ALBERT

Name _____ Date _____

Factoring with Complex Numbers Worksheet

Algebra 2 · Common Core HSN-CN.C.8

> (+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.

Practice

Builds the skill step by step.

1. $x^2 + 9 = (x + ki)(x - ki)$. What is k ($k > 0$)?

2. $x^2 + 64 = (x + ki)(x - ki)$. What is k ($k > 0$)?

3. Which is $x^2 + 4$ factored over the complex numbers?

   A. $(x + 2)^2$

   B. $(x + 2i)(x - 2i)$

   C. $(x + 2)(x - 2)$

   D. $(x + 4i)(x - i)$

4. $(x + 5i)(x - 5i) = x^2 + k$. What is k?

5. $x^2 + 1 = (x + ki)(x - ki)$. What is k ($k > 0$)?

6. What is the constant term of $(x + i)(x - i)$?

7. Which expression cannot be factored over the real numbers but can over the complex numbers?

   A. $x^2 + 16$

   B. $x^2 - 16$

   C. $x^2 - 8x + 16$

   D. $x^2 + 8x + 16$

8. $4x^2 + 25 = (2x + ki)(2x - ki)$. What is k ($k > 0$)?

9. $x^2 + 3 = (x + i\sqrt{k})(x - i\sqrt{k})$. What is k?

10. What is the value of $(x - 2i)(x + 2i)$ when $x = 1$?

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On Level

Grade-level practice.

1. $9x^2 + 4 = (3x + ki)(3x - ki)$. What is k ($k > 0$)?

2. $x^2 + 2x + 5 = (x - a - bi)(x - a + bi)$ with $b > 0$. What are a and b?

3. $x^2 - 6x + 13 = (x - a - bi)(x - a + bi)$ with $b > 0$. What are a and b?

4. $x^4 - 81 = (x - 3)(x + 3)(x + ki)(x - ki)$. What is k ($k > 0$)?

5. $(x - (2 + i))(x - (2 - i)) = x^2 + bx + c$. What are b and c?

6. Which identity factors a sum of squares over the complex numbers?

   A. $a^2 + b^2 = (a + bi)(a - bi)$

   B. $a^2 + b^2 = (a + b)^2$

   C. $a^2 + b^2 = (a + b)(a - b)$

   D. $a^2 + b^2 = (a - bi)^2$

7. $x^2 + 12 = (x + ki\sqrt{3})(x - ki\sqrt{3})$. What is k ($k > 0$)?

8. Explain how to factor $x^2 + 36$ using complex numbers.

9. $x^3 + 4x = x(x + ki)(x - ki)$. What is k ($k > 0$)?

10. How many linear factors does $x^4 - 1$ have over the complex numbers?

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Challenge

Multi-step and word problems that stretch it.

1. What is the product of all four zeros of $x^4 - 16$?

2. $x^2 + 4x + 13 = (x - a - bi)(x - a + bi)$ with $b > 0$. What are a and b?

3. $x^4 + 5x^2 + 4 = (x + i)(x - i)(x + ki)(x - ki)$. What is k ($k > 1$)?

4. $13 = (a + bi)(a - bi)$, where a and b are positive whole numbers and $a > b$. What are a and b?

5. Which is $x^2 + 2$ factored over the complex numbers?

   A. $(x + \sqrt{2})(x - \sqrt{2})$

   B. $(x + 2i)(x - 2i)$

   C. $(x + i)(x - 2i)$

   D. $(x + i\sqrt{2})(x - i\sqrt{2})$

6. $x^3 - x^2 + 4x - 4 = (x - 1)(x^2 + 4)$. How many of its zeros are real?

7. What is the constant term of $(x - 3i)^2$?

8. Explain why $x^2 + 9$ has no real linear factors but does have complex ones.

9. $4x^2 + 1 = (2x + ki)(2x - ki)$. What is k ($k > 0$)?

10. $x^2 - 2x + 2 = (x - a - bi)(x - a + bi)$ with $b > 0$. What are a and b?