1. Sketch the graphs of the following functions, labeling all asymptotes, intercepts, and any other pertinent points.

(a) \( f(x) = \frac{2x^3 - 5x^2 + 4x}{x^2 - 2x + 1} \)

(b) \( g(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} \)

2. Calculate the following limits.

(a) \( \lim_{x \to 1} \frac{\sqrt{2x - x^4} - \sqrt{x}}{1 - \sqrt{x^4}} \)

(b) \( \lim_{y \to \infty} \frac{\ln(y)}{\sqrt{y} + \sqrt{y}} \)

(c) \( \lim_{x \to 0^+} (e^{1/x} - 1) \tan(x) \)

(d) \( \lim_{y \to \infty} \left( \frac{x^2}{x + 2} - \frac{x^3}{x^2 + 3} \right) \)

3. Solve the initial value problem where \( \frac{dy}{dx} = x\sqrt{x + 1} \) and \( y(4) = 7 \).

4. Find the right and left Riemann sums for \( h(x) = x^3 + x + 1 \) on \([-2, 3]\) for \( n = 5 \).

5. Evaluate \( \int_1^5 (5 - 2x) \, dx \) using the Riemann sum \( \lim_{n \to \infty} \sum_{i=1}^{n} f(x_i) \Delta x \).

6. Compute the following integrals.

(a) \( \int \sin^2(u) \cos^2(u) \, du \)

(b) \( \int_{\pi/4}^\pi \sin^3(t) \cos^3(t) \, dt \)

(c) \( \int_{0}^{1} x^3 \sqrt{x^2 + 3} \, dx \)

(d) \( \int_{-2}^{2} (3 + \sqrt{4 - t^2}) \, dt \)

(e) \( \int_{-3}^{2} |x^3 + x^2 - 2x| \, dx \)

(f) \( \int \frac{\ln(\ln(x))}{x\ln(x)} \, dx \)

(g) \( \int_{1}^{2} \frac{\sqrt{t^3} - \sqrt{t} + t^3}{2t^2} \, dt \)
7. Find \( g'(x) \) if
\[
g(x) = \int_{\sin(x)}^{3x+1} \frac{\tan^2(2t)}{1 + t\cos(t^2)} \, dt.
\]

8. Find the average value of \( y = f(x) = |\cos(x)| \) on the interval \([\pi/4, 7\pi/4]\).

9. For constants \( a \) and \( b \), calculate \( \lim_{x \to \infty} (1 + \frac{a}{x})^bx \).

10. Evaluate \( \lim_{x \to 0^+} \frac{\int_0^x t^2 \csc^2(t) \, dt}{5x} \).

11. A large rock is dropped from the top of a 128 foot tall building. At the same time, a ball is thrown straight upwards from ground level from a point directly below the rock. With what initial velocity should the ball be thrown so that the ball meets the rock when the rock is halfway, in terms of height, to the ground?

12. When a mass is hung from a spring and then displaced from its natural hanging position, the spring, and consequently the mass, will oscillate (up and down). In this case, the mass’ acceleration at time \( t \), in seconds, is given by
\[
a(t) = \frac{-4\pi^2 x_m \cos(2\pi t/T)}{T^2},
\]
where \( T \) is the period of motion and \( x_m \) is the maximum displacement of the mass from its natural hanging position. If the mass’ initial velocity is \( v_0 \) and initial position is \( y_0 \), find the velocity and position of the mass at any time \( t \).

13. For the following problems, sketch the area bounded by the given curves, and then compute this area.
   (a) \( x = y^3 - y, \ x = 1 - y^4 \)
   (b) \( y = x^3, \ y = 2x^3 + x^2 - 2x \)

14. Find the length of the arc defined by \( y = x^2 - (\ln(x))/8 \) from \( x = 1 \) to \( x = e \).

15. Find the area of the surface generated by rotating the curve \( y = e^x \) for \( 0 \leq x \leq 1 \) about the \( x \)-axis.