Cost *The total cost function for a product is given by* $C(x) = 3x^3 - 6x^2 - 300x + 1800$*, where* x *is the number of units produced and* C *is the cost in hundreds of dollars. Use factoring by grouping to find the numbers of units that will give a total cost of $120,000.* [1]

In this problem we need to remember that C is the cost in hundreds of dollars. Since $120,000 is $1200-hundred, we want to find the value of x that will result in $C(x) = 1200$.

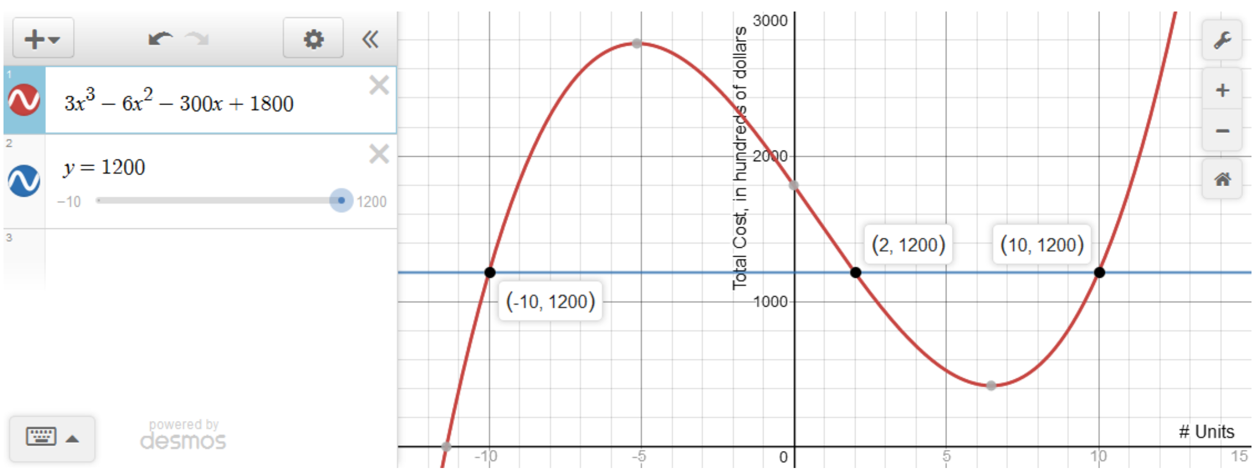
$$
\begin{aligned}
C(x) &= 3x^3 - 6x^2 - 300x + 1800 && \\
1200 &= 3x^3 - 6x^2 - 300x + 1800 && \text{Subtract 1200 from each side so one side is equal to 0.} \\
0 &= 3x^3 - 6x^2 - 300x - 600 && \text{Divide each term by 3 to simplify the factoring.} \\
0 &= x^3 - 2x^2 - 100x - 200 && \text{Factor by grouping.} \\
0 &= (x^3 - 2x^2) + (-100x - 200) && \\
0 &= x^2(x-2) - 100(x-2) && \\
0 &= (x^2 - 100)(x-2) && \text{Set each factor equal to 0.}
\end{aligned}
$$

$$
\begin{aligned}
x^2 - 100 &= 0 \quad \text{or} \quad & x - 2 &= 0 \\
x^2 &= 100 \quad \text{or} \quad & x &= 2 \\
x &= \pm 10 & &
\end{aligned}
$$

The three algebraic solutions are $x = -10, 2, 10$ but in the context of this problem, where x is the number of units produced, negative values of x must be omitted.

So the solutions are $x = 2, 10$ and we can say that if either 2 units or 10 units are produced the total cost for the product will be $120,000.

We can verify this result using the graph of C.



[1] Harshbarger/Yocco, *College Algebra In Context*, 5e, p. 465, #42.