

AP CALCULUS - MR.McDOWELL

Welcome back! Please find your assigned seat and begin on the warm up.

1. Factor: $6x^2 + x - 12$

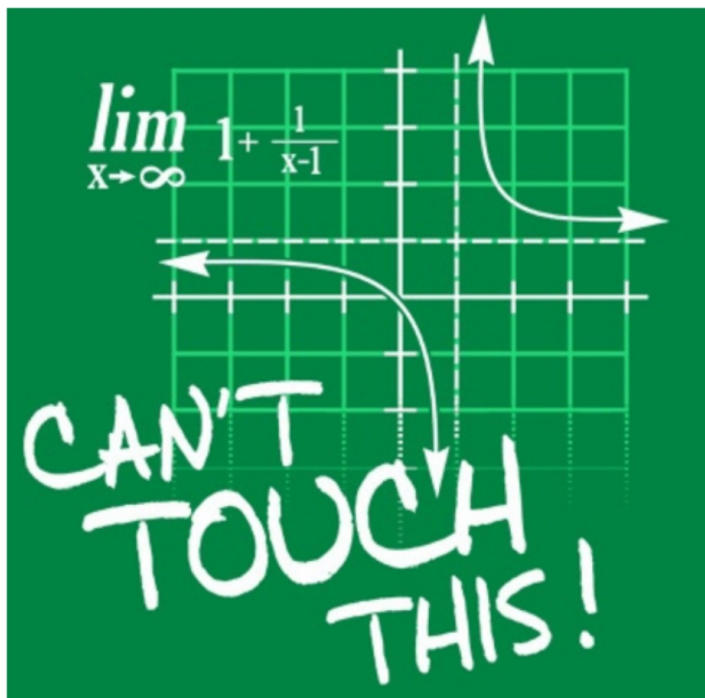
2. Identify the location of the hole for $f(x)$:

$$f(x) = \frac{x^3 - 1}{x - 1}$$

3. Describe, in your own words, what is a limit.

4. Find all solution of $2\sin^2x - \sin x - 1 = 0$ in the interval $[0, 2\pi)$

Introduction to Limits



Objective:

- Define a limit (including one sided limits)
- Estimate a limit using a table or graph.

What is a Limit?

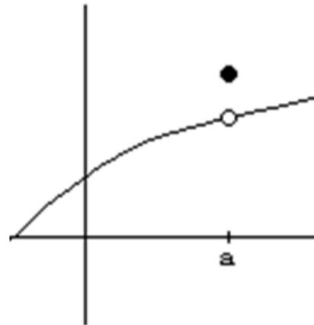
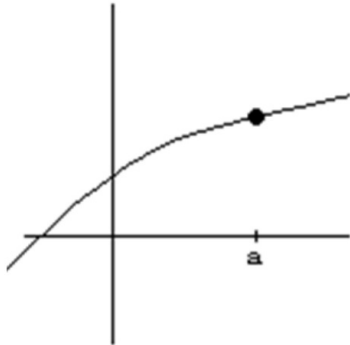
The limit of a function is the value the function approaches as you approach a given point.

Important: This does not mean it has to be the value **AT** the given point (but it could be).

What is a Limit?

The limit of a function is the value the function approaches as you approach a given point.

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Consider the function from the warm up:

$$f(x) = \frac{x^3 - 1}{x - 1}$$

Although x cannot equal to 1, what happens to the graph of $f(x)$ as you move closer and closer to 1?

$$f(x) = \frac{x^3 - 1}{x - 1}$$

x approaches 1 from the left.

x approaches 1 from the right.

x	0.75	0.9	0.99	0.999	1	1.001	1.01	1.1	1.25
$f(x)$	2.313	2.710	2.970	2.997	?	3.003	3.030	3.310	3.813

$f(x)$ approaches 3.

