Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Factors and Zeros

Student Worksheet

1. Factored polynomial to exact zeros

1. Find every zero.

$(x - 1)(5x - 4)$

2. Find every zero.

$(x)(x^2 + 50)$

3. Find every zero.

$(x - 3)(x + 1)(x + 3)(2x - 3)$

4. Find every zero.

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

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Factors and Zeros

Student Worksheet

2. Exact zeros to an integer polynomial

5. Use these zeros and multiplicities to write the polynomial.

$\frac{-1}{3}$, -2, -3, 1, 2, $\frac{4}{5}$

6. Use these zeros and multiplicities to write the polynomial.

$-\frac{4}{5}\sqrt{2}i$, $\frac{4}{5}\sqrt{2}i$

7. Use these zeros and multiplicities to write the polynomial.

-1, $\frac{-2}{3}$, 1

8. Use these zeros and multiplicities to write the polynomial.

$-\frac{1}{7}\sqrt{3}i$ (mult. 2), $\frac{1}{7}\sqrt{3}i$ (mult. 2)

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Factors and Zeros

Student Worksheet

3. Expanded polynomial to factors and zeros

9. Factor completely, then find every zero.

$30x^5 + 41x^4 - 92x^3 - 53x^2 + 98x - 24$

10. Factor completely, then find every zero.

$12x^6 + 52x^5 + 277x^4 + 987x^3 + 975x^2 + 225x$

11. Factor completely, then find every zero.

$6x^2 + x - 1$

12. Factor completely, then find every zero.

$x^3 + 3x^2 + x + 3$

Math Sheet

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Factors and Zeros

Worked Answer Key

1. Factored polynomial to exact zeros

1. Use the zero-product property.

$(x - 1)(5x - 4)$

Complete factors: $(x - 1)(5x - 4)$

Factor equations: $x - 1 = 0$ $5x - 4 = 0$

Solve each linear equation exactly.

Exact zeros: $1, \frac{4}{5}$

2. Use the zero-product property.

$(x)(x^2 + 50)$

Complete factors: $(x)(x^2 + 50)$

Factor equations: $x = 0$ $x^2 + 50 = 0$

Quadratic formula: D = b^2 - 4ac = -200; extract square factors, then divide by 2a.

Exact zeros: $-5\sqrt{2}i, 5\sqrt{2}i, 0$

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Factors and Zeros

Worked Answer Key

1. Factored polynomial to exact zeros

3. Use the zero-product property.

$$(x-3)(x+1)(x+3)(2x-3)$$

Complete factors: $(x-3)(x+1)(x+3)(2x-3)$

Factor equations: $x-3=0$ $x+1=0$ $x+3=0$ $2x-3=0$

Solve each linear equation exactly.

Exact zeros: $-1,\ -3,\ 3,\ \frac{3}{2}$

4. Use the zero-product property.

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

Complete factors: $(x-1)(x^2+2)(x^2+2)$

Factor equations: $x-1=0$ $x^2+2=0$ $x^2+2=0$

Quadratic formula: D = b^2 - 4ac = -8, -8; extract square factors, then divide by 2a.

Exact zeros: $-\sqrt{2}i$ (mult. 2) , $\sqrt{2}i$ (mult. 2) , 1

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Factors and Zeros

Worked Answer Key

2. Exact zeros to an integer polynomial

5. Pair conjugates, multiply, and normalize.

Given: $\frac{-1}{3}$, -2, -3, 1, 2, $\frac{4}{5}$

Monic factors: $(x + \frac{1}{3})^*$ $(x + 2)^*$ $(x + 3)^*$ $(x - 1)^*$ $(x - 2)^*$ $(x - \frac{4}{5})$

Monic product: $x^6 + \frac{23}{15}x^5 - \frac{41}{5}x^4 - \frac{79}{15}x^3 + \frac{88}{5}x^2 - \frac{52}{15}x - \frac{16}{5}$

Clear denominators: multiply the monic product by LCM 15; divide coefficient GCD 1.

