12.7 intermediate value theorem

essential question

How do I use the IVT to prove values of continuous functions?

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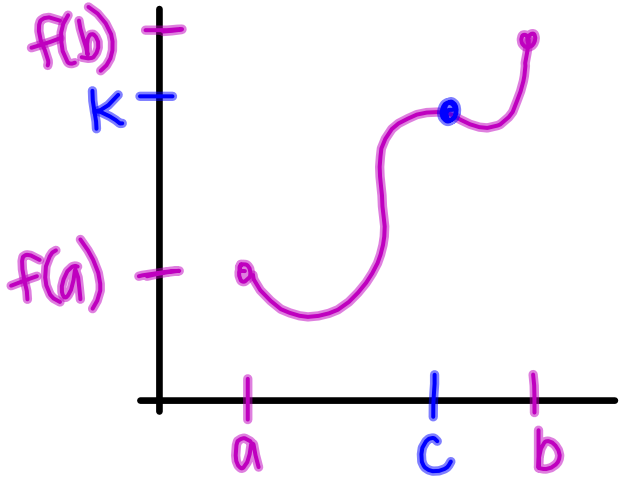
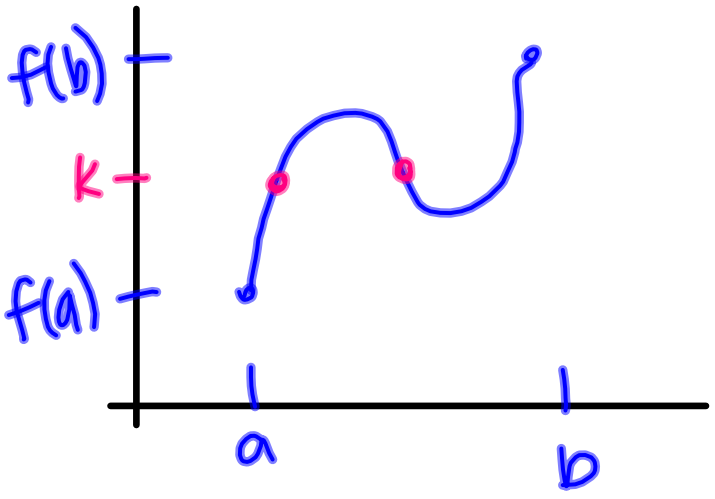
Intermediate Value Theorem (IVT)

If f is continuous on $[a,b]$ and k is any number between $f(a)$ and $f(b)$,

then there is at least one number c in $[a,b]$ such that $f(c)=k$





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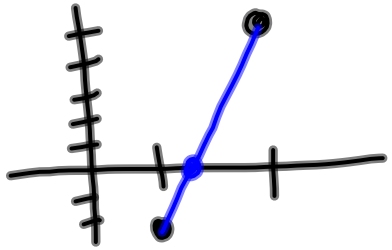
essential question How do I use the IVT to prove values of continuous functions?

ex. Use IVT to show $\underbrace{f(x) = x^4 - 3x^2 + x - 1}_{\text{cont. bc poly.}}$ has a zero on $[1, 2]$

y=0

x values



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

$f(2) = (2)^4 - 3(2)^2 + 2 - 1 = 5$

$-2 < 0 < 5$

$f(1) < 0 < f(2)$ ✓

12.7 Intermediate Value Theorem

essential question How do I use the IVT to prove values of continuous functions?

ex. Use IVT to find the value of c guaranteed by the theorem.

$$f(x)=\frac{2x^2+x}{3x-1} \quad \left[\underset{a}{\frac{3}{2}},\underset{b}{3}\right] \quad f(c)=2$$

$\frac{12}{7}<2<\frac{21}{8}$

$\frac{3}{2}<c<3$ ✓

$$f\left(\frac{3}{2}\right)=\frac{2\left(\frac{3}{2}\right)^2+\frac{3}{2}}{3\left(\frac{3}{2}\right)-1}=\frac{2\left(\frac{9}{4}\right)+\frac{3}{2}}{\frac{9}{2}-1}=\frac{\frac{18}{4}+\frac{6}{4}}{\frac{9}{2}-\frac{2}{2}}=\frac{\frac{24}{4}}{\frac{7}{2}}$$

$$=\frac{24}{\cancel{4}_{2}}\cdot\frac{\cancel{2}^{1}}{7}=\frac{24}{14}\boxed{\frac{12}{7}}$$

1.7

$$f(3)=\frac{2(3)^2+3}{3(3)-1}=\frac{18+3}{8}=\boxed{\frac{21}{8}}$$

2.6