

## Writing Polynomials When Given the Roots

Tips:

1. radicals and complex numbers (imaginary) always come in pairs!

Examples:  $2i + -2i = \pm 2i$   
 $\sqrt{3} + -\sqrt{3} = \pm\sqrt{3}$

2. multiply parenthesis with radicals or imag. # together 1st  $(x-3)(x+i)(x-i)$   
mult. 1st

Practice: The given number is a zero of a polynomial, what is the other zero?

A.  $-\sqrt{10}$      $\sqrt{10}$

D.  $-8i$      $8i$

B.  $4-3i$      $4+3i$

E.  $\frac{-8+\sqrt{7}}{2}$      $\frac{-8-\sqrt{7}}{2}$

C.  $2-\sqrt{5}$      $2+\sqrt{5}$

Given the zeros, write the polynomial function with the least degree.

1. -2, 3, 5

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

① write factors for each zero.  $x=-2$      $x=3$   
 $\frac{+2+2}{x+2=0}$      $\frac{-3-3}{x-3=0}$

$(x+2)(x^2-5x-3x+15)$

② multiply factors

$(x+2)(x^2-8x+15)$

$x^3 - 8x^2 + 15x$   
 $2x^2 - 16x + 30$

$y = x^3 - 6x^2 - x + 30$

Given the zeros, write the polynomial function with the least degree.

2) Zeros: 5, 4, -1/2

$$y = (x-5)(x-4)\left(x+\frac{1}{2}\right)$$

$$y = (x-5)(x-4)(2x+1)$$

$$y = (x-5)(2x^2+1x-8x-4)$$

$$y = (x-5)(2x^2-7x-4)$$

$$y = \begin{array}{r} 2x^3 - 7x^2 - 4x \\ + \quad -10x^2 + 35x + 20 \\ \hline \end{array}$$

$$y = 2x^3 - 17x^2 + 31x + 20$$

3) 7 and  $-\sqrt{2}$  Remember radicals + i come in opposite pairs

Zeros: 7,  $-\sqrt{2}$ ,  $+\sqrt{2}$

$$y = (x-7)(x+\sqrt{2})(x-\sqrt{2})$$

$$y = (x-7)(x^2 - \sqrt{2}x + \sqrt{2}x - 2)$$

$$y = (x-7)(x^2 - 2)$$

$$y = x^3 - 7x^2 - 2x + 14$$

write as factors

mult. parenth. w/ radicals 1st!

Your radicals or i will cancel.

4. Zeros: -1, 7i i comes in pairs!

Zeros: -1, 7i, -7i

factors:  $(x+1)(x-7i)(x+7i)$  \*mult. ( ) with i 1st!

$$y = (x+1)(x^2+7ix-7ix-49i^2)$$

$-49(-1)$  \* $i^2 = -1$

$$y = (x+1)(x^2+49)$$

$$y = x^3 + x^2 + 49x + 49$$

5. Zeros: -2i and 3 with multiplicity of 2

"twice" or "2 times" bounces off x-axis at 3

Zeros: -2i, 2i, 3, 3

factors:  $(x+2i)(x-2i)(x-3)(x-3)$

$$y = (x^2-2ix+2ix-4i^2)(x^2-3x-3x+9)$$

$-4(-1)$

$$y = (x^2+4)(x^2-6x+9)$$

mult. again

$$y = \begin{array}{r} x^4 - 6x^3 + 9x^2 \\ + \quad 4x^2 - 24x + 36 \\ \hline \end{array}$$

$$y = x^4 - 6x^3 + 13x^2 - 24x + 36$$