

Complex Zeros Worksheet - Answer Key

Conjugate Root Theorem | Exact answers

LEVEL 1 - Conjugates & Degree

1. **$3 - 4i$**

Conjugate pair: $3 + 4i$ and $3 - 4i$.

2. **$-2 + 5i$**

Change only the sign of the imaginary part.

3. **$-6i$**

The conjugate of $0 + 6i$ is $0 - 6i$.

4. **$2, -1 + 3i, -1 - 3i$; degree 3**

One real zero plus one conjugate pair gives 3 zeros.

5. **-4 (mult. 2), $2 + i, 2 - i$; degree 4**

The conjugate has the same multiplicity as its partner; here each complex zero occurs once.

6. **$-3, 1 + 2i$ (mult. 2), $1 - 2i$ (mult. 2); degree 5**

Conjugate roots have matching multiplicity for real-coefficient polynomials.

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LEVEL 2 - Build the Polynomial

7. $x^4 - x^3 - 3x^2 + 17x - 30$

$$(x - 2)(x + 3)[(x - 1)^2 + 4] = (x - 2)(x + 3)(x^2 - 2x + 5).$$

8. $x^3 - 7x^2 + 9x + 17$

$$(x + 1)[(x - 4)^2 + 1] = (x + 1)(x^2 - 8x + 17).$$

9. $x^3 + 4x^2 + 13x$

$$x[(x + 2)^2 + 9] = x(x^2 + 4x + 13).$$

10. $x^4 - 4x^3 + 2x^2 - 12x + 45$

$$(x - 3)^2[(x + 1)^2 + 4] = (x - 3)^2(x^2 + 2x + 5).$$

11. $x^3 - 2x + 4$

$$(x + 2)[(x - 1)^2 + 1] = (x + 2)(x^2 - 2x + 2).$$

12. $x^3 - 5x^2 + 4x - 20$

$$(x - 5)(x^2 + 4).$$

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LEVEL 3 - Find All Zeros / Challenge

13. 2, 3i, -3i

$$(x - 2)(x^2 + 9).$$

14. -3, 1 + 2i, 1 - 2i

$$(x + 3)(x^2 - 2x + 5).$$

15. -4, 2, i, -i

$$(x + 4)(x - 2)(x^2 + 1).$$

16. 1 (multiplicity 2), -2 + i, -2 - i

$$(x - 1)^2(x^2 + 4x + 5).$$

17. 0, -1, 4, 2 + 3i, 2 - 3i

$$x(x + 1)(x - 4)(x^2 - 4x + 13).$$

18. $2x^5 - 12x^4 + 20x^3 + 40x^2 - 102x + 52$

$$2(x + 2)(x - 1)^2[(x - 3)^2 + 4] = 2(x + 2)(x - 1)^2(x^2 - 6x + 13).$$