

Section 1.2 Problems 15-23 (odd) Section 1.3 Problems
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 Problems 37-49 (odd) Section 2.1 Problems 11-23 (odd) Section 2.2
 Problems 3-57 (odd) Section 2.3 Problems 7-51 (odd)

1. Compute the following limits:

- (a) $\lim_{x \rightarrow 4} \frac{x-4}{x^2-3x-4}$
 (b) $\lim_{h \rightarrow 0} \frac{(1+h)^2-1}{h}$
 (c) $\lim_{h \rightarrow 0} \frac{(x+h)^2-x^2}{h}$
 (d) $\lim_{x \rightarrow 4} \frac{x-4}{x^2-16}$
 (e) $\lim_{x \rightarrow -1} \frac{x^2-x-2}{x^2+3x+2}$
 (f) $\lim_{x \rightarrow 16} \frac{4-\sqrt{x}}{x-16}$
 (g) $\lim_{x \rightarrow 2} \frac{\sqrt{x+2}-\sqrt{2x}}{x^2-2x}$
 (h) $\lim_{x \rightarrow 0} \frac{\frac{1}{2+x}-\frac{1}{2}}{x}$
 (i) $\lim_{h \rightarrow 0} \frac{\frac{1}{x+h}-\frac{1}{x}}{h}$
 (j) $\lim_{x \rightarrow 1^-} \frac{x-1}{|x-1|}$
 (k) $\lim_{x \rightarrow 2^-} \frac{|x-2|}{x-2}$
 (l) $\lim_{x \rightarrow 1^-} \frac{x}{1-x}$
 (m) $\lim_{x \rightarrow 1^+} \frac{x}{1-x}$

2. Let

$$f(x) = \begin{cases} x^2 & \text{if } x < 1 \\ 5 - x^2 & \text{if } 1 \leq x < 2 \\ \sqrt{x^2 - 4} & \text{if } x \geq 2 \end{cases}$$

Find

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

3. For what value of c is the function

$$f(x) = \begin{cases} cx + 1 & \text{if } x < 3 \\ cx^2 - 1 & \text{if } x \geq 3 \end{cases}$$

continuous at $x = 3$?

4. Compute the following limits:

(a) $\lim_{x \rightarrow 0} \frac{\sin 2x}{5x}$

(b) $\lim_{x \rightarrow 0} \frac{\sin x}{\sin 5x}$

(c) $\lim_{x \rightarrow 0} \frac{2x}{\tan x}$

5. Find the derivative by the limit process: $f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$

(a) $f(x) = x^2$

Answer: $f'(x) = 2x$

(b) $f(x) = x^3$

Answer: $f'(x) = 3x^2$

(c) $f(x) = \sqrt{x}$

Answer: $f'(x) = \frac{1}{2\sqrt{x}}$

(d) $f(x) = \frac{1}{x}$

Answer: $f'(x) = -\frac{1}{x^2}$

(e) $f(x) = \frac{1}{x^2}$

Answer: $f'(x) = -\frac{2}{x^3}$

6. Find the slope of the tangent line to the given function at the indicated point:

(a) $y = \frac{1}{x}$; (1,1)

Answer: $f'(x) = -\frac{1}{x^2}$ and the slope of the tangent line is $f'(1) = -\frac{1}{1^2} = -1$

(b) $y = \sqrt{x}$; (4,2)

Answer: $f'(x) = \frac{1}{2\sqrt{x}}$ and the slope of the tangent line is $f'(4) = \frac{1}{2\sqrt{4}} = \frac{1}{2(2)} = \frac{1}{4}$

(c) $y = \frac{2}{x+1}$; (0,2)

Answer: $f'(x) = -\frac{2}{(x+1)^2}$ and the slope of the tangent line is $f'(0) = -\frac{2}{(0+1)^2} = -\frac{2}{1} = -2$

(Note that we have used $f(x)$ instead of y in the problems 6(a), 6(b), and 6(c))

7. Find $\frac{dy}{dx}$ for the following functions.

(a) $y = \frac{12}{x} - \frac{4}{x^3} + \frac{1}{x^4}$

(b) $y = \sqrt{x} + \frac{1}{\sqrt{x}}$

(c) $y = \frac{2x+1}{\sqrt[3]{x}}$

(d) $y = \frac{\sqrt{x}-1}{\sqrt{x+1}}$

(e) $y =$

$(2x-7)^{-1}(x+5)$

(f) $y = \frac{4-x}{3+x}$

(g) $y = x \sin x$

(h) $y = (\sin x)(\cos x)$

(i) $y = \tan x - x$

(j) $y = \frac{\tan x}{1+\tan x}$

(k) $y = (\sin x + \cos x) \sec x$

(l) $y = (1 + \csc x) \cos x$

(m) $y = 4 - x^2 \sin x$

(n) $y = \sec x \csc x$

(o) $y = \frac{\cos x}{1+\cos x}$

8. Find an equation for the tangent line to the given function at the indicated point:

(a) $y = \frac{x}{x^2-2}$; (1,-1)

(b) $y = \sqrt{x}$; (4,2)

(c) $y = \tan x$; $(\frac{\pi}{3}, \sqrt{3})$

(d) $y = \frac{2}{x+1}$; (0,2)