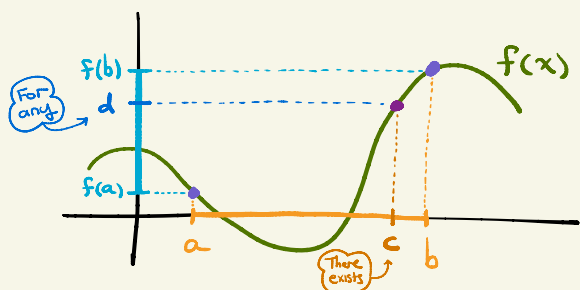


# THE INTERMEDIATE VALUE THEOREM - YIGAL KAMEL

Suppose  $f(x)$  is continuous on  $[a, b]$ .



The Intermediate value theorem says that for any  $y$ -value  $d$  between  $f(a)$  &  $f(b)$ , there exists a corresponding  $x$ -value  $c$  between  $a$  &  $b$  such that  $f(c) = d$ .

In other words...

As a continuous function  $f$  travels from  $f(a)$  to  $f(b)$ , it cannot "jump" over any intermediate value  $d$ .

## Example

Q: Does the equation  $x^4 - 3x^3 + 6x^2 + 2x = 5$  have any solutions?

A: Consider  $f(x) = x^4 - 3x^3 + 6x^2 + 2x - 5$ .

Then  $f(0) = -5$  and  $f(1) = 1$ . Since  $f$  is continuous and  $-5 < 0 < 1$ , the IVT says there exists a number  $c$

(between 0 and 1) such that  $f(c) = 0$ .

Then  $c$  is a solution to the original equation.