

Let take that Kate will add x gallons of hot water at 70 degrees to 2 gallons of cold water at 10 degrees if she wants to receive warm water at 40 degrees. Then we will have next equation:

$$\begin{aligned}70 \cdot x + 10 \cdot 2 &= 40 \cdot (2 + x) \Rightarrow \\ \Rightarrow 70 \cdot x + 20 &= 80 + 40 \cdot x \Rightarrow \\ \Rightarrow 70 \cdot x - 40 \cdot x &= 80 - 20 \Rightarrow \\ \Rightarrow 30 \cdot x &= 60 \Rightarrow \\ \Rightarrow x &= 2\end{aligned}$$

So, she needs to add 2 gallons of hot water for receive warm water.

Answer: 2 gallons.