Primitive integer result: $15x^6 + 23x^5 - 123x^4 - 79x^3 + 264x^2 - 52x - 48$

6. Pair conjugates, multiply, and normalize.

Given: $-\frac{4}{5}\sqrt{2}i$, $\frac{4}{5}\sqrt{2}i$

Monic factors: $(x^2 + \frac{32}{25})$

Monic product: $x^2 + \frac{32}{25}$

Clear denominators: multiply the monic product by LCM 25; divide coefficient GCD 1.

Primitive integer result: $25x^2 + 32$

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Factors and Zeros

Worked Answer Key

2. Exact zeros to an integer polynomial

7. Pair conjugates, multiply, and normalize.

Given: $-1,\ \frac{-2}{3},\ 1$

Monic factors: $(x + 1)*\ (x + \frac{2}{3})*\ (x - 1)$

Monic product: $x^3 + \frac{2}{3}x^2 - x - \frac{2}{3}$

Clear denominators: multiply the monic product by LCM 3; divide coefficient GCD 1.

Primitive integer result: $3x^3 + 2x^2 - 3x - 2$

8. Pair conjugates, multiply, and normalize.

Given: $-\frac{1}{7}\sqrt{3}i$ (mult. 2) , $\frac{1}{7}\sqrt{3}i$ (mult. 2)

Monic factors: $(x^2 + \frac{3}{49})*\ (x^2 + \frac{3}{49})$

Monic product: $x^4 + \frac{6}{49}x^2 + \frac{9}{2401}$

Clear denominators: multiply the monic product by LCM 2401; divide coefficient GCD 1.

Primitive integer result: $2401x^4 + 294x^2 + 9$

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Factors and Zeros

Worked Answer Key

3. Expanded polynomial to factors and zeros

9. Use the zero-product property.

$$30x^5 + 41x^4 - 92x^3 - 53x^2 + 98x - 24$$

Complete factors: $(x - 1)(x + 2)(2x + 3)(3x - 1)(5x - 4)$

Factor equations: $x - 1 = 0$ $x + 2 = 0$ $2x + 3 = 0$ $3x - 1 = 0$ $5x - 4 = 0$

Solve each linear equation exactly.

Exact zeros: $-2,\ \frac{-3}{2},\ 1,\ \frac{1}{3},\ \frac{4}{5}$

10. Use the zero-product property.

$$12x^6 + 52x^5 + 277x^4 + 987x^3 + 975x^2 + 225x$$

Complete factors: $(x)(x + 1)(x + 3)(3x + 1)(4x^2 + 75)$

Factor equations: $x = 0$ $x + 1 = 0$ $x + 3 = 0$ $3x + 1 = 0$ $4x^2 + 75 = 0$

Quadratic formula: D = b^2 - 4ac = -1200; extract square factors, then divide by 2a.

Exact zeros: $-\frac{5}{2}\sqrt{3}i,\ \frac{5}{2}\sqrt{3}i,\ -1,\ \frac{-1}{3},\ -3,\ 0$

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Factors and Zeros

Worked Answer Key

3. Expanded polynomial to factors and zeros

11. Use the zero-product property.

$6x^2 + x - 1$

Complete factors: $(2x + 1)(3x - 1)$

Factor equations: $2x + 1 = 0$ $3x - 1 = 0$

Solve each linear equation exactly.

Exact zeros: $\frac{-1}{2}, \frac{1}{3}$

12. Use the zero-product property.

$x^3 + 3x^2 + x + 3$

Complete factors: $(x + 3)(x^2 + 1)$

Factor equations: $x + 3 = 0$ $x^2 + 1 = 0$

Quadratic formula: D = b^2 - 4ac = -4; extract square factors, then divide by 2a.

Exact zeros: $-i, i, -3$