Remainder & Factor Theorems Guided Notes

Name: ____________

Remainder Theorem: for a polynomial \( p(x) \) and a number \( a \), the remainder on division by \( (x-a) \) is \( p(a) \); so \( p(a) = 0 \) if and only if \( (x-a) \) is a factor of \( p(x) \). In essence, if the remainder is 0, then \( (x-a) \) is a factor of \( f(x) \).

Factor Theorem: the binomial \( (x-a) \) is a factor of the polynomial \( f(x) \) if and only if \( f(a) = 0 \).

Write a true statement using the given and the provided vocabulary term:

| Given \((x-2)\) is a factor of \( f(x) \) |
|-----------------|-----------------|
| \( f(2) \)      | Remainder       |
| Quotient        | Depressed polynomial |

1. Use \( f(x) = x^3 - 6x^2 + 5x + 12 \) to demonstrate the remainder and factor theorems.

2. Given \( f(x) = 3x^4 + 2x^3 - 5x^2 + x - 2 \) find \( f(-2) \) using synthetic substitution.

3. Given \( f(x) = 5x^2 + 2x - 1 \) find \( f(3) \) using synthetic substitution.

4. Show that \((x+5)\) is a factor of \( f(x) = x^3 + 2x^2 - 13x + 10 \) then find the remaining factors of the polynomial.

5. Show that \((x-6)\) is a factor of \( f(x) = 3x^3 - 13x^2 - 34x + 24 \) then find the remaining factors of the polynomial.
Try it on your own!

Use synthetic substitution to find \( f(4) \) and \( f(-3) \) for following functions

1. \( f(x) = 2x^3 + x^2 - 5x + 3 \)  
2. \( f(x) = 5x^3 - 4x^2 + 2 \)

Given a polynomial and one of its factors, find the remaining factors of the polynomial:

3. \( x^3 + x^2 - 10x + 8 \) with factor \((x-2)\)

4. \( x^3 + 15x^2 + 71x + 105 \) with factor \((x+7)\)

5. \( 2x^3 - x^2 - 7x + 6 \) with factor \((x-1)\)