Answer to Question #85635 – Math – Algebra

Question

Solve the equation by completing the square $10v^2 - 15v = 27 + 4v^2 - 6v$

Solution

Subtract $4\text{v}^2 - 6\text{v} + 27$ from both sides:

$6\text{v}^2 - 9\text{v} - 27 = 0$

Divide both sides by 6:

$\text{v}^2 - 1.5\text{v} - 4.5 = 0$

We write the coefficients of the quadratic equation:

$a = 1, \quad b = 1.5, \quad c = 4.5$

Multiply the equation by $4a$, that is, by 4 · 1 = 4:

$4 * 1\text{v}^2 - 4 * 1.5\text{v} - 4 * 4.5 = 4 * 0$

$4\text{v}^2 - 6\text{v} - 18 = 0$

Transfer the number that does not contain v to the right side of the equation (during the transfer it will change the sign to the opposite):

$4\text{v}^2 - 6\text{v} = 18$

The coefficient near v is 6 in absolute value.

Divide 6 in half (by 2), then divide the result by the square root of the coefficient a (that is, by the root of 4, or simply by 2):

$6: 2: 2 = 1.5$

Add to both sides of the equation a number equal to $1.5^2 = 2.25$

$4\text{v}^2 - 6\text{v} + 2.25 = 18 + 2.25$

Let us consider the expression on the left side using the formula for the square of the difference (in this step, we must get an expression):

$4\text{v}^2 - 6\text{v} + 2.25 = (2\text{v} - 1.5)^2$

$(2\text{v} - 1.5)^2 = 20.25$

The previous equation is equivalent to two non-square equations:

$2\text{v} - 1.5 = \sqrt{20.25}$

$2v - 1.5 = -\sqrt{20.25}$

Let's transfer - 1.5 to the right side:

$2v = 1.5 + \sqrt{20.25}$

$2v = 1.5 - \sqrt{20.25}$

Divide both sides by 2:

$$v1 = \frac{1.5 + \sqrt{20.25}}{2}$$

$$v2 = \frac{1.5 - \sqrt{20.25}}{2}$$

Simplify the resulting roots:

$$v1 = \frac{1.5 + \sqrt{20.25}}{2} = \frac{1.5 + 4.5}{2} = 3$$

$$v2 = \frac{1.5 - \sqrt{20.25}}{2} = \frac{1.5 - 4.5}{2} = \frac{-3}{2}$$

Answer: $v1 = 3$ and $v2 = \frac{-3}{2}$.