**So What If No Factoring Techniques Works?**

**The Last Resort: Factoring by Dividing**

**Example 1**  
First of all, how do you use dividing to factor, when you’re just dealing with numbers? Let’s take an example in which you need to factor the number 29106. How do you do it?

*Step 1:* Find one factor by guessing and checking.

*Step 2:* Use it to divide in order to find other factors

*Step 3:* Write your answer.

Here’s a related question: Divide 29106 by 5 and show that it is NOT a factor.
Example 2  
Factor the polynomial $f(x) = 2x^2 + 17x + 21$, using both long division and synthetic division.

Example 3  
Decide whether $2x + 3$ is a factor of $4x^2 - 2x + 1$, using both long division and synthetic division.
Example 4  Factor $f(x) = 2x^3 - 3x + 5$. 
Example 5

Factor \( y = x^3 + 7x^2 + 8x - 16 \).
Example 6  Use synthetic division to find the value of $k$ so that $x + 3$ will be a factor of $x^3 + kx + 6$.

Example 7  When $x^3 + kx + 1$ is divided by $x + 1$, the remainder is $-4$. Find $k$, using synthetic division.
Example 8  Divide and write your answer in the form:  
\[ \text{dividend} = \text{quotient} \times \text{divisor} + \text{remainder}. \]

(a) \[ \frac{3x^4 - x^2 + 1}{x + 2} \]

(b) \[ \frac{5x^3 - 3x^2 + 7}{x^2 - 2} \]
Unit 4 Homework Five (4.5)

Factor and graph each of the following, using x and y intercepts. Each of these should factor without using division.

1) \( y = 27x^3 - 125 \)  
2) \( y = x^5 + 2x^4 - 9x^3 - 18x^2 \)  
3) \( y = x^6 - 26x^3 - 27 \)  
4) \( f(x) = x^3 - 3x^2 - x + 3 \)  
5) \( f(x) = x^4 - 9x^2 \)  
6) \( f(x) = x^5 + x^4 - 3x^3 - 3x^2 - 4x - 4 \)
Divide the following, leaving your answer as \( \text{dividend} = \text{quotient} \times \text{divisor} + \text{remainder} \).

**Circle any problem for which the divisor is a factor of the dividend.**

7) \((k^3 - k^2 - k - 2) \div (k - 2)\)

8) \((b^4 - 8b^3 - b^2 + 62b - 34) \div (b - 7)\)

9) \((n^4 + 9n^3 + 14n^2 + 50n + 9) \div (n + 8)\)

10) \((p^4 + 6p^3 + 11p^2 + 29p - 13) \div (p + 5)\)

11) \((p^4 - 8p^3 + 10p^2 + 2p + 4) \div (p - 2)\)

12) \((n^5 - 25n^3 - 7n^2 - 37n - 18) \div (n + 5)\)
13) Divide, using long division, and write your answer as 
\( dividend = quotient \times divisor + remainder. \)

(a) \( \frac{3x^4 - x^2 + 1}{x + 2} \)

(b) \( \frac{5x^3 - 3x^2 + 7}{x^2 - 2} \)