GURUTOR

GMAT PREP

Course Documents

Roots

GMAT Roots

The GMAT doesn't test roots nearly as often as it does exponents, but they still come up enough such that we should know how to do a few things with them. Here's what we need to know.

1. Adding and Subtracting with Roots
2. Multiplying and Dividing with Roots
3. Solving Equations with Roots
4. Removing Roots from Denominators

1 Adding and Subtracting with Roots

We can only add or subtract terms with roots if the numbers underneath the roots are the same.

Example 1:

$\sqrt{48} + \sqrt{108}$

$\sqrt{16 \times 3} + \sqrt{3 \times 63}$

$4\sqrt{3} + 6\sqrt{3}$
$10\sqrt{3}$

2 Multiplying and Dividing with Roots

There are no such limitations for multiplying and dividing roots!

Example 2:

$\sqrt{5} \times \sqrt{20} = \sqrt{5 \times 20} = \sqrt{100} = 10$

Example 3:

$\frac{\sqrt{60}}{\sqrt{3}} = \frac{\sqrt{60}}{\sqrt{3}} = \sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}$

3 Solving Equations with Roots

To solve for a variable that's underneath a square symbol, isolate the root symbol and then square both sides of the equation to remove the root from the equation.

Example 4:

Solve for x: $2\sqrt{x-1}+5=11$

$2\sqrt{x-1}+5=11$

$2\sqrt{x-1}=6$
$\sqrt{x-1}=3$ **Square both Sides!**

$x-1=9$

$x=8$

4 Removing Roots from Denominators

The math gods have decreed that roots do not belong in the denominators of fractions. In most cases, multiplying the numerator and denominator of the fraction by the root in the denominator will fix that problem.

Example 5:

$$\frac{2}{\sqrt{2}} \qquad \frac{(\sqrt{2})}{\sqrt{2}}$$

$$\frac{2\sqrt{2}}{\sqrt{4}}$$

$$\frac{2\sqrt{2}}{\sqrt{2}}$$

$$\sqrt{2}$$

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Problem Set

Solve the following problems

1. Simplify: Five times the square root of three plus two times the square root of three minus the square root of three.
2. Simplify: The square root of twenty plus the square root of forty-five.
3. Simplify: The square root of seven multiplied by the square root of two.
4. Simplify: The square root of seventy-two divided by the square root of eight.
5. Solve for x: The square root of x plus four equals five.
6. Solve for y: Three times the square root of y minus one equals twelve.
7. Rationalize the denominator: Three divided by the square root of five.
8. Rationalize the denominator: Ten divided by the square root of two.
9. Simplify: The square root of six squared.
10. If x equals three, what is the value of the square root of four times x plus thirteen?

Explanations

1. Explanation: To add or subtract terms with roots, the numbers underneath the roots must be the same. In this problem, all terms have the square root of three, so we can simply add and subtract the coefficients: 5+2-1 = 6. Therefore, the simplified expression is six times the square root of three.

2. Explanation: To simplify the square root of twenty plus the square root of forty-five, we first need to simplify each radical individually. The square root of twenty can be written as the square root of four multiplied by five, which simplifies to two times the square root of five. The square root of forty-five can be written as the square root of nine multiplied by five, which simplifies to three times the square root of five. Now that both terms have the square root of five, we can add their coefficients: two times the square root of five plus three times the square root of five equals five times the square root of five.

3. Explanation: To multiply roots, we multiply the numbers underneath the roots. So, the square root of seven multiplied by the square root of two equals the square root of seven multiplied by two, which equals the square root of fourteen.

4. Explanation: To divide roots, we divide the numbers underneath the roots. So, the square root of seventy-two divided by the square root of eight equals the square root of seventy-two divided by eight, which equals the square root of nine. The square root of 9 is 3.

5. Explanation: To solve for x in the square root of x plus four equals five, we need to isolate the root, which is already done. Then, we square both sides of the equation to eliminate the square root: the square root of x plus four squared equals five squared. This gives x plus four equals twenty-five. Subtracting 4 from both sides results in x equals twenty-one.

6. Explanation: To solve for y in three times the square root of y minus one equals twelve, first divide both sides by 3 to isolate the root: the square root of y minus one equals four. Next, square both sides of the equation: the square root of y minus one squared equals four squared. This simplifies to y minus one equals sixteen. Adding 1 to both sides gives y equals seventeen.

7. Explanation: To rationalize the denominator of three divided by the square root of five, we multiply both the numerator and the denominator by the square root of five: three divided by the square root of five multiplied by the square root of five divided by the square root of five equals three times the square root of five divided by five.

8. Explanation: To rationalize the denominator of ten divided by the square root of two, we multiply both the numerator and the denominator by the square root of two: ten divided by the square root of two multiplied by the square root of two divided by the square root of two equals ten times the square root of two divided by two. This expression can be further simplified by dividing 10 by 2, resulting in five times the square root of two.

9. Explanation: When a square root is squared, the result is the number under the root. Therefore, the square root of six squared equals six.

10. Explanation: To find the value of the square root of four times x plus thirteen when x equals three, substitute 3 for x in the expression: the square root of four multiplied by three plus thirteen. This simplifies to the square root of twelve plus thirteen, which is the square root of twenty-five. The square root of 25 is 5.