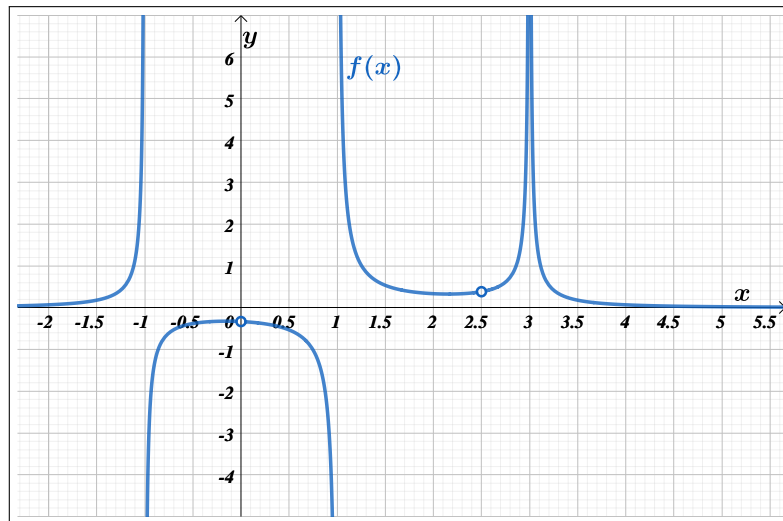




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EXAM 1 REVIEW

**Problem 1.** Use the graph below to find the following limits. If there is infinite behavior, use limit notation to describe it.



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

b.  $\lim_{x \rightarrow 3} f(x)$

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

**Problem 2.** If  $\lim_{x \rightarrow 19} f(x) = 17$  and  $\lim_{x \rightarrow 19} g(x) = -9$  find the following limits, if they exist.

a.  $\lim_{x \rightarrow 19} (f(x) - 2g(x) + x^3)$

b.  $\lim_{x \rightarrow 19} \frac{f(x) - 3}{x - 19}$

c.  $\lim_{x \rightarrow 19} \frac{9 + g(x)}{f(x) - 17}$

**Problem 3.** Complete the table below to numerically estimate  $\lim_{x \rightarrow -11} g(x)$ , if it exists. If the limit does not exist, use limit notation to describe any infinite behavior. Round answers to 4 decimal places.

$$g(x) = \begin{cases} \frac{x^2 + 22x + 121}{x + 11} & \text{if } x < -11 \\ 11 & \text{if } x = -11 \\ \frac{-x}{11} - 1 & \text{if } x > -11 \end{cases}$$

$x$	-11.1	-11.01	-11.001	-11	-10.999	-10.99	-10.9
$g(x)$							

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**Problem 4.** Find the following limits algebraically. If they do not exist because of infinite behavior, use limit notation to describe it.

a.  $\lim_{x \rightarrow -11} g(x)$ , where  $g(x)$  is the function from **Problem 3**.

b.  $\lim_{x \rightarrow -4} \frac{x^2 - 16}{x^2 + 8x + 16}$

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**Problem 5.** Find the following limits algebraically. If they do not exist because of infinite behavior, use limit notation to describe it.

a.  $\lim_{x \rightarrow \infty} (2x^5 - 22x^3 + 0.2x)$

b.  $\lim_{x \rightarrow -\infty} (9x^3 - 7x^5)$

c.  $\lim_{x \rightarrow \infty} \frac{6x^3 + 3x + 1}{x^4 - 1}$



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**Problem 6.** Find the horizontal asymptotes of  $g(x) = \frac{8e^{7x} - 4e^{-5x}}{4 + 16e^{-5x} + 9e^{8x}}$  algebraically.



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**Problem 7.** Find the vertical asymptotes and holes of  $f(x) = \frac{(x-2)^2(x+1)}{(x-3)(x-2)(x+1)}$ . For any vertical asymptotes, use limit notation to describe the infinite behavior. For any holes, find both the  $x$ - and  $y$ -values.

**Problem 8.** Determine where  $f(x) = \frac{\log_8(3-9x)}{x+3}$  is continuous algebraically.



**Problem 9.** Determine where  $g(x)$  is continuous algebraically, where

$$g(x) = \begin{cases} \frac{x^2}{x+1} & \text{if } x < 0 \\ 15 & \text{if } 0 < x \leq 3 \\ \frac{4(x+12)(x-3)}{(x-3)(x+1)} & \text{if } x > 3 \end{cases}$$



**Problem 10.** Find the value(s) of  $k$  that make  $g(x)$  continuous at  $x = 4$  if

$$g(x) = \begin{cases} x - 5k & \text{if } x < 4 \\ 64 & \text{if } x = 4 \\ x^2 - 4k & \text{if } x > 4 \end{cases} .$$



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**Problem 11.** The total profit function for a ghost busting business is given by

$P(x) = -x^2 + 170x - 210$  dollars when  $x$  ghosts are busted.

a. What's the average rate of change of the profit when the number of ghosts busted changes from 30 to 50? Interpret your answer.

b. Find the instantaneous rate of change when 40 ghosts are busted. Interpret your answer.

**Problem 12.** Let  $f(x) = \sqrt{x - 4}$ .

a. Find  $f'(x)$ .

b. Find the slope of the line tangent to  $f(x)$  at  $x = 13$ .

c. Find the equation of the line tangent to  $f(x)$  at  $x = 13$ .