$f(x)$ approaches 3.

$$\lim_{x \rightarrow 1} f(x) = 3$$

Limit Notation

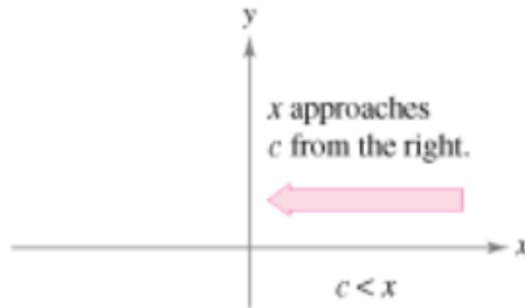
$$\lim_{x \rightarrow c} f(x) = L.$$

"The limit of $f(x)$ as x approaches c is L ."

One-Sided Limits

Limit from the Right

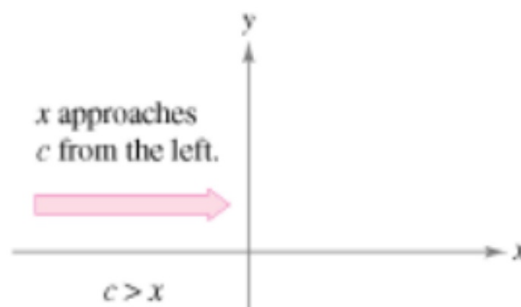
$$\lim_{x \rightarrow c^+} f(x) = L$$



One-Sided Limits

Limit from the Left

$$\lim_{x \rightarrow c^-} f(x) = L$$

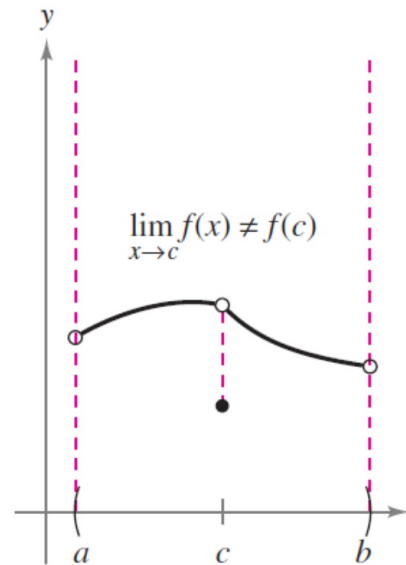


Limits and One-Sided Limits

$$\lim_{x \rightarrow c^+} f(x) = \lim_{x \rightarrow c^-} f(x) = L$$

then

$$\lim_{x \rightarrow c} f(x) = L$$

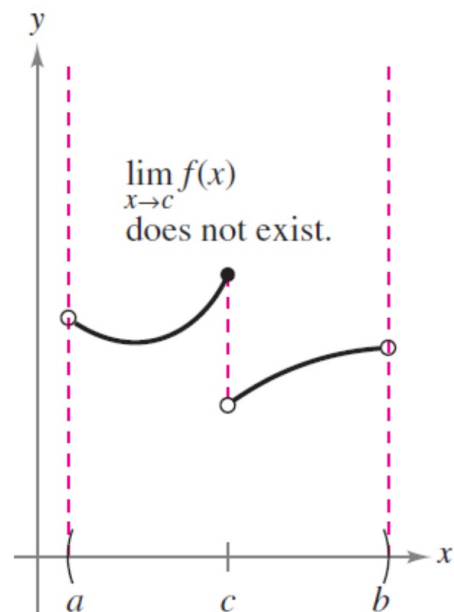


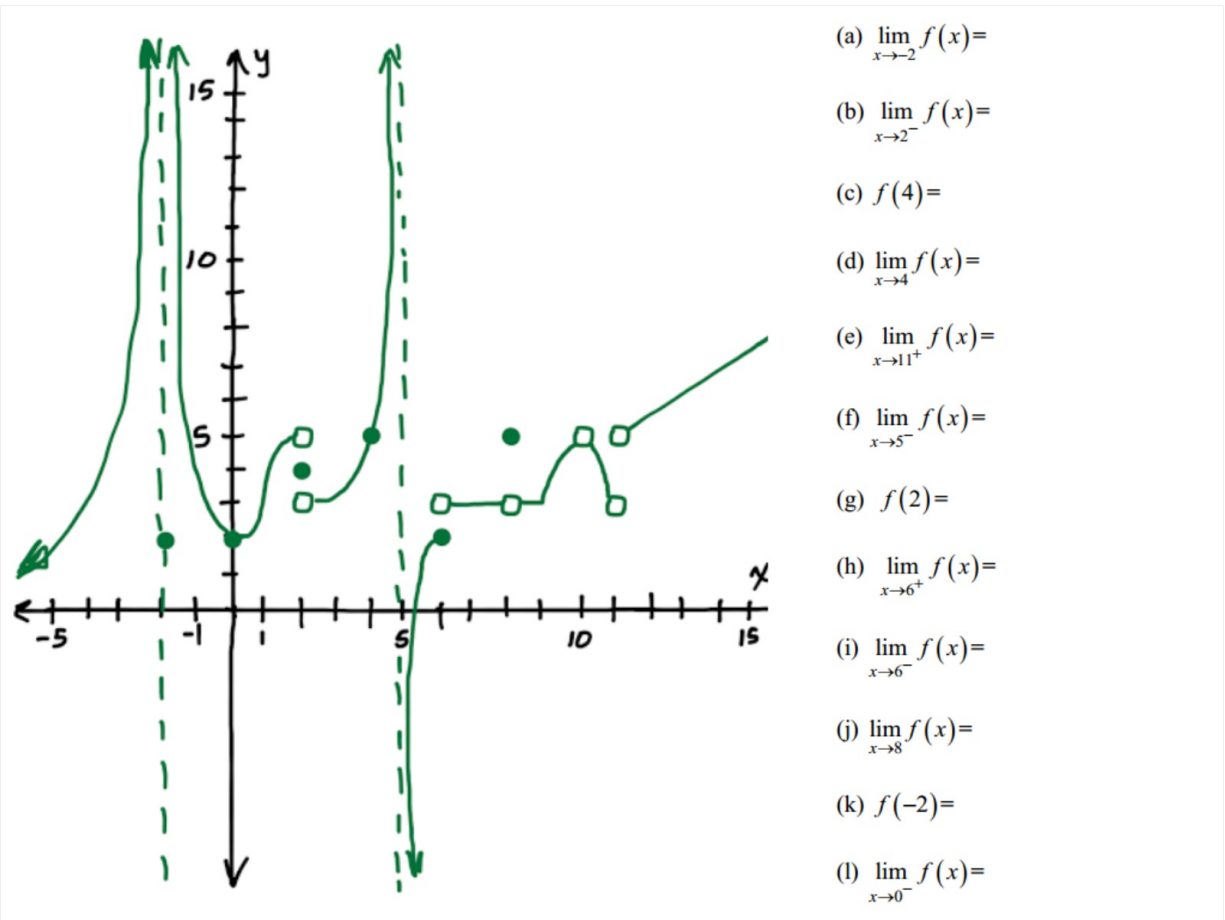
Limits and One-Sided Limits

$$\lim_{x \rightarrow c^+} f(x) \neq \lim_{x \rightarrow c^-} f(x)$$

then

$$\lim_{x \rightarrow c} f(x) = DNE$$

