1.4 Continuity and the IVT

Obj: Find intervals of continuity; Describe types of discontinuity; Understand and use the Intermediate Value theorem

Mathematical definition of continuity has 3 parts.

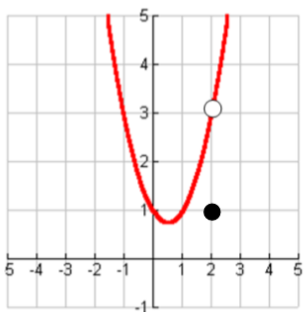
A function is continuous at x=c if:

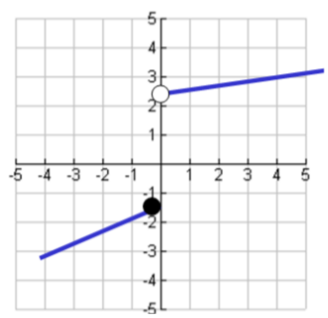
1.

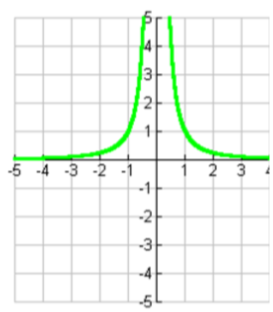
2.

3.

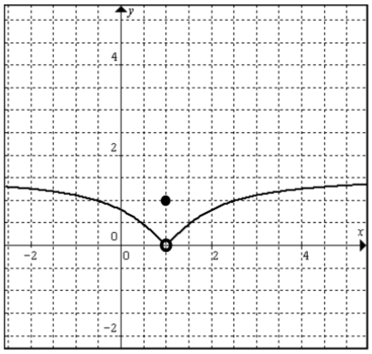
There are 3 types of discontinuity.







Explain why these are discontinuous using the definition.



$\lim_{x \to 1^-} f(x)$ $\lim_{x \to 1^+} f(x)$ $\lim_{x \to 1} f(x)$

f(1)=

Is the function continuous? Use your definition to justify.

Removable discontinuities. What causes a removable discontinuity?

$$y = \frac{x-1}{x^2 - 4x + 3}$$

Two common sense theorems. Draw examples.

f(x) is continuous on the open interval (*a*,*b*) iff *f(x)* is continuous at every point in the interval.

f(x) is continuous on the closed interval [*a*,*b*] iff it is continuous on (*a*,*b*) and continuous from the right at *a* and continuous from the left at *b*.

For what interval is $y = \frac{x-1}{x^2 - 4x + 3}$ Continuous?

Is *f(x)* continuous along the closed interval of [-1, 1]

Justify your answer with the definition.

A very common AP MC problem.

For what value k is the function continuous? $f(x)=\begin{cases}\dfrac{x^2-144}{x-12} & x\neq 12\\ k, \quad x=12\end{cases}$

Find a and b so that f is everywhere continuous.

$$f(x)=\begin{cases}2, \quad x\leq 1\\ ax+b, \quad -1<x<3\\ -2, \; x\geq 3\end{cases}$$

More common sense theorems:

<u>Intermediate Value Theorem. "IVT" One of the most used on the AP test!</u>

Given a continuous function on a closed interval [a, b] then that function takes on every value between f(a) and f(b)

Draw a picture!

Use the IVT to show that $f(x)=x^2+x-6$ has a root in the interval [1, 3]. Then find the root.

Justification. Since f(x) is continuous, and f( )= and f( ) = , by the IVT, there exists a c in [ ], such that f(c)= (or within [ ])

You try. Apply the IVT, if possible, on [0,5] so that f(c)= 11 for the function $f(x) = x^2 + x - 1$

time	0	5	7	9	14
V(t)	3.35	4.25	2.75	2.55	4.70

You try. The table above gives several measurements of the velocity of a particle moving along a straight line. What is the smallest possible number of times where v(t) is exactly 4 m/s if v(t) is a continuous function?

a. 0   b. 1   c. 2   d. 3   e. 4