1. (10 points each) Evaluate the following indefinite and definite integrals. When appropriate you may use the Fundamental Theorem of Calculus.

(a) \( \int_{-1}^{1} (4x^2 - 3x + 5) \, dx \)

(b) \( \int (\frac{\sqrt{x}}{4} + \frac{4}{\sqrt{x}}) \, dx \)
(c) \[ \int_{\pi/4}^{\pi/3} \csc x \cot x \, dx \]

(d) \[ \int \frac{\sin x}{1 + \cos x} \, dx \]

(e) \[ \int e^{4x+1} \, dx \]
2. (10 points) Using a Riemann sum with \( n = 40 \) and right-hand endpoint evaluation, approximate the definite integral

\[
\int_{-2}^{1} \frac{1}{2x^2 + 1} \, dx.
\]

3. (10 points) For the function

\[ p(x) = x^3 - 6x^2 + 9x + 3 \]

find the intervals on which the function is increasing and decreasing.
4. A piece of cardboard measures 10 inches by 15 inches. Two equal squares are removed from a 10-inch side as shown in the figure below. Two equal rectangles are removed from the other corners so that the tabs can be folded to form a rectangular box with a lid. Note that the figure below is not drawn to scale.

(a) (3 points) Write a formula \( V(x) \) for the volume of the box.

(b) (2 points) What are the largest and smallest values of \( x \) that are physically permitted?

(c) (5 points) Find the value of \( x \) which maximizes the volume of the box.
5. (10 points) For the function

\[ g(x) = 2x^3(x - 4) \]

find the intervals on which the function is concave up and concave down. State the \( x \) values for any points of inflection of \( g(x) \).
6. (10 points) On the interval $[-3, 3]$ the following facts are known about the continuous function $f(x)$.

- $f(1) = 0$
- $f'(1) = 0$
- $\lim_{x \to 2^+} f(x) = \infty$, $\lim_{x \to 2^-} f(x) = -\infty$, and $\lim_{x \to 0} f(x) = -\infty$
- $\lim_{x \to -\infty} f(x) = 0$, $\lim_{x \to +\infty} f(x) = \infty$
- $f''(x) > 0$ for $x > 2$ and $f''(x) < 0$ for $x < 2$ with $x \neq 0$

Sketch a plausible graph for $f(x)$ on the axes below.