

Multiply the following

$$1. (x + 3)(x - 10)$$
$$x^2 - 7x - 30$$

$$2. (x - 2)(x^2 + 4x - 6)$$
$$x^3 + 2x^2 - 14x + 12$$

## Writing the Equation of a Polynomial Given the Roots

Steps to writing the equation:

1. Change the roots into factors.
2. Write the equation in factor form.
3. Multiply all the factors to find the polynomial in standard form.

- Level 1 Example: Write the polynomial in standard form with the roots  $x = 3$  and  $x = -4$ .

$$x-3$$

$$x+4$$

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

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

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

- Level 2 Example: Write the polynomial in standard form with the roots  $x = 1$ ,  $x = 1$ , and  $x = 5$ .

$$x-1$$

$$x-1$$

$$x-5$$

$$\begin{aligned} & (x-1)(x-1) \\ & x^2 - 1x - 1x + 1 \\ & x^2 - 2x + 1 \end{aligned}$$

$$\begin{aligned} & (x-5)(x^2 - 2x + 1) \\ & x^3 - 2x^2 + 1x \\ & \quad - 5x^2 + 10x - 5 \\ \hline & x^3 - 7x^2 + 11x - 5 \end{aligned}$$

$$f(x) = (x-1)(x-1)(x-5)$$

$$f(x) = (x^2 - 2x + 1)(x-5)$$

$$f(x) = x^3 - 7x^2 + 11x - 5$$

- Level 3 Example: Write the polynomial in standard form with the roots  $x = 2$  and  $x = -4i$ .  $x = 4i$   $f(x) = -(x-2)(x+4i)(x-4i)$

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

$$x^2 - 4ix + 4ix - 16i^2$$

$$x^2 - 16(-1)$$

$$x^2 + 16$$

$$(x-2)(x^2+16)$$

$$f(x) = (x-2)(x^2+16)$$

$$x^3 + 16x - 2x^2 - 32 \quad f(x) = x^3 - 2x^2 + 16x - 32$$

- Level 4 Example: Write the polynomial in standard form with the roots  $x = 1$  and  $x = 2 + \sqrt{10}$ .  $x = 2 - \sqrt{10}$

$$(x-1) \quad (x-2-\sqrt{10}) \quad (x-2+\sqrt{10})$$

$$(x-2-\sqrt{10})(x-2+\sqrt{10})$$

$$\begin{array}{r} x^2 - 2x + x\sqrt{10} \\ -2x \qquad \qquad \qquad +4 - 2\sqrt{10} \\ \hline -x\sqrt{10} \quad -10 + 2\sqrt{10} \end{array}$$

$$x^2 - 4x - 6$$

$$f(x) = (x-1)(x-2-\sqrt{10})(x-2+\sqrt{10})$$

$$f(x) = (x-1)(x^2 - 4x - 6)$$

$$\begin{array}{r} x^3 - 4x^2 - 6x \\ -1x^2 + 4x + 6 \\ \hline \end{array}$$

$$f(x) = x^3 - 5x^2 - 2x + 6$$