

Notes: Solving Polynomials Completely!

STEPS:

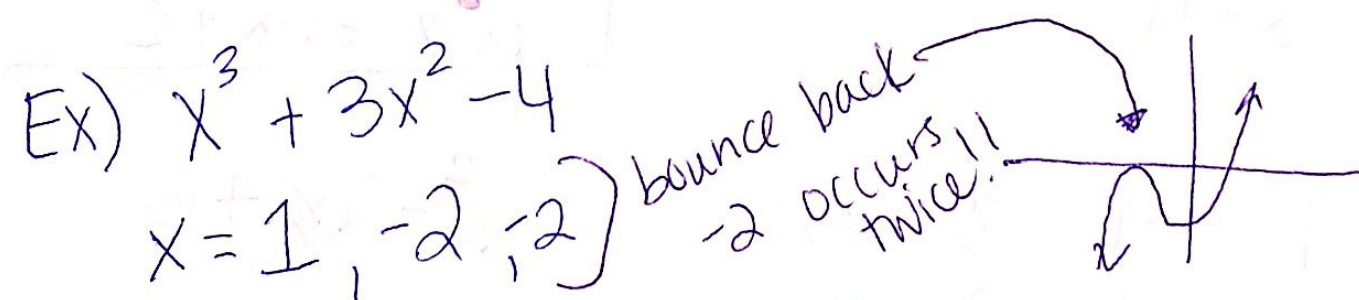
- ① Graph the polynomial.
 - ② Look for any visible "zeros" (x-intercept)
 - ③ Find visible factors by "tracing":
2nd → Trace → # 2
Left → Right → Enter!] Do for all visible!
 - ④ Factor or use Quadratic Formula if needed
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Ex) $x^3 - 3x^2 - 18x + 40$

$x = -4, 2, 5$

Ex) $x^3 + 3x^2 - 4$

$x = 1, -2, -2$



Ex) $2x^3 + 7x^2 - 9$

$x = -3, -1.5, 1$

Ex) $x^4 - x^3 + 3x^2 + 5x$

$x = -1, 0$

Factors: $(x+1)x$

* Divide by zeros we see!

$$\begin{array}{r}
 \overbrace{x^3 - x^2 + 3x + 5} \\
 x \overline{) x^4 - x^3 + 3x^2 + 5x} \\
 \underline{-x^4} \\
 -x^3 \\
 \underline{+x^3} \\
 3x^2 \\
 \underline{-3x^2} \\
 5x \\
 \underline{-5x} \\
 0
 \end{array}$$

$(x^3 - x^2 + 3x + 5) / (x+1)$

~~⊙~~

-1 | -1 3 5

↓ + -1 2 -5

1 -2 5 0

x^2 x constant Remainder

$x^2 - 2x + 5 \rightarrow \text{QF}$

How many solutions?

By degree $\rightarrow 4$
We only see 2!

* Can't see the others

Quadratic Formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$ax^2 + bx + c$$

$x^2 - 2x + 5$

$a = 1$
 $b = -2$
 $c = 5$

$$X = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(5)}}{2(1)}$$

$$X = \frac{2 \pm \sqrt{-16}}{2} = \frac{2 \pm 4i}{2}$$

* $\sqrt{-1} = i \rightarrow$ imaginary number

$$X = 1 \pm 2i$$

$$X = 1 + 2i \quad X = 1 - 2i$$

Solve Completely: $-1, 0, 1 + 2i, 1 - 2i$