

1. Find the following limits if they exist.

(a)

$$\lim_{x \rightarrow 1} \frac{\frac{2}{x+1} - 1}{x - 1}$$

(b)

$$\lim_{x \rightarrow 0} \frac{\tan 2x}{\sin 5x}$$

2. Let  $f$  be the function defined by

$$f(x) = \begin{cases} c^2 - x^2 & \text{if } x < 0 \\ 2(c - x)^2 & \text{if } x \geq 0. \end{cases} \quad (1)$$

(a) Calculate  $\lim_{x \rightarrow 0^+} f(x)$ ,  $\lim_{x \rightarrow 0^-} f(x)$

(b) Find the value of the constant  $c$  so that the function  $f$  is continuous everywhere.

3. Find the derivative of  $f(x) = \sqrt{x+3}$  using the definition of the derivative. No credit will be given for finding the derivative by other means.

4. Find the derivatives of the following functions:

(a)

$$f(x) = 3 + \frac{2x+1}{\sqrt{x}}$$

(b)

$$g(x) = e^x \sin x$$

5. Find the equation of the tangent line to the graph of  $f(x) = xe^x$  at the point where  $x = 1$ .

6. Let  $f(x) = \sin 2x$  and  $g(x) = \frac{1}{x^2+1}$ .

a) What are the domain and range of  $f$  and  $g$ ?

b) Draw the graph of  $f$ .

c) Compute  $f \circ g$  and  $g \circ f$ .

7. Use the intermediate value property of continuous functions to show that the equation

$$x^3 + x + 3 = 0$$

has a solution in the interval  $[-2, 2]$ .

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