Answer on Question #58471 – Math – Algebra

Question

A manufacturer has 600 liters of 12%acid solution. How many liters of 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%?

Solution

Let $x \geq 0$ represent the volume of 30% acid solution (in liters).
The amount of acid in 12% solution is $600 \cdot 0.12$.
The amount of acid in 30% solution is $0.3x$.
The total amount of acid in the final solution is $600 \cdot 0.12 + 0.3x$.
The total volume of final solution is $600 + x$.
The acid concentration in the final solution is
$\frac{600 \times 0.12 + 0.3x}{600 + x}$.
The concentration is required to be in 0.15 – 0.18 range, therefore,

$$0.15 < \frac{72 + 0.3x}{600 + x} < 0.18;$$

$$\frac{72 + 0.3x}{600 + x} > 0.15 \text{ and } \frac{72 + 0.3x}{600 + x} < 0.18;$$

$$\frac{72 + 0.3x - 0.15(600 + x)}{600 + x} > 0 \text{ and } \frac{72 + 0.3x - 0.18(600 + x)}{600 + x} < 0;$$

$$\frac{72 + 0.3x - 90 - 0.15x}{600 + x} > 0 \text{ and } \frac{72 + 0.3x - 108 - 0.18x}{600 + x} < 0;$$

$$\frac{0.15x - 18}{600 + x} > 0 \text{ and } \frac{0.12x - 36}{600 + x} < 0;$$

$$0.15x > 18 \text{ and } 0.12x < 36;$$

$$x > 120 \text{ and } x < 300;$$

$$120 < x < 300.$$

Answer: the volume of 30% acid should be in range of 120 – 300 liters.