

**IIT Madras**  
ONLINE DEGREE

# Zeros of Polynomial Functions

Recall: If  $f$  is a polynomial function, the values of  $x$  for which  $f(x)=0$  are called **zeros** of  $f$ .

If the equation of the polynomial function can be factored, we can set each factor equal to zero and solve for the zeros.

Also, any value  $x=a$  that is a zero of a polynomial function yields a factor of the polynomial, of the form  $(x-a)$ .

Given the equation of a polynomial function, we can use this method to find  $x$ -intercepts because at the  $x$ -intercepts we find the input values whose output value is zero.

For general polynomials, this can be a challenging prospect. However quadratic functions can be solved using the quadratic formula.

The corresponding formulas for cubic and fourth-degree polynomials are not simple enough to remember. And formulas do not exist for general higher-degree polynomials.

# Zeros of Polynomial Functions and Factoring

- The polynomial can be factored using known methods:
  - a. greatest common factor,
  - b. factor by grouping, and
  - c. trinomial factoring.
- The polynomial is given in factored form.
- Technology is used to determine the intercepts.

# x-intercept of Polynomial Function by Factoring

1. Set  $f(x)=0$ .
2. If the polynomial function is not given in factored form:
  - a. Factor out any common monomial factors.
  - b. Factor any factorable binomials or trinomials.
3. Set each factor equal to zero and solve to find the x-intercepts.

# Example

Find x-intercepts of  $f(x) = x^6 - 8x^4 + 16x^2$ .

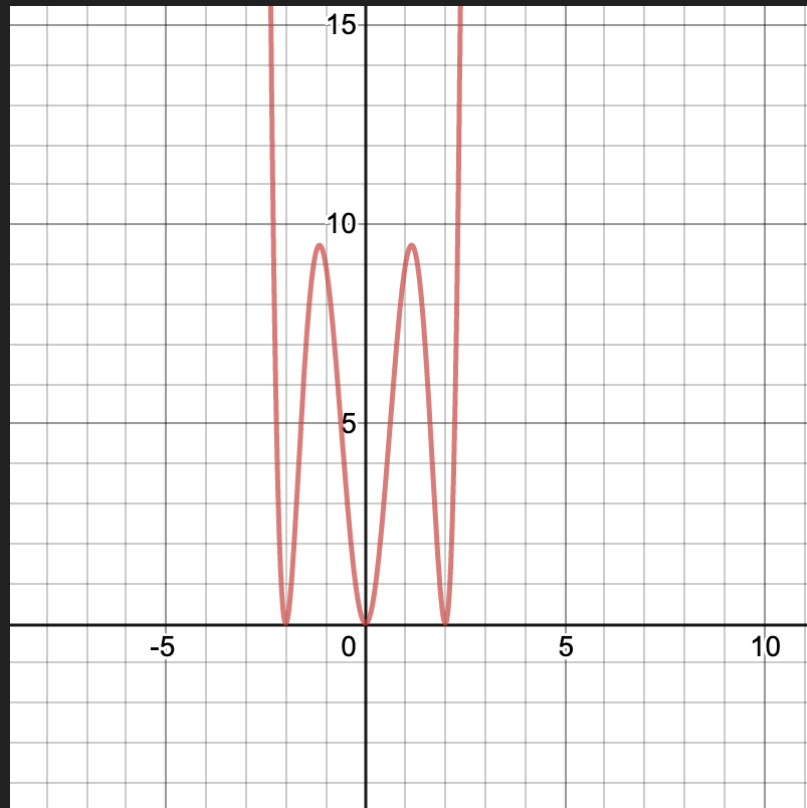
Set  $f(x)=0$

$$x^6 - 8x^4 + 16x^2 = 0$$

$$x^2(x^4 - 8x^2 + 16) = 0$$

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

$x=0, 2, -2$  are the  $x$ -intercepts of  $f$ .



# Example

Find x-intercepts of  $f(x) = x^3 - 4x^2 - 3x + 12$ .

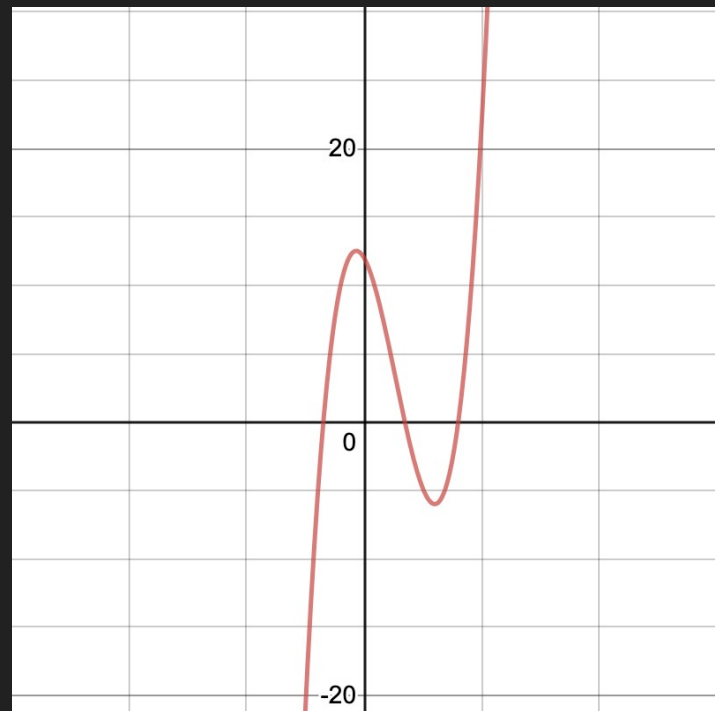
Set  $f(x)=0$

$$x^3 - 4x^2 - 3x + 12 = 0$$

$$x^2(x-4) - 3(x-4) = 0$$

$$(x^2 - 3)(x-4) = 0$$

$x=4, \sqrt{3}, -\sqrt{3}$  are the x-intercepts of  $f$ .



# Example

Find the y- and x-intercepts of  $g(x)=(x-1)^2(x+3)$ .

*Set  $g(x)=0$*

*$x = 1, -3$  are the x-intercepts of  $f$ .*

*For y-intercept,  $g(0) = 3$*

