \cdot 2$ $15\sqrt{2}$
3. $7\sqrt{50}$ $25 \cdot 2$ $35\sqrt{2}$
4. $6\sqrt{20}$ $4 \cdot 5$ $12\sqrt{5}$
5. $-2\sqrt{32}$ $16 \cdot 2$ $-8\sqrt{2}$
6. $-6\sqrt{27}$ $9 \cdot 3$ $-18\sqrt{3}$
7. $-9\sqrt{40}$ $4 \cdot 10$ $-36\sqrt{10}$
8. $-3\sqrt{45}$ $9 \cdot 5$ $-9\sqrt{5}$

1. What is the greatest perfect-square factor of 12? 4, or 6?

Add or subtract.

9. $12\sqrt{7} - 4\sqrt{7}$ $8\sqrt{7}$
10. $11\sqrt{2} + 11\sqrt{2}$ $22\sqrt{2}$
11. $6\sqrt{2} + 3\sqrt{8}$ $6\sqrt{2}$ $12\sqrt{2}$
12. $7\sqrt{3} - 2\sqrt{27}$ $6\sqrt{3}$ $1\sqrt{3}$
13. $12\sqrt{18} - 3\sqrt{8}$ $36\sqrt{2} - 6\sqrt{2}$ $30\sqrt{2}$
14. $8\sqrt{45} + 4\sqrt{20}$ $24\sqrt{5} + 16\sqrt{5}$ $40\sqrt{5}$

9. 12 apples − 4 apples = ? 8 apples, or 8?

Solve.

15. The distance from home plate to second base is $30\sqrt{18}$ in a Baby Ruth league and $15\sqrt{50}$ in a pony league. What is the difference in the distances? $15\sqrt{2}$

$30\sqrt{18} - 15\sqrt{50}$
$30\sqrt{9 \cdot 2} - 15\sqrt{25 \cdot 2}$
$30 \cdot 3\sqrt{2} - 15 \cdot 5\sqrt{2}$
$90\sqrt{2} - 75\sqrt{2}$

15. What is the greatest perfect-square factor of 162? 9, or 81?

16. The distance from first base to third base is $10\sqrt{162}$ feet in a baseball field and $15\sqrt{32}$ feet in a Little League field. What is the difference in the distances? $30\sqrt{2}$

$10\sqrt{162} - 15\sqrt{32}$
$10\sqrt{81 \cdot 2} - 15\sqrt{16 \cdot 2}$
$10 \cdot 9\sqrt{2} - 15 \cdot 4\sqrt{2}$
$90\sqrt{2} - 60\sqrt{2}$

On Your Own!

Circle the best answer for each question.

1. $6\sqrt{5} + 8\sqrt{5} =$ _____

   A. $14\sqrt{5}$
   B. $14\sqrt{10}$
   C. $48\sqrt{5}$
   D. $48\sqrt{10}$

2. $11\sqrt{3} - 4\sqrt{3} =$ _____

   A. $15\sqrt{6}$
   B. $15\sqrt{3}$
   C. $7\sqrt{6}$
   D. $7\sqrt{3}$

3. $24\sqrt{6} + 21\sqrt{6} =$ _____

   A. 270
   B. $90\sqrt{3}$
   C. $45\sqrt{12}$
   D. $45\sqrt{6}$

4. $9\sqrt{48} + 3\sqrt{12} =$ _____

   $9\sqrt{16\cdot3} + 3\sqrt{4\cdot3}$

   A. $42\sqrt{3}$
   B. $12\sqrt{60}$
   C. $48\sqrt{5}$
   D. $78\sqrt{3}$

   $9\cdot4\sqrt{3} + 3\cdot2\sqrt{3}$
   $36\sqrt{3} + 6\sqrt{3}$

5. $5\sqrt{40} - 2\sqrt{90} =$ _____

   $5\sqrt{4\cdot10} - 2\sqrt{9\cdot10}$

   A. $-4\sqrt{10}$
   B. $4\sqrt{10}$
   C. $3\sqrt{50}$
   D. $3\sqrt{70}$

   $5\cdot2\sqrt{10} - 2\cdot3\sqrt{10}$
   $10\sqrt{10} - 6\sqrt{10}$
   $4\sqrt{10}$

6. $11\sqrt{32} + 8\sqrt{50} =$ _____

   $11\sqrt{16\cdot2} + 8\sqrt{25\cdot2}$

   A. $84\sqrt{2}$
   B. $19\sqrt{82}$
   C. $128\sqrt{2}$
   D. $88\sqrt{82}$

   $11\cdot4\sqrt{2} + 8\cdot5\sqrt{2}$
   $44\sqrt{2} + 40\sqrt{2}$
   $84\sqrt{2}$

7. Ben cut a 9-foot by 12-foot rug between opposite corners. Each cut side is $\sqrt{180}$ feet. How many feet of binding are needed for both cut sides?

   A. $18\sqrt{10}$
   B. $6\sqrt{10}$
   C. $12\sqrt{5}$
   D. $2\sqrt{70}$

8. The distance between first and third base is $25\sqrt{18}$ feet in one field and $10\sqrt{72}$ feet in another field. What is the difference in distances?

   A. $45\sqrt{6}$
   B. $45\sqrt{2}$
   C. $15\sqrt{3}$
   D. $15\sqrt{2}$

   $25\sqrt{18} - 10\sqrt{72}$
   $25\sqrt{9\cdot2} - 10\sqrt{36\cdot2}$
   $25\cdot3\sqrt{2} - 10\cdot6\sqrt{2}$
   $75\sqrt{2} - 60\sqrt{2}$

9. Simplify the following expression.

   $11\sqrt{45} + 12\sqrt{20} - 7\sqrt{80}$
   $11\sqrt{9\cdot5} + 12\sqrt{4\cdot5} - 7\sqrt{16\cdot5}$
   $11\cdot3\sqrt{5} + 12\cdot2\sqrt{5} - 7\cdot4\sqrt{5}$
   $33\sqrt{5} + 24\sqrt{5} - 28\sqrt{5}$
   $59\sqrt{5} - 28\sqrt{5}$
   $31\sqrt{5}$

10. Simplify the following expression.

    $4\sqrt{18} + 5\sqrt{8} - 3\sqrt{50}$
    $4\sqrt{9\cdot2} + 5\sqrt{4\cdot2} - 3\sqrt{25\cdot2}$
    $4\cdot3\sqrt{2} + 5\cdot2\sqrt{2} - 3\cdot5\sqrt{2}$
    $12\sqrt{2} + 10\sqrt{2} - 15\sqrt{2}$
    $7\sqrt{2}$
    $22\sqrt{2} - 15\sqrt{2}$
    $7\sqrt{2}$

Math Words Fill in the blanks.

11. To add and subtract square roots, they must be the same

12. To simplify a square root, look for the greatest perfect square factor.

(7) $\sqrt{180} + \sqrt{180}$
$\sqrt{360}$
$\sqrt{36\cdot10}$
$6\sqrt{10}$