

Solve each of the following problems. Use the available space to **show all work**.

1. $\int_1^2 (2x^3 + 9) dx$



2. Find the equation of the tangent line to the curve $y = x^2 - 3x$ at $x = 2$.



3. At what value(s) of x does the function $f(x) = 2x^3 - 5x^2 - 4x$ have a relative minimum?

4. $\int \frac{x + \sqrt{x}}{x} dx$

5. On what interval(s) is the function
 $f(x) = -x^4 + 4x^3 + 56x^2$
decreasing?




6. If $x - y = xy^2$, find $\frac{dy}{dx}$.



7.

Evaluate the limit:

$$\lim_{x \rightarrow 1} \frac{x^2 + 3x - 4}{2x - 2}$$

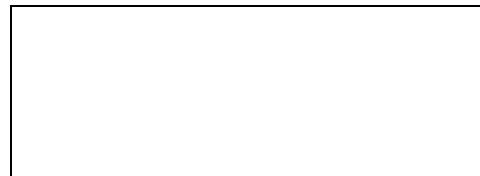


8.

Let f be the function given by

$$f(x) = \frac{10x^2}{e^x}$$

What are all the values of x that satisfy the conclusion of the Mean Value Theorem on the interval $[-0.5, 9]$?



9. The velocity of a particle moving in a straight line is given by $v(t) = x^3 - e^x$. What is the total length of the path traveled by the particle from $t = 0$ to $t = 5$?

10. On what interval(s) is the function $f(x) = 2x^6 + 57x^5 - 25x^4 - 950x^3$ concave up?

11. Find all values of x that are critical values for the function

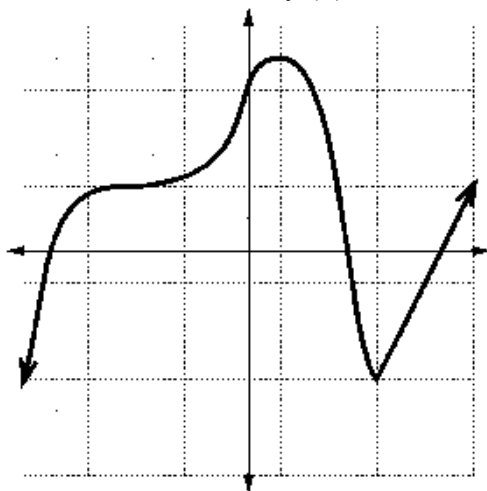
$$f(x) = 5(x + 5)^{1/5} - 3(x - 3)^{1/3}$$

12. Evaluate the limit:

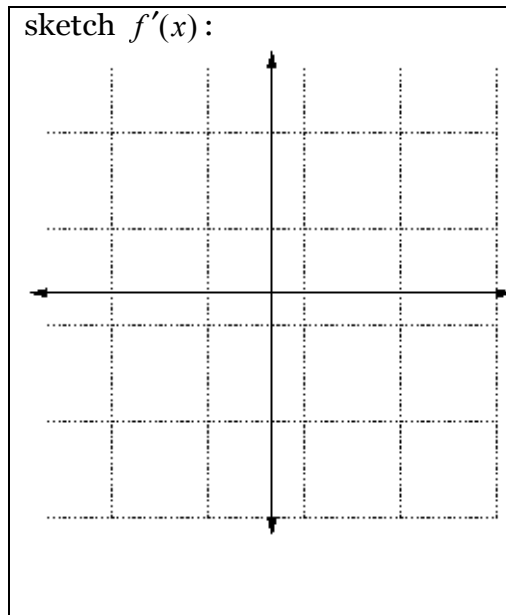
$$\lim_{x \rightarrow -3^+} \frac{5}{x + 3}$$

13. For the function $f(x) = x^{-1/2}$, the quantity $\int_1^2 f(x) dx$ is approximated by a Riemann Sum using the left edge of each of five subintervals of equal width. Compute the value of the approximation.

