Use Synthetic Division.

1) \( \frac{n^4 - 5n^3 - 16n^2 + 21n - 9}{n + 3} \)  

2) \( (a^3 + 2a^2 - 56a + 48) \div (a - 6) \)

3) \( (v^3 - 3v^2 - 35v + 25) \div (v + 5) \)  

4) \( (6n^3 + 17n^2 + 5n - 10) \div (n + 2) \)

Use Synthetic Substitution (Remainder Theorem) to evaluate each function at the given value.

5) \( f(a) = a^3 - 4a^2 + 8a - 22 \) at \( a = 3 \)

6) \( f(x) = 2x^4 + 18x^3 + 38x^2 + 8x - 16 \) at \( x = -6 \)

7) \( f(x) = x^3 - 9x^2 + 16x + 6 \) at \( x = 3 \)  

8) \( f(x) = x^4 + x^3 - 21x^2 + 9x - 25 \) at \( x = 4 \)

Factor each and find all roots.

9) \( x^4 - 9 = 0 \)  

10) \( x^4 + 8x^2 - 9 = 0 \)

11) \( x^3 - 3x^2 - 2x + 6 = 0 \)  

12) \( x^3 - 4x^2 - x + 4 = 0 \)

13) \( x^4 + 7x^2 + 6 = 0 \)  

14) \( x^4 + 10x^2 + 25 = 0 \)
Factoring and Solving Higher Degree Polynomials

Use Synthetic Division.

1) \( \frac{n^4 - 5n^3 - 16n^2 + 21n - 9}{n + 3} \)
\[ n^3 - 8n^2 + 8n - 3 \]

2) \( (a^3 + 2a^2 - 56a + 48) \div (a - 6) \)
\[ a^2 + 8a - 8 \]

3) \( (v^3 - 3v^2 - 35v + 25) \div (v + 5) \)
\[ v^2 - 8v + 5 \]

4) \( (6n^3 + 17n^2 + 5n - 10) \div (n + 2) \)
\[ 6n^2 + 5n - 5 \]

Use Synthetic Substitution (Remainder Theorem) to evaluate each function at the given value.

5) \( f(a) = a^3 - 4a^2 + 8a - 22 \) at \( a = 3 \)
\[ -7 \]

6) \( f(x) = 2x^4 + 18x^3 + 38x^2 + 8x - 16 \) at \( x = -6 \)
\[ 8 \]

7) \( f(x) = x^3 - 9x^2 + 16x + 6 \) at \( x = 3 \)
\[ 0 \]

8) \( f(x) = x^4 + x^3 - 21x^2 + 9x - 25 \) at \( x = 4 \)
\[ -5 \]

Factor each and find all roots.

9) \( x^4 - 9 = 0 \)
Factors to: \( (x^2 - 3)(x^2 + 3) = 0 \)
Roots: \( \sqrt{3}, -\sqrt{3}, i\sqrt{3}, -i\sqrt{3} \)

10) \( x^4 + 8x^2 - 9 = 0 \)
Factors to: \( (x - 1)(x + 1)(x^2 + 9) = 0 \)
Roots: \( 1, -1, 3i, -3i \)

11) \( x^3 - 3x^2 - 2x + 6 = 0 \)
Factors to: \( (x - 3)(x^2 - 2) = 0 \)
Roots: \( 3, \sqrt{2}, -\sqrt{2} \)

12) \( x^3 - 4x^2 - x + 4 = 0 \)
Factors to: \( (x - 4)(x - 1)(x + 1) = 0 \)
Roots: \( 4, 1, -1 \)

13) \( x^4 + 7x^2 + 6 = 0 \)
Factors to: \( (x^2 + 1)(x^2 + 6) = 0 \)
Roots: \( i, -i, i\sqrt{6}, -i\sqrt{6} \)

14) \( x^4 + 10x^2 + 25 = 0 \)
Factors to: \( (x^2 + 5)^2 = 0 \)
Roots: \( i\sqrt{5} \text{ mult. } 2, -i\sqrt{5} \text{ mult. } 2 \)