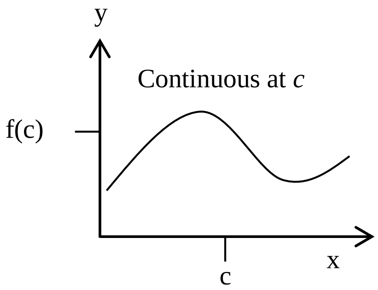
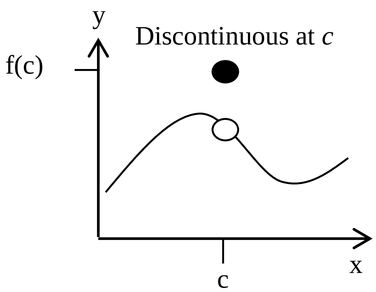
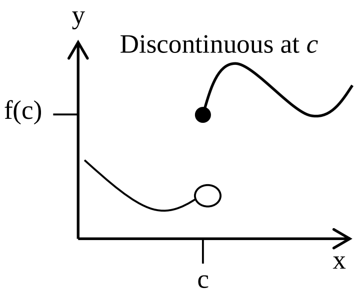
Limits & Continuity
1.4 – Continuity

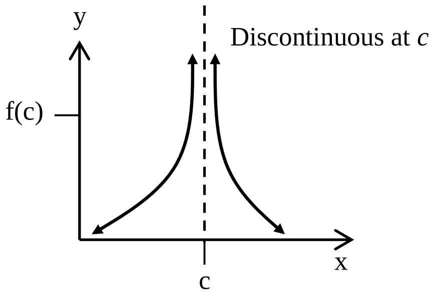
Continuity from PreCalculus

A function is said to be continuous at *c* if its graph passes through the point at *x* = *c* without a “hole” or a “jump”









Continuity from Calculus

A function *f* is continuous at *c* if the following three conditions hold:

1. *f(c)* is defined
2. $\lim_{x \to c} f(x)$ exists
3. $\lim_{x \to c} f(x) = f(c)$

f is *discontinuous* at *c* if one or more of these conditions fails to be true.

Which Functions Are Continuous?

If functions *f* and *g* are continuous at *c*, then the following are also continuous at *c*:

1. $f \pm g$
2. $a \bullet f$ [for any constant *a*]
3. $f \bullet g$
4. f/g [if $g(c) \neq 0$]
5. $f(g(x))$ [for *f* continuous at *g(c)*]

All polynomial functions are continuous. Rational functions are not continuous when the denominator = 0 (vertical asymptote). Piece-wise functions have the potential to be continuous or not.

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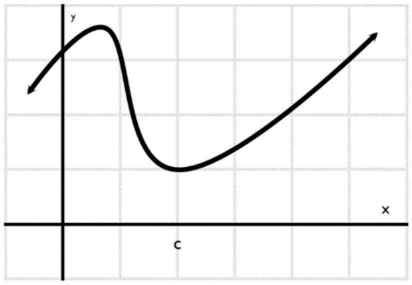
Ex A: Determine if each function is continuous. If discontinuous, state why.

#1)



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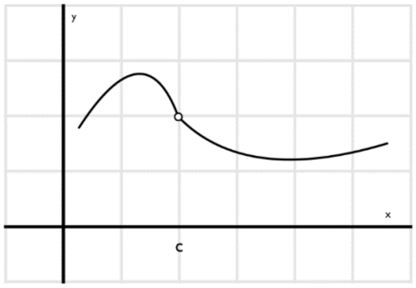

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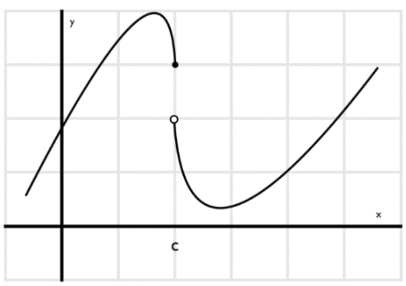

Ex B: Determine if each function is continuous. If discontinuous, state where it is discontinuous and why.

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

#2) $f(x) = \frac{1}{(x-1)^2}$

#3) $f(x) = \begin{cases} 2x+1 & if\ x < 2 \\ -2x+9 & if\ x \geq 2 \end{cases}$

#4) $f(x) = \begin{cases} x^2+1 & if\ x < 4 \\ 5x-1 & if\ x \geq 4 \end{cases}$