14. Given the sketch of $f(x)$...



sketch $f'(x)$:



15. Given $g(x) = \ln x - \sin x$, find $g''(\pi)$.

16. $\int x(2-x)^{1/6} dx$

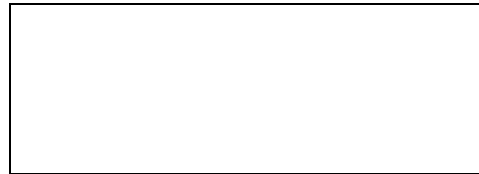
17. Evaluate the limit:

$$\lim_{x \rightarrow \infty} \frac{4x^3 - 3x^2 + 18x - 23}{5x^3 + 14x^2 + 108}$$

18. $\int \cot^2 x \sec^2 x \, dx$

19.

$$\int x \cos 2x \, dx$$



20.

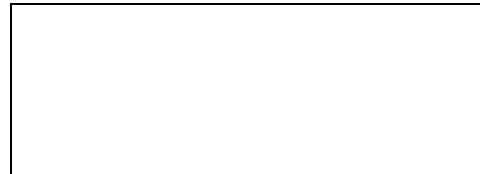
If $y = 2xe^{-x}$, then y has an inflection point at what value of x ?



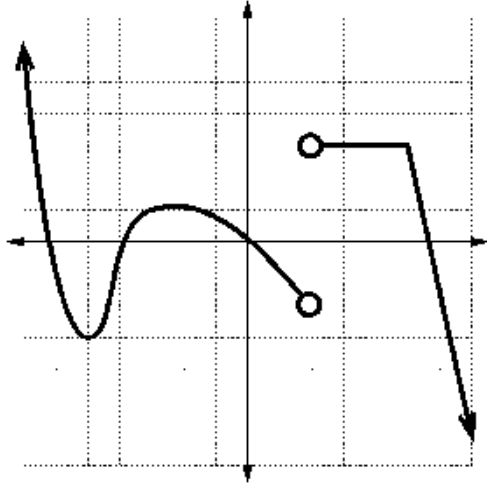
- 21.** If the edge lengths of a cube are increasing at a rate of 1.27 meters per second, how fast (in square meters per second) is the surface area increasing when the edge length is 3.59 meters?



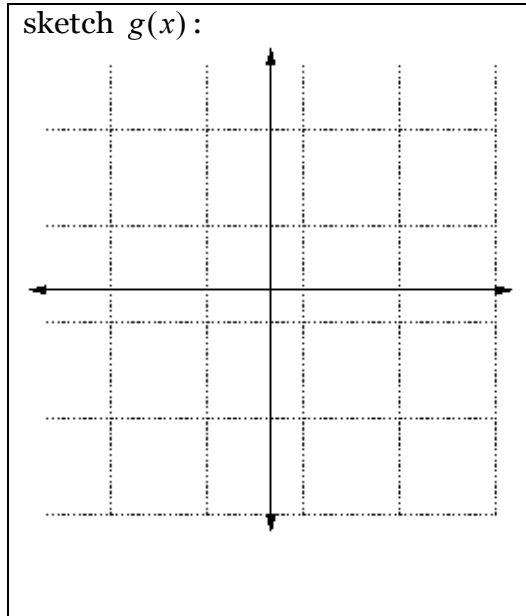
- 22.** If $f(x) = \tan \sqrt{x}$, find $f'(x)$.



