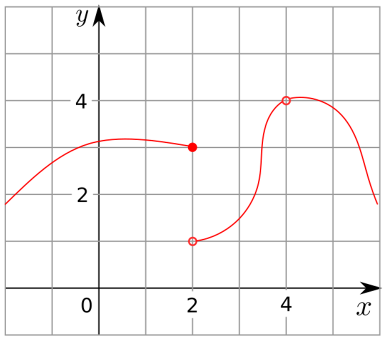
2.2.4 Use the given graph of f to state the value of each quantity, if it exists. If it does not exist, explain why.

(a) $\lim_{x \to 2^-} f(x)$ (b) $\lim_{x \to 2^+} f(x)$ (c) $\lim_{x \to 2} f(x)$

(d) $f(2)$ (e) $\lim_{x \to 4} f(x)$ (f) $f(4)$

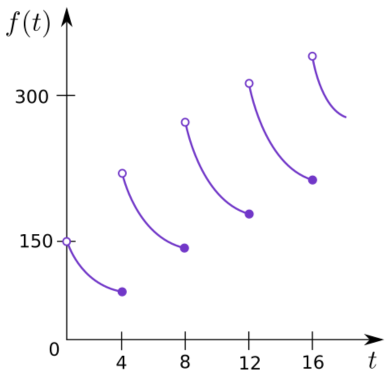


2.2.10 A patient receives a 150-mg injection of a drug every 4 hours. The graph shows the amount $f(t)$ of the drug in the bloodstream after t hours.

Find

$$\lim_{t \to 12^-} f(t), \quad \lim_{t \to 12^+} f(t)$$

and explain the significance of these one-sided limits.



2.2.16 Sketch the graph of an example of a function f that satisfies all of the given conditions.

$$\lim_{x\to 0} f(x) = 4, \quad \lim_{x\to 8^-} f(x) = 1, \quad \lim_{x\to 8^+} f(x) = -3, f(0) = 6, \quad f(8) = -1$$

2.2.38 Determine the infinite limit.

$$\lim_{x\to 3^-} \frac{x^2+4x}{x^2-2x-3}$$

2.2.42 (a) Find the vertical asymptotes of the function

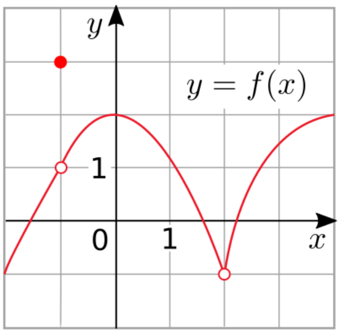
$$y = \frac{x^2+1}{3x-2x^2}$$

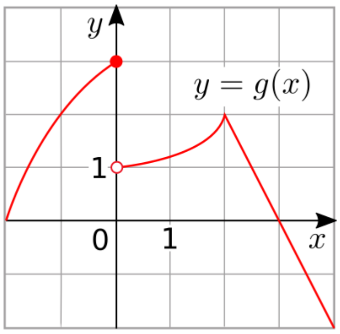
(b) Confirm your answer to part (a) by graphing the function.

2.3.2 The graphs of f and g are given. Use them to evaluate each limit, if it exists. If the limit does not exist, explain why.

(a) $\lim_{x\to 2}[f(x)+g(x)]$ (b) $\lim_{x\to 0}[f(x)-g(x)]$ (c) $\lim_{x\to -1}[f(x)g(x)]$

(d) $\lim_{x\to 3}\dfrac{f(x)}{g(x)}$ (e) $\lim_{x\to 2}\left[x^2 f(x)\right]$ (f) $f(-1)+\lim_{x\to -1}g(x)$





2.3.26 Evaluate the limit, if it exists.

$$\lim_{h\to 0}\frac{(-2+h)^{-1}+2^{-1}}{h}$$

2.3.34 Evaluate the limit, if it exists.

$$\lim_{h\to 0}\frac{\frac{1}{(x+h)^2}-\frac{1}{x^2}}{h}$$

2.3.54 Let

$$g(x) = \begin{cases} x & \text{if } x < 1 \\ 3 & \text{if } x = 1 \\ 2 - x^2 & \text{if } 1 < x \leq 2 \\ x - 3 & \text{if } x > 2 \end{cases}$$

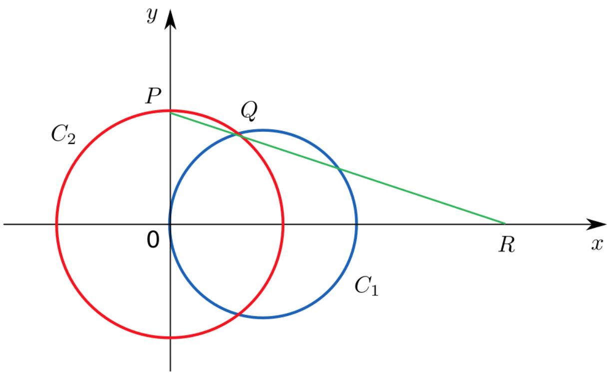
(a) Evaluate each of the following, if it exists.

(i) $\lim_{x \to 1^-} g(x)$ (ii) $\lim_{x \to 1} g(x)$ (iii) $g(1)$

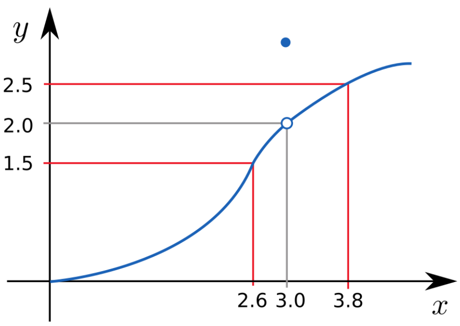
(iv) $\lim_{x \to 2^-} g(x)$ (v) $\lim_{x \to 2^+} g(x)$ (vi) $\lim_{x \to 2} g(x)$

(b) Sketch the graph of t.

2.3.68 The figure shows a fixed circle C_1 with equation $(x-1)^2 + y^2 = 1$ and a shrinking circle C_2 with radius r and center the origin. P is the point $(0, r)$, Q is the upper point of intersection of the two circles, and R is the point of intersection of the line P and the x-axis. What happens to R as C_2 shrinks, that is, as $r \to 0^+$?



2.4.2 Use the given graph of f to find a number δ such that if $0 < |x-3| < \delta$ then $|f(x)-2| < 0.5$



2.4.14 Given that $\lim_{x \to 2} (5x-7) = 3$, illustrate the precise definition of a limit by finding values of δ that correspond to

(a) $\epsilon = 0.1$ (b) $\epsilon = 0.05$ (c) $\epsilon = 0.01$.

2.4.28 Prove that $\lim_{x \to -6^+} \sqrt[8]{6+x} = 0$ using the ϵ, δ definition of a limit.

2.4.42 Use the precise definition of an infinite limit to prove that $\lim_{x \to -3} \frac{1}{(x+3)^4} = \infty$.

2.4.44 Suppose that $\lim_{x \to a} f(x) = \infty$ and $\lim_{x \to a} g(x) = c$, where $c \in \mathbb{R}$. Prove each statement.

(a) $\lim_{x \to a} [f(x) + g(x)] = \infty$

(b) $\lim_{x \to a} [f(x)g(x)] = \infty$ if $c > 0$

(c) $\lim_{x \to a} [f(x)g(x)] = -\infty$ if $c < 0$