1. What is the slope of the tangent line to \( x = 2y + x^2 \) at \((1/2, -2)\)?

2. What is the area under the curve \( f(x) = \frac{2x}{x^2 + 9} \) from \( x = 0 \) to \( x = 1 \)?

3. Tracey and Alice (having tired of raising llamas) have gone back to technical writing. Their client wants the pages in their newest book to have 1-inch side margins and 2-inch top and bottom margins. If the area of the page can be at most 50 in\(^2\), what dimensions give the most printed area per page?

4. What is \( \frac{d}{dx} (x^2) \)?

5. Find the volume of the solid generated by rotating the region bounded by \( y = \sin x \) and the \( x \)-axis between 0 and \( \pi \) around the \( x \)-axis.

6. A particle moves so that its displacement at time \( t \) is given by
\[
s(t) = \sqrt{3t^2 + 4}.
\]
What is \( \lim_{t \to \infty} v(t) \)?

7. A solid has a circular base of radius 1. Parallel cross-sections perpendicular to the base are squares. What is the volume of the solid?

8. Let \( f(x) = 1 - kx^2 \), where \( k \) is a real constant. It is easy to see that for \( k \leq 0 \) and even for small positive values of \( k \), that the point on the graph of \( y = f(x) \) closest to the origin is \((0,1)\). It is equally easy to see that for large positive values of \( k \), that \((0,1)\) is not the closest point on the graph to the origin. What is the largest value of \( k \) for which the point on the graph of \( y = f(x) \) closest to the origin is \((0,1)\)?

9. A certain function \( f(x) \) has the following properties: \( f(0) = 2 \), \( f(2) = 4 \), and \( f''(x) > 0 \) for all \( x > 0 \). What are the possible values of \( f'(4) \)?

10. Imagine two right circular cones, one inscribed upside down inside the other. The vertex of the smaller (inside) cone is in the center of the larger cone’s base. If the height of the larger cone is 8 inches and its radius is 2 inches, find the radius \( r \) and height \( h \) of the smaller cone so that it will have the largest possible volume.

11. Suppose \( \int_0^7 f(t) \, dt = xe^{2x} \). What is \( f(x) \)?
12. Calculate \( \frac{dy}{dx} \) if \( x = \int_0^y \frac{1}{\sqrt{1 + 16t^2}} \, dt \).

13. Suppose \( f(x) = \frac{\sin 4x}{|x|} \) for \( x \) different from zero. Can \( f(0) \) be defined so that \( f \) will be continuous for all \( x \)? If so, what should \( f(0) \) be?

14. If \( y = (1 + x)^\frac{1}{1+x} \), then calculate \( \frac{1}{y} \frac{dy}{dx} \).

15. What is \( \lim_{x=0^+} \arctan(\ln(x)) \)?

16. Suppose \( f(x) \) is a differentiable function. Express

\[
\lim_{x \to a} \frac{\sqrt{f(x)} - \sqrt{f(a)}}{\sqrt{x} - \sqrt{a}}
\]

in terms of \( a \), \( f(a) \) and \( f'(a) \).