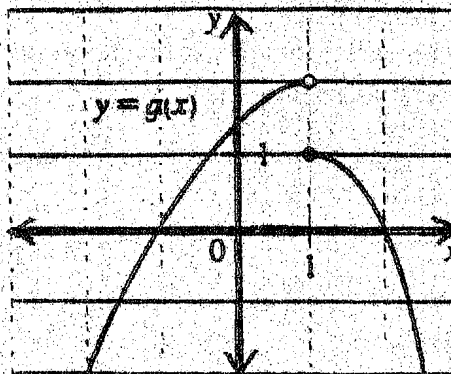
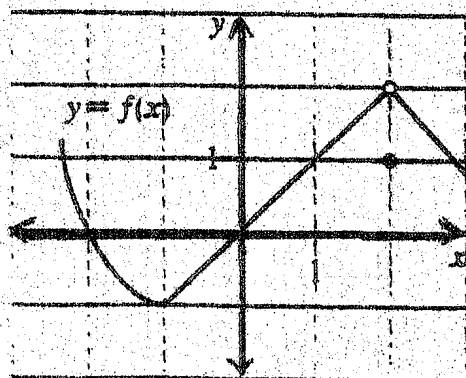


1. Given that $\lim_{x \rightarrow a} f(x) = -3$, $\lim_{x \rightarrow a} g(x) = 0$, $\lim_{x \rightarrow a} h(x) = \frac{2}{3}$, find the limits that exist. If the limit does not exist, explain why.

- (a) $\lim_{x \rightarrow a} [f(x) + h(x)]$ (b) $\lim_{x \rightarrow a} [f(x)]^2$
 (c) $\lim_{x \rightarrow a} \sqrt[3]{h(x)}$ (d) $\lim_{x \rightarrow a} \frac{1}{f(x)}$
 (e) $\lim_{x \rightarrow a} \frac{f(x)}{h(x)}$ (f) $\lim_{x \rightarrow a} \frac{g(x)}{f(x)}$
 (g) $\lim_{x \rightarrow a} \frac{f(x)}{g(x)}$ (h) $\lim_{x \rightarrow a} \frac{2f(x)}{h(x) - f(x)}$

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) $\lim_{x \rightarrow 2} [f(x) + g(x)]$ (b) $\lim_{x \rightarrow 1} [f(x) + g(x)]$
 (c) $\lim_{x \rightarrow 0} [f(x)g(x)]$ (d) $\lim_{x \rightarrow -1} \frac{f(x)}{g(x)}$
 (e) $\lim_{x \rightarrow 2} x^3 f(x)$ (f) $\lim_{x \rightarrow 1} \sqrt{3 + f(x)}$

3. Find the following limits. Show all steps. No calculator.

- (a) $\lim_{x \rightarrow 0} \frac{\sin(2x)}{x}$ (b) $\lim_{x \rightarrow 0} \frac{\sin x}{2x^2 - x}$
 (c) $\lim_{x \rightarrow 0} \frac{x + \sin x}{x}$ (d) $\lim_{x \rightarrow 0} \frac{\sin^2 x}{x}$
 (e) $\lim_{x \rightarrow \frac{\pi}{2}} \frac{3 \sin(4x)}{\sin(3x)}$ (f) $\lim_{x \rightarrow 0} \frac{x^2}{1 - \cos x}$

Helpful hint box:

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1 \quad \lim_{x \rightarrow 0} \frac{1 - \cos x}{x} = 1$$

4. Find the following limits. Show all steps. No calculator.

(a) $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x - 2}$

(b) $\lim_{x \rightarrow 3} \frac{\sqrt{x+1} - 2}{x - 3}$

(c) $\lim_{x \rightarrow 0} \frac{\frac{1}{3+x} - \frac{1}{3}}{x}$

(d) $\lim_{x \rightarrow \infty} \sin x$

(e) $\lim_{x \rightarrow \frac{\pi}{2}^+} \tan x$

(f) $\lim_{x \rightarrow -\frac{\pi}{2}^+} \sec x$

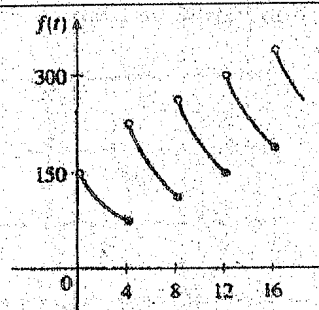
(g) $\lim_{x \rightarrow \pi^-} \csc x$

(h) $\lim_{x \rightarrow 0^-} \cot x$

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

$\lim_{t \rightarrow 12^-} f(t)$ and $\lim_{t \rightarrow 12^+} f(t)$

and explain the significance of these one-sided limits.



6. Explain the meaning of each of the following.

(a) $\lim_{x \rightarrow -3} f(x) = \infty$

(b) $\lim_{x \rightarrow 4^+} f(x) = -\infty$

(c) $\lim_{x \rightarrow \infty} f(x) = 8$

7. Find the following limits. Explain your reasoning.

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

(b) $\lim_{x \rightarrow \infty} \frac{2n^5-7}{(-5n)^2+9}$

(c) $\lim_{n \rightarrow \infty} \frac{7n^4+500}{3^n}$

(d) $\lim_{x \rightarrow (-\infty)} 6^{\frac{1}{x}}$

Helpful hint for comparing size of functions:

logarithmic < polynomial < exponents

8. Find i) $\lim_{x \rightarrow \infty}$ ii) $\lim_{x \rightarrow -\infty}$

(a) $f(x) = \frac{2x^3 - 9x^2 + 4x}{-3x^3 + 6x^2 + 24x}$

(b) $f(x) = \frac{\sqrt{4x^2 - x - 5}}{2x - 6}$

(c) $f(x) = \frac{3^x + 2}{6^x}$

9. Evaluate $\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x - 2}$ algebraically first. Then use a table of values to determine the limit as x approaches 2.

10. Evaluate the $\lim_{x \rightarrow -4} r(x)$ if $r(x) = \begin{cases} 2x^2 - 3 & x \neq -4 \\ 1.7 & x = -4 \end{cases}$