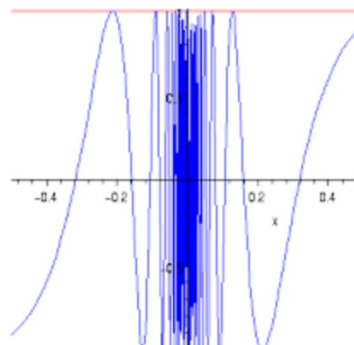




When does a limit NOT exist at a particular value of x?

1. The right limit \neq the left limit
2. There is no limit on one side of 'c'
3. Vertical asymptotes at 'c' (note: answer could be +/- ∞)
4. Oscillates between two points at 'c'

Example of $\lim_{x \rightarrow 0} \sin\left(\frac{1}{x}\right)$



Closure:

The table gives the values of three functions, f , g , and h near $x = 0$. Based on the values given, for which of the functions does it appear that the limit as x approaches zero is 2? (multiple choice)

x	-0.3	-0.2	-0.1	0	0.1	0.2	0.3
$f(x)$	2.018	2.008	2.002	2	2.002	2.008	2.018
$g(x)$	1	1	1	2	2	2	2
$h(x)$	1.971	1.987	1.997	undefined	1.997	1.987	1.971

- (a) f only
- (b) g only
- (c) h only
- (d) f and h only
- (e) f , g , and h