Vocabulary

Review
1. Circle the expressions that are \textit{trinomials}.

\begin{align*}
7x^2 + 4x - 5 &\quad x^4 - 3x + 1 \\
x^3 + 9x &\quad 3x^3 + x^2 - x + 1
\end{align*}

Vocabulary Builder

\textbf{fundamental} [adjective] \textit{fund uh MENT ul}

\textbf{Related Words:} basic, essential

\textbf{Definition:} Something is \textit{fundamental} if it serves as the foundation of a system.

\textbf{Main Idea:} The \textit{Fundamental} Theorem of Algebra is the central idea of algebra.

Use Your Vocabulary

Write \textit{T} for \textit{true} or \textit{F} for \textit{false}.

2. The \textit{fundamental} idea of geometry is the study of the provable properties of shapes.

3. A \textit{fundamental} idea in the Declaration of Independence is that all people have the right to life, liberty, and the pursuit of happiness.

4. A \textit{fundamental} rule of history is that kings are always right.

Theorem \hspace{1cm} The Fundamental Theorem of Algebra

If \( P(x) \) is a polynomial of degree \( n \geq 1 \), then \( P(x) = 0 \) has exactly \( n \) roots, including multiple and complex roots.
Write the degree and the number of complex roots of each equation.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Degree</th>
<th>Number of Complex Roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7x^6 - 4x^3 + x + 5 = 0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$4x^5 + 5x^3 - 9x^2 + 2 = 0$</td>
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<td></td>
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<tr>
<td>$17x^{12} + x^7 - x^3 - 8 = 0$</td>
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**Problem 1 Using the Fundamental Theorem of Algebra**

**Got It?** What are all the complex roots of the equation $x^4 + 2x^3 = 13x^2 - 10x$?

8. Write the polynomial equation in standard form.

9. Factor out an $x$.

10. A rational root of the polynomial is $\boxed{}$.

11. Use the Rational Root Theorem on the cubic factor. List the possible rational roots.

12. Underline the correct word(s) or number to complete each sentence.

   When you substitute $1$ for $x$, the value of the cubic factor is $0/1/3$.

   Therefore, $1$ is / is not a root, and $x - 1$ is / is not a factor.

13. Use synthetic division to factor out $x - 1$ from the cubic factor.

14. Factor the resulting quadratic trinomial.

   $\boxed{} = (\boxed{\boxed{}})(\boxed{\boxed{}})$

15. Write all the roots of $x^4 + 2x^3 = 13x^2 - 10x$. 

   $\boxed{} \quad \boxed{} \quad \boxed{}$
Problem 2 Finding All the Zeros of a Polynomial Function

Got It? What are all the zeros of the function \( g(x) = 2x^4 - 3x^3 - x - 6 \)?

16. Use the graph of the function at the right to write the real zeros of the function.

17. Write the linear factors.

18. Use synthetic division to factor out the first linear factor.

19. Factor out the second linear factor from the quotient you found in Exercise 18.

20. The remaining quadratic factor is __________.

21. Use the Quadratic Formula to factor your answer to Exercise 20.

22. The four zeros of the function \( g(x) = 2x^4 - 3x^3 - x - 6 \) are __________, __________, __________, and __________.
Lesson Check  •  Do you know HOW?

Find the number of roots of the equation \(5x^4 + 12x^3 - x^2 + 3x + 5 = 0\).

23. The degree of the polynomial is \(\underline{\phantom{0}}\).

24. The number of roots is \(\underline{\phantom{0}}\).

Lesson Check  •  Do you UNDERSTAND?

Open-Ended  Write a polynomial function of degree 4 with two complex roots of multiplicity 2.

25. Write a complex number.

Write its conjugate.

26. Now use the numbers you wrote in Exercise 25 to write a polynomial function of degree 4 with two complex roots of multiplicity 2.

\[f(x) = \left(\underline{\phantom{0}}\right)^2 \left(\underline{\phantom{0}}\right)^2\]

Math Success

Check off the vocabulary words that you understand.

- Fundamental Theorem of Algebra
- polynomial equation

Rate how well you can solve polynomial equations.

Need to review 0 2 4 6 8 10 Now I get it!