2.4. Zeros of polynomial functions.

Zeros of polynomial functions:

- are values of x that satisfy a polynomial function $P(x) = 0$.
- are determined by applying the Zero-Factor Property.
- are the same x values expressed as solutions of the equation $P(x) = 0$.
- are the same x values expressed as x-intercepts of the graph of the function $P(x)$.
- are the same x values expressed as k in the factor $(x - k)$.

Example: If the zeros of polynomial $P(x) = 3x^3 - x^2 - 8x - 4$ are -1 , $^{-2}/_3$, and 2, then

- $x = -1$, $x = {}^{-2}/_3$, and $x = 2$ are solutions of the equation $P(x) = 0$.
- $P(-1) = 0$, $P({}^{-2}/_3) = 0$, $P(2) = 0$ are values that satisfy the $P(x) = 0$.
- (-1, 0) ; ($^{-2}/_3$, o) ; and (2 , 0) are x-intercepts of the graph of the function $P(x)$.

$(x - (-1))$ $(x - ({}^{-2}/_3))$ $(x - (2))$ or in simplified form $(x + 1)$ $(3x + 2)$ $(x - 2)$ are factors of P.

In a previous lesson, we found zeros of polynomial functions by factoring.

Let's review.

STEPS TO FIND ALL ZEROS OF $P(x) = x^4 - 8x^2 + 16$	COMMENTS
$P(x) = x^4 - 8x^2 + 16$	If the degree of the polynomial is 4, then there are at most 4 distinct zeros.
$P(x) = (x^2 - 4)(x^2 - 4)$ or $P(x) = (x^2 - 4)^2$	Factor the perfect square trinomial.
$P(x) = (x - 2)(x+ 2)(x - 2)(x + 2)$	Factor the difference of two squares.
$(x - 2) = 0$; $(x + 2) = 0$; $(x - 2) = 0$; $(x + 2) = 0$	Apply Zero-Factor Property -- 4 linear equations
$x =$ 2; $x = -$ 2 $x =$	4 distinct zeros, but only 2 zeros each with multiplicity of 2.

2; x = -2	
Zeros are 2 and -2	

Remember! Some zeros are *rational*, *irrational* or *complex*.

Find the zeros of $P(x) = x^3 + 8$. You will be prompted by responding to the quiz questions.

So, the zeros of the polynomial $P(x) = x^3 + 8$ are -2, $x = 1 + i\sqrt{3}$, $x = 1 - i\sqrt{3}$.

Here is another example to find all zeros of a polynomial given one zero. Again you will be prompted by responding to the following quiz questions.

Let's Review.

$P(x) = x^4 + 10x^3 + 27x^2 + 10x + 26$; *given the zero of* i