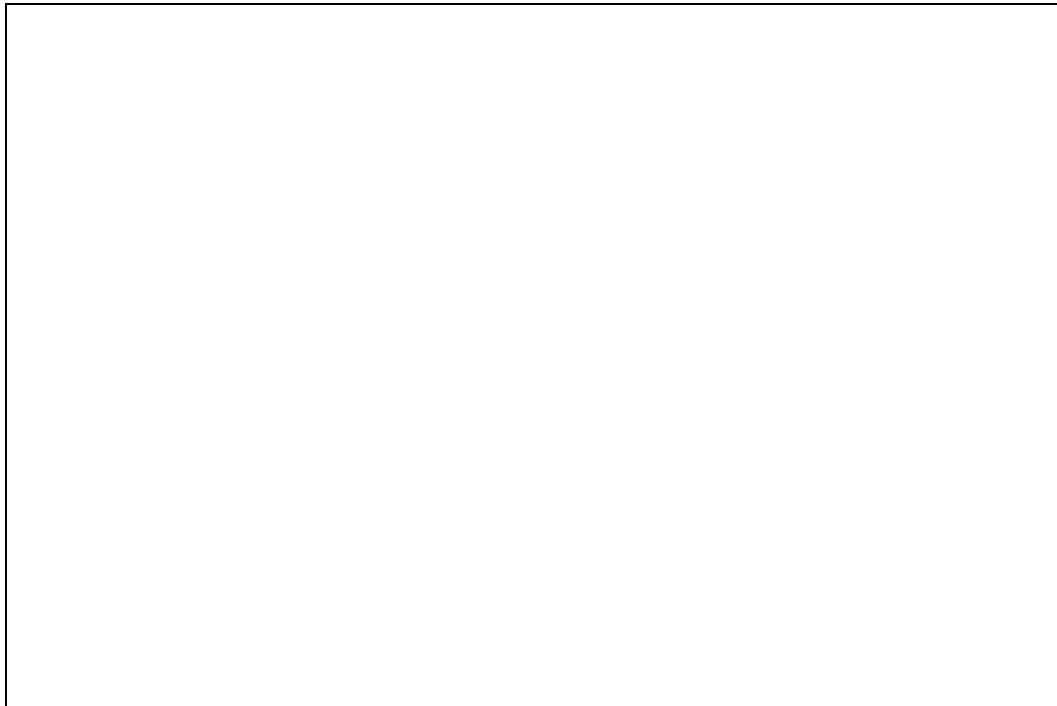
23. Given the sketch of $g'(x)$...



sketch $g(x)$:

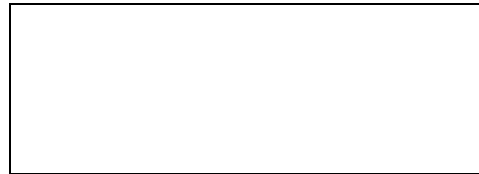


24. Prove or disprove that the function $f(x) = \sqrt{9-x}$ is continuous on the interval $[0,9]$.



25. Find the area of the region enclosed by the given curves:

$$y = x\sqrt{25 - x^2}$$
$$y = 6x - 6$$
$$x = -3$$



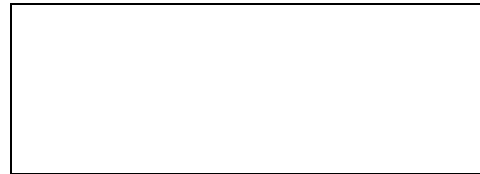
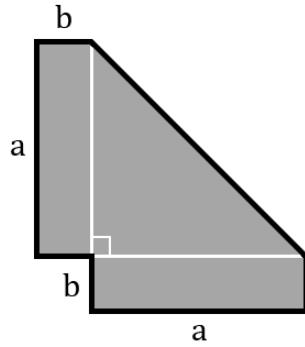
26. Use the Squeeze Theorem to show that

$$\lim_{x \rightarrow 0} x^2 \sin x = 0$$

Illustrate using $f(x) = x^2$ and $h(x) = -x^2$ as the squeezing functions.



27. The shape below is created by attaching two rectangles to the two equal sides of an isosceles right triangle (see below). It has an outer perimeter of 40 cm (bold line). Find the dimensions a and b that maximize the area of the shape.



28. Find the volume of the solid created by revolving about the y -axis the region enclosed by the given curves.

$$y = x^{1/3}$$

$$y = x - 6$$

$$y = 1$$

