

Final exam (take home)

1. Answer questions about each of the following functions, given the graph:

a. $\lim_{x \rightarrow -\infty} f(x) = \boxed{}$ (see graph to right)

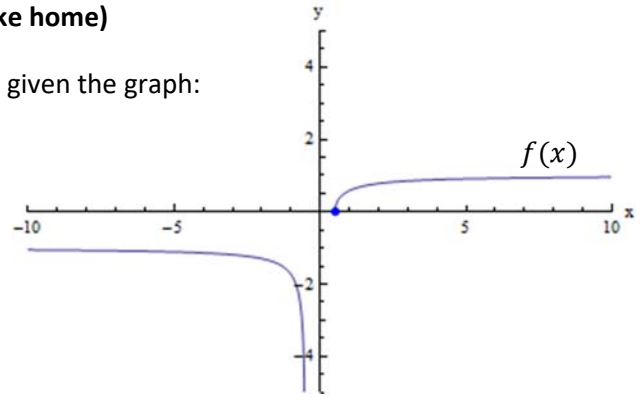
b. $\lim_{x \rightarrow 0.5^+} f(x) = \boxed{}$ (see graph to right)

c. $\lim_{x \rightarrow 0.5^-} f(x) = \boxed{}$ (see graph to right)

d. $\lim_{x \rightarrow 0^-} f(x) = \boxed{}$ (see graph to right)

e. On the graph above, draw another function $g(x)$ that has the **same limit** as $f(x)$ as $x \rightarrow -\infty$, but that is **NOT equal** to $f(x)$ for **ANY** value of x .

f. On the graph above, draw another function $h(x)$ that has the **same limit** as $f(x)$ as $x \rightarrow 0.5^+$, but that is **NOT equal** to $f(x)$ for **ANY** value of x .



2. How many different ways can we have a limit that does not exist? Draw below **at least two** functions that show two **different** function behaviors that would produce a limit that does not exist as $x \rightarrow \infty$. (If you can think of more than two, draw extra functions for extra credit.)

3. Consider the following functions: $f(x) = 2x^2$, $g(x) = 4x^3$, $h(x) = 6x^2$

a. Find $\lim_{x \rightarrow 0} \frac{1}{f(x)}$

b. Find $\lim_{x \rightarrow 0} \frac{f(x)}{g(x)}$

c. Find $\lim_{x \rightarrow 0} \frac{g(x)}{f(x)}$

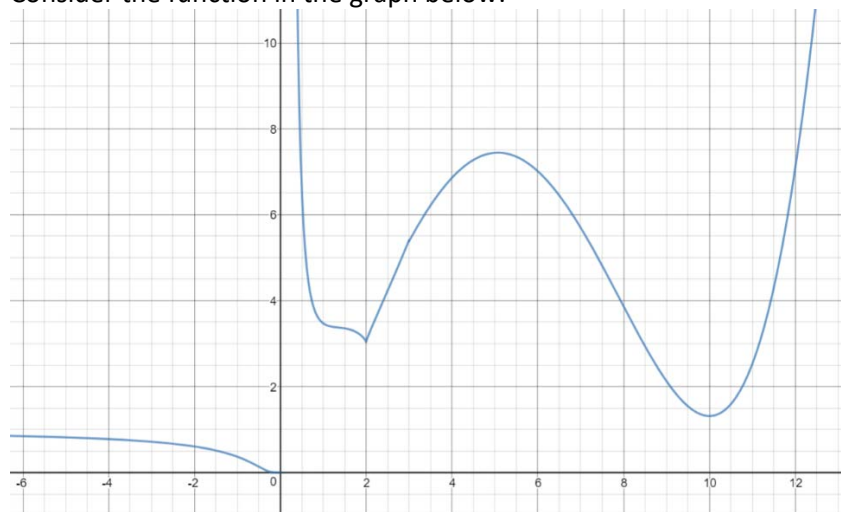
d. Find $\lim_{x \rightarrow 0} \frac{f(x)}{h(x)}$

e. Use your answers to a-e above to help you to **explain WHY**:

i. $\frac{0}{0}$ is an indeterminate form

ii. $\frac{1}{0}$ is NOT an indeterminate form

4. Consider the function in the graph below:



- a. Graph the derivative of this function.
- b. Over which intervals of the domain on this graph will the **second** derivative be **positive**?
5. How many different ways can a function fail to be differentiable at a point? Draw below **at least two** functions that show two **different** function behaviors that would produce a derivative that does not exist at $x = 2$. (If you can think of more than two, draw extra functions for extra credit.)