



3. Find the intervals on which the given function is increasing or decreasing. Find and classify any local extrema.

$$f(x) = \frac{x}{x^2 + 16}.$$

4. Find the intervals of concavity and any points of inflection:

$$f(x) = e^{-x^2}.$$

5. Suppose you have two positive numbers, and the sum of the first number and three times the second number is 27. How large can the product of the two numbers be (at most)?

6. A poster is to have a printed area of 480 square inches. If the poster will have top and bottom margins measuring 4 inches, and side margins measuring 5 inches, then what are the dimensions of the poster having the smallest possible area?

7. Evaluate the limit:  $\lim_{x \rightarrow 0} \frac{\arctan x - x}{x^3}$ .

8. Evaluate the limit:  $\lim_{x \rightarrow 0^+} (\cos x)^{\frac{1}{x^2}}$ .

9. Suppose that  $f''(x) = \frac{3}{\sqrt{x}}$ ,  $f(4) = 20$ , and  $f'(4) = 7$ . Find  $f(x)$ .

10. A rock is dropped from a 100-meter-high cliff. How long does the rock take to strike the ground at the base of the cliff? How fast is the rock travelling when it strikes the ground? (You may assume that  $g = -10m/s^2$  and that there is no wind resistance.)