

Find the zeros algebraically

a) $f(x) = 2x^2 + 5x - 12$ $\frac{-24}{-3 \cdot 8}$

$$(2x^2 - 3x) + (8x - 12) = 0$$

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

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

$$2x-3=0 \quad x+4=0$$

$$x = \frac{3}{2} \quad x = -4$$

c) $f(x) = x^3 - 25x$

$$x(x^2 - 25) = 0$$

$$x(x-5)(x+5) = 0$$

$$x=0 \quad x=5 \quad x=-5$$

b) $f(x) = x^3 - x^2 - 6x$

$$x(x^2 - x - 6) = 0$$

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

$$x=0 \quad \begin{array}{l} x-3=0 \\ x+2=0 \end{array} \quad \begin{array}{l} x=3 \\ x=-2 \end{array}$$

$$x^2 + 0x - 25$$

State the degree and list the zeros of the polynomial function. State the multiplicity of each zero and whether the graph crosses the x-axis at the corresponding x-intercept. Graph the function on your calculator to verify your answer.

Multiplicity

How many times

value is a zero

Multiplicity

odd - graph

Crosses
x-axis

even - touches
at point
and turns

a) $f(x) = x(x+2)^2$
 $x(x+2)(x+2)$

Degree = 3

Zeros	Mult	
$x=0$	1	Cross
$x=-2$	2	touch

c) $f(x) = x^3(x-4)$
Degree = 4

Zeros	Mult	
$x=0$	3	Cross
$x=4$	1	Cross

b) $f(x) = (x+3)^3(x-1)^2$

Degree = 5

Zeros	Mult	
$x=-3$	3	Cross
$x=1$	2	touch

$$\frac{3x=0}{3} \quad x=0$$

d) $f(x) = 3x(x-2)^3(x-1)^2$
Degree = 6

Zeros	Mult	
$x=1$	2	touch
$x=2$	3	Cross
$x=0$	1	Cross

Graph the function in a viewing window that shows all of its x-intercepts and approximate all of its zeros.

A) $f(x) = x^3 - 3x^2 - 18x + 40$

$x = -2, 4, 5$

B) $f(x) = -x^4 + 4x^3 - 5x^2 + 2x$

$x = 0, 1, 2$

In Varsity Learning they set the equation = 0

Using only algebra, find a cubic function with the given zeros.

A) 2, -4, 5

$\rightarrow x = 2 \quad x = -4 \quad x = 5$

$\rightarrow (x-2)(x+4)(x-5)$

$(x-2)(x^2 - x - 20)$

$x^3 - x^2 - 20x$
 $-2x^2 + 2x + 40$

$x^3 - 3x^2 - 18x + 40 = 0$

Zoom to uncover Hidden Behavior

A) $f(x) = x^4 + .1x^3 - 6.5x^2 + 7.9x - 2.4$

B) $\sqrt{2}, -\sqrt{2}, 3$

$x = \sqrt{2}, x = -\sqrt{2}, x = 3$

$(x-\sqrt{2})(x+\sqrt{2})(x-3)$

$(x^2 + x\sqrt{2} - x\sqrt{2} - \sqrt{4})(x-3)$

$(x^2 - 2)(x-3)$

$x^3 - 3x^2 - 2x + 6 = 0$

Using the IVT to determine if a function has a zero on a given interval

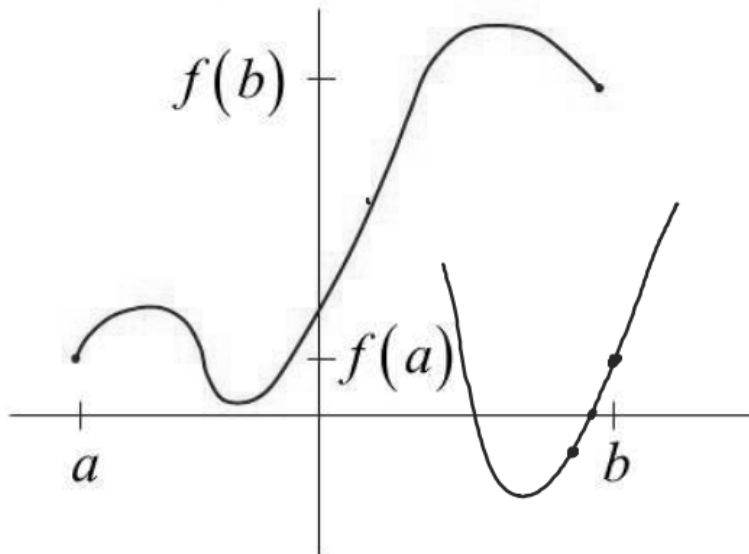
If $f(a) < 0$ and $f(b) > 0$ we can conclude there is at least one zero in the interval $[a, b]$

Or

If $f(a) > 0$ and $f(b) < 0$ we can conclude there is at least one zero in the interval $[a, b]$

Intermediate Value Theorem:

If a function is continuous between a and b , then it takes on every value between $f(a)$ and $f(b)$



Because the function is continuous, it must take on every y value between $f(a)$ and $f(b)$

1. Determine if $f(x) = 3x^2 + 4x - 4$ crosses the x -axis between $x = -5$ and $x = 0$.

$$f(-5) = 3(-5)^2 + 4(-5) - 4 = 75 - 20 - 4 = 51$$

$$f(0) = 3(0)^2 + 4(0) - 4 = -4$$

2. Determine if $f(x) = 3x^2 + 4x - 4$ crosses the x -axis between $x = 1$ and $x = 5$.

$$f(5) = 3(5)^2 + 4(5) - 4 = 75 + 20 - 4 = 91$$

$$f(1) = 3(1)^2 + 4(1) - 4 = 3 + 4 - 4 = 3$$