1. Do not open this booklet until you are told to do so.

2. Try not to separate the pages. If they do become separated, write your names on every page and point this out to your proctor when you hand it in.

3. Show an appropriate amount of work (including appropriate explanation) for each problem and not just the final answer. Include units in your answer where that is appropriate.

4. You may use any calculator functionally equivalent to a TI-83/TI-83+ or TI-84/TI-84+. Use of calculators with more functionality than these is not allowed.

5. Turn off all cell phones and pagers, and remove all headphones.

Proficiency Level on Module 1:___________

Proficiency Level on Module 2:___________

“Whatever you are, be a good one”
- Abraham Lincoln, born February 12, 1809
Module 1 - Problem 1

(I) The graph of $f$ is shown below. On the same plot, sketch the graphs of

$$g(x) = f(x + 1), \ h(x) = -g(x), \ j(x) = g(-x)$$
Module 1 - Problem 2

The figure below is the graph of the function $f'(x)$. In the problems which follow please explain your answers.

(a) Find the equation of the tangent to $f(x)$ at $x = 2$ if $f(2) = -0.2$

(b) What are the local minimum and maximum points of $f(x)$?

(c) On which interval is $f''(x) > 0$?

(d) On which interval is $f(x)$ concave down?

(e) Sketch a graph of $f$ on same axis as $f'$ above.
Module 1 - Problem 3
The figure below shows the graph of \( f \), \( f' \) and \( f'' \). Identify each curve and explain your choices.
Module 2 - Problem 1

(I) Use the graph of $f$ shown below and the function $g(x) = \sin(x)$ to evaluate the limit or explain why the limit doesn’t exist.

(II) What is $\lim_{x \to 1} f(x)$ if $\frac{1}{12} x^2 \leq f(x) \leq \frac{x^2}{2} - x + \frac{7}{12}$ for values of $x$ close to 1.
Module 2 - Problem 2

(I) