Please answer the following questions. Your answers will be evaluated on their correctness, completeness, and use of mathematical concepts we have covered. Please show all work and write out your work neatly. Answers without supporting work will receive no credit. The point values of the problems are listed in parentheses.

1. (10 points each) The indefinite integral problems on this test are multiple choice answer. There is only one correct answer per problem. Circle the roman numeral corresponding to the correct answer.

(a) \( \int \left( 4\sqrt{x} - x \right) \, dx \)

i. \( \frac{2}{\sqrt{x}} = 2 + C \)

ii. \( \frac{8}{3} x^{3/2} - x^2 + C \)

iii. \( 4x^{3/2} - x^2 \)

iv. \( \frac{8}{3} x^{3/2} - x^2 \)

v. \( 4x^{1/2} - x^2 + C \)

vi. None of the above.
(b) \[ \int \frac{2x^{-1/4} + x^{5/4}}{x^{3/4}} \, dx \]

i. \[ \frac{2}{x} + \sqrt{x} + C \]
ii. \[ \frac{2}{x^2} + \sqrt{x} + C \]
iii. \[ 2 \ln x + x^{3/2} + C \]
iv. \[ 2 \ln x + \frac{2}{3} x^{3/2} + C \]
v. \[ 2 \ln x + \frac{2}{3} x^{1/2} + C \]
vi. None of the above.

(c) \[ \int (3 \sin x - \cos x) \, dx \]

i. \[ -3 \cos x - \sin x + C \]
ii. \[ 3 \cos x - \sin x + C \]
iii. \[ -3 \cos x + \sin x + C \]
iv. \[ 3 \cos x + \sin x + C \]
v. \[ -\cos 3x - \sin x + C \]
vi. None of the above.
(d) \( \int 5 \sin 4x \, dx \)

i. \( \frac{5}{4} \sin 4x + C \)
ii. \( \frac{5}{4} \cos 4x + C \)
iii. \( -\frac{5}{4} \cos 4x + C \)
iv. \( 20 \cos 4x + C \)
v. \( -20 \cos 4x + C \)
vi. None of the above.

(e) \( \int \cot x \, dx \)

i. \( \ln |\cos x| + C \)
ii. \( -\ln |\cos x| + C \)
iii. \( -\ln |\sin x| + C \)
iv. \( -\csc^2 x + C \)
v. \( \ln |\sin x| + C \)
vi. None of the above.
(f) \[ \int \frac{2 - e^{2x}}{e^x} \, dx \]

i. \[ -\frac{2}{e^x} + e^x + C \]

ii. \[ \frac{2}{e^x} - e^x + C \]

iii. \[ \frac{2}{e^x} - e^x + C \]

iv. \[ \frac{2}{e^x} + e^x + C \]

v. \[ \ln|2 - e^{2x}| + C \]

vi. None of the above.

2. (3 points each) Consider the function and its derivatives given below.

\[ f(x) = x - \frac{4}{x} \]
\[ f'(x) = 1 + \frac{4}{x^2} \]
\[ f''(x) = -\frac{8}{x^3} \]

(a) What is the domain of \( f(x) \)?
(b) Find the horizontal and vertical asymptotes of the function, if any.

(c) On which intervals is the function increasing or decreasing?

(d) Find the local maximum and minimum values of the function, if any.

(e) On which intervals is the function concave up or concave down?
(f) Find the points of inflection of the function, if any.

(g) Sketch the graph of the function on the axes below.
3. (9 points) For the function \( f(x) = \sqrt{x - 4} \), find the Riemann sum on the interval \([5, 13]\) with \( n = 10 \), and right endpoint evaluation.
4. (10 points) An 11 inch by 17 inch rectangular sheet of cardboard will be formed into an open box by removing squares from the corners of the sheet and folding up the sides. Find the size of the squares to be removed from the corners so that the volume of the box is maximized.