

# Homework Guide

Name \_\_\_\_\_

Date: \_\_\_\_\_

## Rational, Irrational and Imaginary Zeros.

Find all Zeros, Roots, or Factors:

1.  $f(x) = x^3 - x^2 + 9x - 9$

Factoring ✓

$$x^2(x-1) + 9(x-1)$$

$$(x^2 + 9)(x-1)$$

SOTS

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

calculator

Root  $x=1$

$$\begin{array}{r|rrrr} 1 & 1 & -1 & +9 & -9 \\ & & \downarrow +1 & 0 & +9 \\ \hline & 1 & 0 & +9 & | \emptyset \end{array}$$

$$x^2 + 9 = 0$$

$$x^2 = -9$$

$$x = \pm 3i$$

Same answer ☺

Zeros:  $x=1, x=3i, \& x=-3i$

2.  $f(x) = 4x^3 - 16x^2 + 9x + 9$

Roots:  $x=3, x=\frac{3}{2}, \& x=-\frac{1}{2}$

3.  $g(x) = x^4 - 5x^2 - 36$

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

4.  $f(x) = x^4 - x^3 - 6x^2 - 50x - 100$

$$\begin{array}{r|rrrrr} -2 & 1 & -1 & -6 & -50 & -100 \\ & & \downarrow -2 & +6 & 0 & +100 \\ \hline & 1 & -3 & 0 & -50 & | \emptyset \end{array}$$

Calculator  
 $x = -2 \& 5$

$$\begin{array}{r|rrrr} 5 & 1 & -3 & 0 & -50 & | \emptyset \\ & & \downarrow +5 & +10 & +50 & \\ \hline & 1 & +2 & +10 & | \emptyset \end{array}$$

$$x^2 + 2x + 10 = 0$$

Does not factor

Complete Square

$$x^2 + 2x + \underline{1} = -10 + \underline{1}$$

$$\sqrt{(x+1)^2} = \sqrt{-9}$$

$$x+1 = \pm 3i$$

$$x = -1 \pm 3i$$

Quadratic Formula

$$\frac{-2 \pm \sqrt{(2)^2 - 4(1)(10)}}{2(1)}$$

$$\frac{-2 \pm \sqrt{-36}}{2}$$

$$\frac{-2 \pm 6i}{2}$$

$$-1 \pm 3i$$

Zeros:  
 $x=-2, x=5, x=-1+3i, \& x=-1-3i$

5.  $f(x) = 2x^3 + x^2 - 16x - 15$

6.  $h(x) = x^4 - 8x^2 - 9$

$$(x^2 + 1)(x^2 - 9) = 0$$

SO'S DOTS

$$(x+i)(x-i)(x+3)(x-3) = 0$$

OR Calculator  $x=3$  &  $x=-3$ 

$$\begin{array}{r} 3 \overline{) 1 + 0 - 8 + 0 - 9} \\ \underline{\downarrow 3 + 9 + 3 + 9} \end{array}$$

$$\begin{array}{r} -3 \overline{) 1 + 3 + 1 + 3 \quad | \quad \cancel{0}} \\ \underline{\downarrow -3 \quad 0 \quad -3} \end{array}$$

$$1 + 0 + 1 \quad | \quad \cancel{0}$$

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$x = \pm i$$

Roots:  $x = -1, x = 3, \& x = -\frac{5}{2}$

Zeros:  $x = -i, x = i, x = -3, \& x = 3$

Given the following sets of roots, find the polynomial:

7) 4, 3, -2, 1

$$f(x) = (x-4)(x-3)(x+2)(x-1)$$

$$f(x) = (x^2 - 3x - 4x + 12)(x^2 - x + 2x - 2)$$

$$f(x) = (x^2 - 7x + 12)(x^2 + x - 2)$$

$$f(x) = x^4 + x^3 - 2x^2 - 7x^3 - 7x^2 + 14x + 12x^2 + 12x - 24$$

$$f(x) = x^4 - 6x^3 + 3x^2 + 26x - 24$$

9) 5, -2, 3i

$$f(x) = x^4 - 3x^3 - x^2 - 27x - 90$$

$$f(x) = (x+3)(x-2i)(x+2i)$$

$$f(x) = (x+3)(x^2 + 2x(-2xi) - 4i^2)$$

8) -3,  $\pm 2i$

$$f(x) = (x+3)(x^2 + 4)$$

$$f(x) = x^3 + 3x^2 + 4x + 12$$

10) -2,  $\pm 3\sqrt{5}$

$$f(x) = x^3 + 2x^2 - 45x - 90$$