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CC ALGEBRA 2 TROICI

LESSON #8: SOLVING HIGHER-DEGREE POLYNOMIAL EQUATIONS WITH COMPLEX ROOTS

Do Now:

Given: $2x + 3 = 11$ $-3 \quad -3$ $2x = 8$ $x = 4$ a. What is the degree? 1 b. How many solutions are there? 1 c. What is the solution(s)? $x = 4$	Given: $x^2 - 9 = 0$ $+9 \quad +9$ $x^2 = 9$ $x = \pm 3$ a. What is the degree? 2 b. How many solutions are there? 2 c. What is the solution(s)? $x = \pm 3$

For #1 and 2, solve for all real and complex solutions of the following polynomial equations. Sketch the graph to verify your results.

1) $x^3 + 4x = 0$

$x(x^2 + 4) = 0$

$x = 0$ | $x^2 + 4 = 0$

$x^2 = -4$

$x = \pm 2i$

EB = down, up

a. What is the solution(s)?

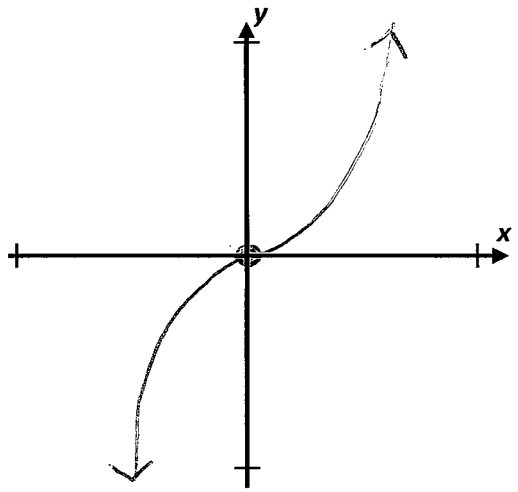
$0, \pm 2i$

b. What is the degree?

3

c. How many solutions are there?

3

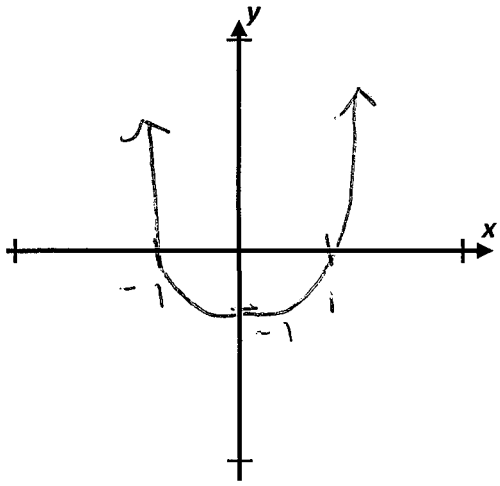


2) $x^4 - 1 = 0$

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

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

$\{\pm 1, \pm i\}$



3) $x^3 + 5x = 0$

$x(x^2+5)=0$

$x=0$	$x^2+5=0$
	$\sqrt{x^2}=\sqrt{-5}$
	$x=\pm i\sqrt{5}$

$\{0, \pm i\sqrt{5}\}$

a m

4) $x^4 - 5x^2 - 36 = 0$

$(x^2-9)(x^2+4)=0$

$\sqrt{x^2}=\sqrt{9}$	$\sqrt{x^2}=\sqrt{-4}$
$x=\pm 3$	$x=\pm 2i$

$\{\pm 3, \pm 2i\}$

5) $x^3 + 27 = 0$ $(a+b)(a^2-ab+b^2)$ SOAP!

$(x+3)(x^2-3x+9)=0$

$x=-3$

$x=-\frac{(-3)\pm\sqrt{(-3)^2-4(1)(9)}}{2(1)}$

$x=\frac{3\pm\sqrt{-27}}{2}$ $\left(\frac{\sqrt{9}}{\sqrt{3}}-3i\sqrt{3}\right)$

$x=\frac{3\pm 3i\sqrt{3}}{2}$

$\{-3, \frac{3\pm 3i\sqrt{3}}{2}\}$

Practice:

6) $x^3 - 5x^2 + 4x - 20 = 0$

$x^2(x-5) + 4(x-5)$

$(x^2+4)(x-5) = 0$

$x^2 = -4$ | $x = 5$

$x = \pm 2i$

$\{5, \pm 2i\}$

7) $x^3 + 16x = 0$

$x(x^2+16) = 0$

$x = 0$ | $\sqrt{x^2} = \sqrt{16}$

$x = \pm 4i$

$\{0, \pm 4i\}$

8) $x^4 - 6x^2 - 7 = 0$ (a, m)

$(x^2-7)(x^2+1) = 0$

$\sqrt{x^2} = \sqrt{7}$ | $\sqrt{x^2} = \sqrt{-1}$

$x = \pm\sqrt{7}$ $\quad x = \pm i$

$\{\pm\sqrt{7}, \pm i\}$

9) $x^3 + 8 = 0$ $\quad (a+b)(a^2 - ab + b^2)$

$(x+2)(x^2-2x+4)$

-2 | $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(4)}}{2(1)}$

$x = \frac{2 \pm \sqrt{-12}}{2}$ $\quad \sqrt{4}\sqrt{3}\ 2i\sqrt{3}$

$x = \frac{2 \pm 2i\sqrt{3}}{2}$

$x = 1 \pm i\sqrt{3}$

$\{-2, 1 \pm i\sqrt{3}\}$