

Name: _____

Date: _____

Learning Goal 3.3	Solving equations algebraically and graphically.
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Example Consider the equation $f(x) = x^4 + x^3 - 10x^2 - 4x + 24$.

Degree	Leading Coefficient	Constant	Domain	$x=0$ y - intercept	Number of x - intercepts
four	1	24	$\{x x \in \mathbb{R}\}$	$y = 24$ $(0, 24)$	0, 1, 2, 3, 4

Factor the equation. SO many choices $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$

$$P(-4) = (-4)^4 + (-4)^3 - 10(-4)^2 - 4(-4) + 24$$

$$= 256 - 64 - 160 + 16 + 24$$

$$= 72 \neq 0$$

$$P(-2) = (-2)^4 + (-2)^3 - 10(-2)^2 - 4(-2) + 24$$

$$= 16 - 8 - 40 - 8 + 24$$

$$P(-6) = (-6)^4 + (-6)^3 - 10(-6)^2 - 4(-6) + 24$$

$$= 1296 - 216 + 360 + 24 + 24 \neq 0$$

$$P(2) = (2)^4 + (2)^3 - 10(2)^2 - 4(2) + 24$$

$$= 16 + 8 - 40 - 8 + 24$$

$$= 0$$

$$2 \begin{array}{r|rrrrr} 1 & 1 & 1 & -10 & -4 & 24 \\ & & 2 & 6 & -8 & -24 \\ \hline 1 & 3 & -4 & -12 & 0 & \end{array}$$

$$x^4 + x^3 - 10x^2 - 4x + 24 = (x-2)(x^3 + 3x^2 - 4x - 12)$$

$\pm 1 \quad + 2 \quad \pm 3 \quad + 4 \quad + 6 \quad \pm 12$

$$P(1) = (1)^3 + 3(1)^2 - 4(1) - 12$$

$$= 1 + 3 - 4 - 12$$

$$2 \begin{array}{r|rrrr} 1 & 1 & 3 & -4 & -12 \\ & & 2 & 10 & 12 \\ \hline 1 & 5 & 6 & 0 & \end{array}$$

$$P(-1) = (-1)^3 + 3(-1)^2 - 4(-1) - 12$$

$$= -1 + 3 - 4 - 12$$

$$P(2) = (2)^3 + 3(2)^2 - 4(2) - 12$$

$$= 8 + 12 - 8 - 12$$

$$x^4 + x^3 - 10x^2 - 4x + 24 = (x-2)(x-2)(x^2 + 5x + 6)$$

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

$$= (x-2)^2(x+2)(x+3)$$

Find the solutions or roots of the equation.

$$f(x) = 0$$

$$(x-2)^2(x+2)(x+3) = 0$$

$$x=2 \quad x=-2 \quad x=-3$$

Multiplicity (of a zero) or of a solution is how many times that solution repeats itself.

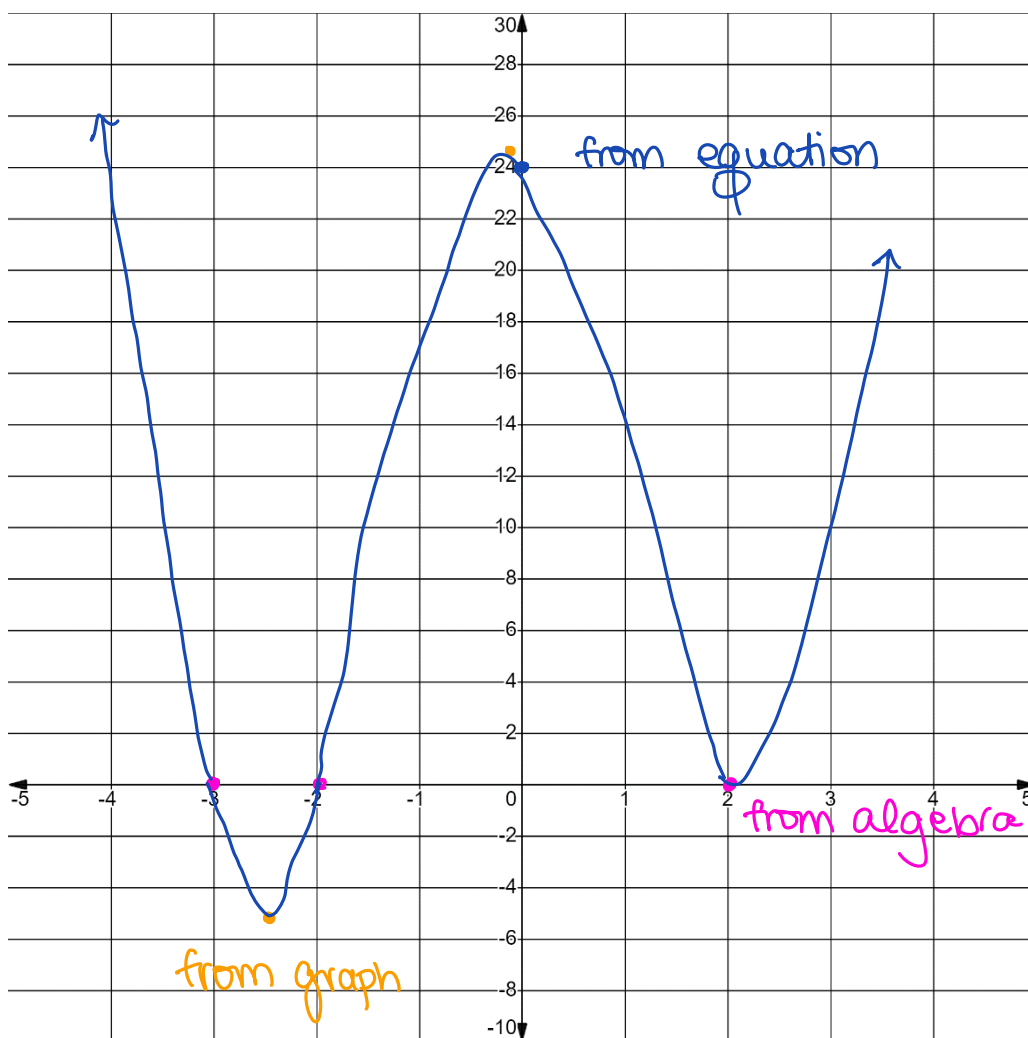
$$(x-2)^2(x+2)(x+3) = 0$$

multiplicity of 2

multiplicity of 1

Range	Maximum(s)	Minimum(s)	End Behaviour
$\{y y > -5, y \in \mathbb{R}\}$	GLOBAL: ∞ LOCAL: $y = 24$	GLOBAL $y = -5$ LOCAL $y = 0$	$\lim_{x \rightarrow \pm\infty} f(x) = \infty$

Graph the function (using technology).



Find the zeros of the equation.

$$x = -3, -2, 2$$