1. Evaluate the following limits if they exist. If a limit does not exist, please explain why.

(a) \( \lim_{{x \to \infty}} \frac{\sqrt{2x^2 - x}}{6x - 1} \)
(b) \( \lim_{{x \to 3^-}} \frac{\sqrt{x} - \sqrt{3}}{x - 3} \)

2. Find the value of \( c \) which makes the following function continuous at \( x = -2 \):

\[
f(x) = \begin{cases} 
  x + 10 & \text{if } x \leq -2 \\
  \frac{c^3}{18} + x + 1 & \text{if } x > -2 
\end{cases}
\]

3. Find the derivatives of the following functions.

(a) \( f(x) = e^{x^3} + \sin(e^x + x^2) + \ln(2 + \cos x) \)
(b) \( g(x) = \left( 1 + \frac{1}{x^2} + \frac{1}{x^2 + 1} \right)^2 \)
(c) \( h(x) = (x^2 - 1)^{15}(x^4 - 3x) \)
(d) \( F(x) = \int_0^{x^2} \sqrt{t^3 + t + 3} \, dt \)
(e) \( G(x) = (x + 1)^{\sin x} \)

4. Use the definition of the derivative as the limit of a difference quotient to find the derivative of \( f(x) = \sqrt{x + 1} \).

5. Use linear approximation to approximate the value of \( e^{1/10} \).

6. Find the equation of the tangent line to the curve

\[
(2x - y)^3 + 6x = 2y + y^2 - 2
\]

at the point (2, 3).

7. Evaluate the following definite and indefinite integrals.

(a) \( \int_0^1 (x^2 + 2) \sqrt{x^3 + 6x + 5} \, dx \)
(b) \( \int \frac{x + 1}{x + 2} \, dx \)
(c) \( \int \frac{\sec^2 x}{\sqrt{2 + \tan x}} \, dx \)
(d) \( \int_0^2 \frac{x^3}{\sqrt{x^4 + 9}} \, dx \)
(e) \[ \int_{1}^{4} \frac{x^2 - x + 1}{\sqrt{x}} \, dx \]

(f) \[ \int_{-5}^{5} 3 + \sqrt{25 - x^2} \, dx \]

8. Suppose that \( f \) is a continuous function such that \( f(3) = -2 \) and \( f(7) = 3 \). Show that the equation \( \frac{1}{1+x} f(x) = 0 \) for some \( x \) between 3 and 7.

9. A bagel is placed in a 50\(^{\circ}\) cooler. After 6 minutes, the bagel’s temperature is 70\(^{\circ}\); after 9 minutes, the bagel’s temperature is 60\(^{\circ}\). What was the bagel’s initial temperature?

10. A rectangular box with a square bottom and no top is to have a volume of 216 cubic feet. The material for the bottom costs $8 per square foot, while the material for the sides costs $4 per square foot. Find the dimensions which give the box with smallest total cost.

11. Graph the function \( f(x) = \frac{e^{x}}{x-1} \). Specifically:
   - Find the \( x \)-coordinates of the \( x \)-intercepts and the \( y \)-coordinate of the \( y \)-intercept (if any).
   - Find the intervals on which \( f \) increases and the intervals on which \( f \) decreases.
   - Find the \( x \)-coordinates of any local maxima or minima.
   - Find the intervals on which \( f \) is concave up and the intervals on which \( f \) is concave down.
   - Find the \( x \)-coordinates of any inflection points.
   - Locate any vertical asymptotes, and compute the relevant limits.
   - Locate any horizontal asymptotes, and compute the relevant limits.
   - Make a qualitatively accurate sketch of the graph based on the information above.