Arithmetic with Radicals

Happily, multiplying with radicals is no different from multiplying other expressions. Remember
\[
x(2 + x) = 2x + x \cdot x \quad \text{We distribute first.}
\[
= 2x + x^2.
\]
This means we can do the following.
\[
\sqrt{5}(2 + \sqrt{5}) = 2\sqrt{5} + \sqrt{5}\sqrt{5} \quad \text{We distribute first.}
\]
\[
= 2\sqrt{5} + 5. \quad \text{By definition of a square root.}
\]
Remember
\[
2
\begin{array}{c}
+3x \\
\times 1 \quad -7x \\
\hline
-14x \\
-21x^2 \\
+2 \\
+3x \\
\hline
2 \\
-11x \\
-21x^2
\end{array}
\]
This means we can do the following.
\[
2
\begin{array}{c}
+3\sqrt{3} \\
\times 1 \quad -7\sqrt{3} \\
\hline
-14\sqrt{3} \\
-21\sqrt{3} \\
+2 \\
+3\sqrt{3} \\
\hline
2 \\
-11\sqrt{3} \\
-21\sqrt{3} = \\
2 \\
-11\sqrt{3} \\
-21(3) = \\
2 \\
-11\sqrt{3} \\
-63 = \\
-61 \end{array}
\]