

Show all work for credit. Also, give exact answers unless otherwise noted.

1. Sketch the graph of a function f such that the following limits hold.

$$\lim_{x \rightarrow \infty} f(x) = 6$$

$$\lim_{x \rightarrow -6^-} f(x) = -\infty$$

$$\lim_{x \rightarrow -\infty} f(x) = -5$$

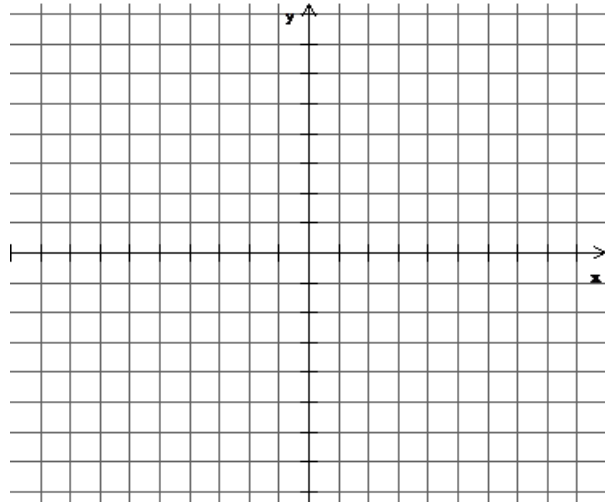
$$\lim_{x \rightarrow -6^+} f(x) = \infty$$

$$\lim_{x \rightarrow 1^-} f(x) = \infty$$

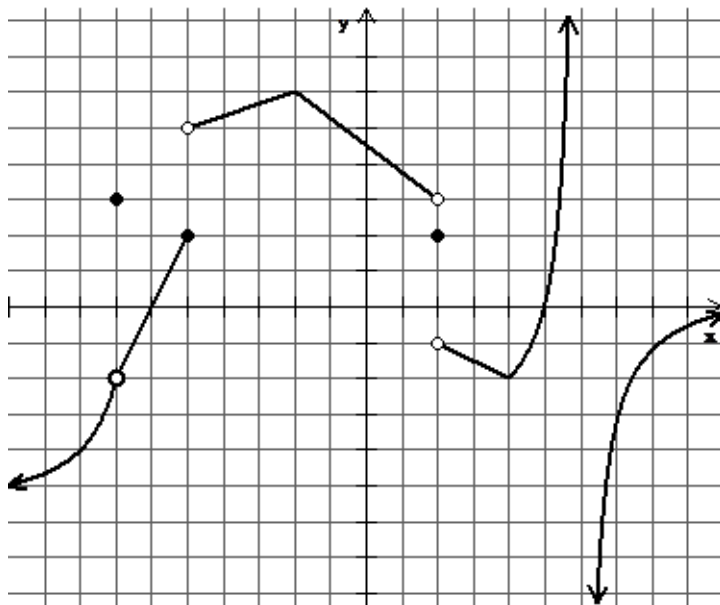
$$\lim_{x \rightarrow 5^-} f(x) = -\infty$$

$$\lim_{x \rightarrow 1^+} f(x) = \infty$$

$$\lim_{x \rightarrow 5^+} f(x) = \infty$$



2. A function p is graphed below. From the graph, find the following. Justify each answer.



(a) Where does p have a removable discontinuity, if anywhere?

(b) Where does p have a jump discontinuity, if anywhere?

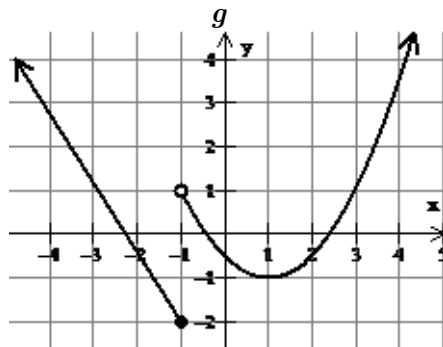
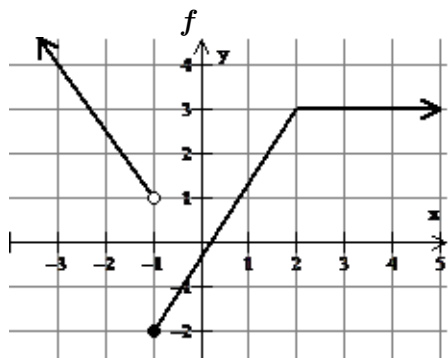
(c) Where does p have an infinite discontinuity, if anywhere?

(d) Where is p continuous, if anywhere?

3. Use the graphs for f and g below to determine the continuity at -1 for: *Justify your answers.*

(a) $f + g$

(a) $f - g$



4. Find and classify all discontinuities for each of the following functions. *Justify your answers.*

(a) $h(t) = \frac{3t^2 + 7t - 6}{2t^2 + 5t - 3}$

(b) $s(\varphi) = \cot \varphi$

(c) $q(r) = \begin{cases} 3r - 2 & \text{if } r < 4 \\ 2r + 1 & \text{if } r \geq 4 \end{cases}$

(d) $w(a) = \begin{cases} |a + 2| & \text{if } a < -1 \\ 1 & \text{if } a = -1 \\ 3a^2 - \sqrt{a + 5} & \text{if } a > -1 \end{cases}$

5. Let the function f be defined by $f(x) = \frac{2x^2 + 5x - 3}{x^2 - 9}$.

- (a) Determine the horizontal asymptote(s) of f . (b) Determine the vertical Asymptote(s) of f .

6. Find each of the following limits.

(a) $\lim_{x \rightarrow \infty} \frac{4x^3 + 6x - 1}{-5x^3 + 2x^2 - 3}$

(b) $\lim_{x \rightarrow 2^+} \frac{2}{3x - 6}$

(c) $\lim_{x \rightarrow 5} \frac{3x^2 - 75}{x - 5}$

(d) $\lim_{x \rightarrow -\infty} \frac{2x - x^3}{x^4 + 2x - 11}$

7. Use the Intermediate Value Theorem to show that $x^3 - 15x + 1 = 0$ has three solutions in the interval $[-4, 4]$.