PART 1. This portion of the exam is to test basic calculation skills to a correct solution. The questions are multiple choice with “None of these” as a possible valid choice. No partial credit is given in this section, so work very carefully. Value: 7 points each

1. Given \( f(x) = -x^3 + 6x^2 - 9x + 1 \), the \( x \)-coordinates of any local maxima and minima are:
   
   A) Max:3; Min:−1 
   B) Max:3; Min:1 
   C) Max:−3; Min:−1 
   D) Max:1; Min:3 
   E) Max:−1; Min:3 
   F) Max:2; Min:3 
   G) Max:2; Min:1 
   H) Max:−3; Min:−2 
   F) None of these.

2. The second derivative of \( g(t) = \cos(4t^3 + 2) \), after simplification, is:
   
   A) \(-\cos(4t^3 + 2)\)  
   B) \(\cos(24t)\)  
   C) \(-12\sin(4t^3 + 2) - 144t^2\cos(4t^3 + 2)\)  
   D) \(-12t^2 \cos(4t^3 + 2) \sin(4t^3 + 2)\)  
   E) \(-24t \sin(4t^3 + 2) - 144t^4 \cos(4t^3 + 2)\)  
   F) \(-12 \sin(4t^3 + 2) + 144t^2 \cos(4t^3 + 2)\)  
   G) \(-12 \sin(4t^3 + 2) - 144t^2 \cos(4t^3 + 2)\)  
   H) \(-24t \sin(4t^3 + 2) - 12t^2 \cos(4t^3 + 2) \sin(4t^3 + 2)\)  
   I) None of these.
3. Use implicit differentiation to find \( \frac{dy}{dx} \) from the equation \( \sin(x + y) = xy \):

A) \( \frac{y - \cos(x + y)}{\cos(x + y) - x} \)  
B) \( \frac{-y - \cos(x + y)}{x} \)  
C) \( \frac{y - \cos(x + y)}{\cos(x + y)} \)  
D) \( -\frac{\cos(x + y)}{x^2} \)  
E) \( \frac{x \cos(x + y) - \sin(x + y)}{x^2} \)  
F) None of these.

4. Determine the horizontal (H) asymptotes and vertical (V) asymptotes for the function \( f(x) = \frac{2x^2 - 9x^3}{x^3 - 8} \):

A) V: \( x = 2 \), \( x = -2 \); H: \( y = 2 \)  
B) V: \( x = 2 \); H: \( y = 9/8 \)  
C) V: \( x = -2 \); H: \( y = -9 \)  
D) V: \( x = 2 \); H: \( y = -9 \)  
E) V: \( x = 2, x = -2 \); H: \( y = -9 \)  
F) V: None; H \( y = 0 \)  
G) V: \( x = 2 \); H: None  
I) None of these.

5. A rectangle whose base, \( b \), is twice its height, \( h \), is expanding (keeping the same proportion) in area at the rate of 10 \( ft^2/sec \). How fast is the height changing when the height is 5 feet?

A) \( \frac{dh}{dt} = \frac{-1}{2} \) ft/sec  
B) \( \frac{dh}{dt} = 200 \) ft/sec  
C) \( \frac{dh}{dt} = \frac{1}{2} \) ft/sec  
D) \( \frac{dh}{dt} = 2 \) ft/sec  
E) \( \frac{dh}{dt} = -2 \) ft/sec  
I) None of these.
Part 2: This portion of the exam will be graded on a partial credit basis. Answers without supporting work shown on the paper will receive NO credit. No calculators.

6. Let \( f(x) = 2\sqrt{x + 1} \).
   a) (8 points) Find the linear approximation \( L(x) \) to \( f(x) \) near the point \( a = 8 \).
   
   b) (8 points) Use the linear approximation to estimate the value of the number \( 2\sqrt{8.9} \).

7. (12 points) A straight wire 60in long is bent into an “L” shape. What is the shortest possible distance between the two ends of the bend wire?
8. (25 points) Consider the function \( g(x) = 2x + 1/x^2 \) which has derivatives given by

\[
g'(x) = 2x^3 - 1/x^3, \quad g''(x) = 6/x^4
\]

Carefully sketch the graph of \( g \), indicating very clearly the open intervals on which \( g \) is increasing and decreasing, the open intervals on which \( g \) is concave up and concave down, the local maxima and local minima, any inflection points, and any horizontal or vertical asymptotes. (Write down all pertinent facts here in a careful manner and use the axes provided for the graph.)