The actual exam, which is scheduled for April 12, will consist of 4 parts of the type listed and exemplified below. Show your work in the space provided.

1. Derivative Tests.
   (a) Use the First Derivative Test and appropriate limits to classify the critical values of each function as non-extrema or local/global max/min.
      
      \[ y = x^4 - 8x^3 + 16x^2 \]
      
      \[ f(x) = \frac{x^2 - 2x + 4}{x - 2} \]

   (b) Use the Second Derivative Test and appropriate limits to classify the critical values of each function as non-extrema or local/global max/min.
      
      \[ s = -16t^2 + 4t + 100 \]
      
      \[ y = e^{-x^2 - 1/x^2} \]

   (c) Use the Fermat’s Theorem to find the maximum and minimum values of each function.
      
      \[ f(x) = \sqrt{2x - x^2} \]
      
      \[ y = \cos(\pi x) \text{ on } [0, 3/2] \]
Make a careful sketch of the graph of each function \( y = f(x) \) defined by a formula. Label any asymptotes, extrema (local min, local max, global min, global max), or inflection points (sidehill, plateau, cliff).

(a) \( y = x^{3/5} \)

(b) \( y = 1 - x^4 \)

(c) \( y = \frac{x^2 - 2x + 4}{x - 2} \)
3. Max/Min.
   (a) Write a fill-in-the-blank sentence that demonstrates the correct form of the answer to the following optimization problem. Do not solve the problem.

   An open box with a capacity of 36,000 cubic inches is needed. If the box must be twice as long as it is wide, what dimensions would require the least amount of material?

   (b) Solve the following optimization problem.

   You are designing an athletic field in the shape of a rectangle of length $x$ capped by semicircular regions of radius $r$ at the two ends. The entire field is to be bounded by a 400 meter track. What values for $x$ and $r$ will give the rectangle its greatest area $A$?
4. **Indefinite Integration.** Evaluate.

(a) \( \int 0 \, dx \)

(b) \( \int dt \)

(c) \( \int x^{-2} \, dx \)

(d) \( \int \sin(x) \, dx \)

(e) \( \int t \, dx \)

(f) \( \int t^2 (1 - 1/t) \, dt \)

(g) \( \int e^{\sin(x)} \cos(x) \, dx \)

(h) \( \int x^3 t^4 \, dt \)

(i) \( \int \frac{dx}{\sqrt{x}} \)

(j) \( \int \frac{x^2 - 1}{x^2} \, dx \)

(k) \( \int e^x \)

(l) \( \int (1 - \cos x) \, dx \)

(m) \( \int \frac{dx}{x} \)

(n) \( \int \cos x \, \sec x \, dx \)

(o) \( \int \left(2x^3 - \sqrt{x} + 5 \csc^2 x\right) \, dx \)