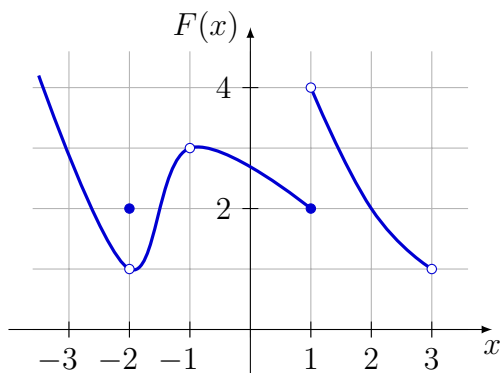


1. 3 pts. each Use the graph below to find the following limits, if they exist. If a limit does not exist, explain why.

(a) $\lim_{x \rightarrow -1} F(x)$ (b) $\lim_{x \rightarrow -2} F(x)$ (c) $\lim_{x \rightarrow 1^-} F(x)$ (d) $\lim_{x \rightarrow 1^+} F(x)$ (e) $\lim_{x \rightarrow 3^+} F(x)$



2. 10 pts. each Evaluate each limit algebraically using limit laws, showing work.

(a) $\lim_{x \rightarrow -b} \frac{(x+b)^7 + (x+b)^{10}}{4(x+b)}$, b a fixed real number.

(b) $\lim_{h \rightarrow 0} \frac{\frac{1}{5+h} - \frac{1}{5}}{h}$

(c) $\lim_{x \rightarrow 81} \frac{\sqrt{x} - 9}{x - 81}$

(d) $\lim_{x \rightarrow 0} \frac{1 - \cos x}{\cos^2 x - 3 \cos x + 2}$

3. 10 pts. Suppose

$$G(x) = \begin{cases} 3x + 2k, & x < -3 \\ x + 9, & x > -3. \end{cases}$$

Determine a value for k for which the limit $\lim_{x \rightarrow -3} G(x)$ exists, and state the value of the limit.

4. 4 pts. each Determine the following limits:

$$\lim_{x \rightarrow 3^+} \frac{-5}{(x-3)^3}, \quad \lim_{t \rightarrow -2^-} \frac{t^3 - 5t^2 + 6t}{t^4 - 4t^2}, \quad \lim_{\theta \rightarrow 0^-} \cot 6\theta.$$

5. 10 pts. Find all vertical asymptotes $x = a$ of the function

$$f(x) = \frac{x + 1}{x^3 - 4x^2 + 4x}.$$

For each value of a determine $\lim_{x \rightarrow a^+} f(x)$, $\lim_{x \rightarrow a^-} f(x)$, and $\lim_{x \rightarrow a} f(x)$.

6. 10 pts. Evaluate the limit

$$\lim_{x \rightarrow -\infty} \frac{8 - 4x^2}{7x^2 + 5x - 12}.$$

7. 15 pts. Let

$$f(x) = \frac{4x^3 + 1}{2x^3 + \sqrt{16x^6 + 1}}.$$

- (a) 10 pts. Determine $\lim_{x \rightarrow \infty} f(x)$ and $\lim_{x \rightarrow -\infty} f(x)$.
(b) 5 pts. Find the horizontal asymptotes of f , if any.

8. 10 pts. Let h be given by

$$h(x) = \begin{cases} 2x^2 + x, & \text{if } x < -1 \\ s, & \text{if } x = -1 \\ 4 - 3x, & \text{if } x > -1 \end{cases}$$

Find the value of s for which h is continuous from the left at -1 , and the value of s for which h is continuous from the right at -1 .

9. Let $f(x) = \sqrt{x - 3}$.

- (a) 10 pts. Use the limit definition of a derivative to find $f'(4)$.
(b) 5 pts. Determine an equation for the tangent line to the graph of f at the point $(4, 1)$.