Read the problem. Write your answer for each part.

1. Jonah and Grace are working on a homework problem together. They are factoring the expression shown below.

   $$4x^3 - 12x^2 - 9x + 27$$

   A Jonah used factoring by grouping to write the expression as a product of two binomials. What was Jonah’s answer? Show your work.

   Answer: _______________________

   B Grace continued Jonah’s work, factoring the expression completely. What was Grace’s answer?

   Answer: _______________________

   C Explain how you found the answer to part B.
Read the problem. Write your answer for each part.

4. A physicist needs to know the values of $x$ for which the trinomial below equals zero. Her first step is to factor the trinomial.

$$x^2 + 10x + 24$$

A Factor the trinomial.

Answer: ______________________

B Explain how you found your answer to part A.

C The physicist also needs to factor the trinomial below.

$$x^2 - 10x + 24$$

What is the factored form of the trinomial?

Answer: ______________________
The physicist must factor several trinomials that are all of the form \( x^2 - mx + n \), where \( m \) and \( n \) are whole numbers greater than zero. She wonders if any of these trinomials factor as \( (x + a)(x + b) \), where \( a > 0 \) and \( b < 0 \). Is that possible? Explain why or why not.
Read the problem. Write your answer for each part.

5. A manufacturing company uses the expressions below to estimate revenue and expenses based on the production of \( n \) units.

   Revenue: \( 20n^2 - 180 \)
   Expenses: \( 4n^2 + 36n + 72 \)

The ratio of revenue to expenses is given by the rational expression below.

\[
\frac{20n^2 - 180}{4n^2 + 36n + 72}
\]

A Factor the numerator and denominator of the rational expression, and simplify if possible. Show your work.

Answer: ____________________________

B The rational expression \( \frac{20n^2 - 180}{4n^2 + 36n + 72} \) is not defined for any values of \( n \) for which the denominator equals zero. Find the values of \( n \) for which the denominator equals zero.

Answer: ____________________________

C The company accountant says that the rational expression \( \frac{20n^2 - 180}{4n^2 + 36n + 72} \) will never have a zero denominator because \( n \), the number of units, is always a whole number. Explain why the accountant is correct.