6.5 Roots of Polynomial Equations

☆ We need to find ALL the roots of the equations.☆

Ex1 $x^3+x^2-3x-3=0$ Find all rational roots!

Step 1: List the possible rational roots. By looking at the first coefficient and the last.
To find all roots: factors of last term
factors of 1st term

$\frac{\pm 1, \pm 3}{\pm 1} = \pm 1, \pm 3$

Step 2: Test each possible rational root. Plug the number in for all x's. It is a root if it equals zero.

① $-1 \mid 1 \;\; 1 \;\; -3 \;\; -3$
$\quad\quad -1 \;\; 0 \;\; 3$
$\quad 1 \;\; 0 \;\; -3 \;\; 0$

Yes this is the factor; b/c the remainder is zero!

② $3 \mid 1 \;\; 1 \;\; -3 \;\; -3$
$\quad\quad 3 \;\; 12 \;\; 27$
$\quad 1 \;\; 4 \;\; 9 \;\; 24$

Step 3: Write the equation from step 2

$x^2 - 3 = 0$
$x^2 = 3$
$x = \pm\sqrt{3}$

$x + 1 = 0$
$x = -1$

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Ex 2. Find all roots of $2x^3 - x^2 + 2x - 1 = 0$

Step 1: List all possible rational roots. $\frac{\pm 1}{\pm 2 \pm 1} = \pm\frac{1}{2}, \pm 1$

Step 2: Use synthetic division to find the factor!!

$-1 \mid 2 \;\; -1 \;\; 2 \;\; -1$
$\quad\quad -2 \;\; 3 \;\; -5$
$\quad 2 \;\; -3 \;\; 5 \;\; -6$

$\frac{1}{2} \mid 2 \;\; -1 \;\; 2 \;\; -1$
$\quad\quad 1 \;\; 0 \;\; 1$
$\quad 2 \;\; 0 \;\; 2 \;\; 0$

Step 3: Write the equation you found in step 2 to find the other answers.

$2x^2 + 2 = 0$
$\frac{2x^2}{2} = \frac{-2}{2}$
$\sqrt{x^2} = \sqrt{-1}$
$x = \pm i$

$x = \frac{1}{2}$

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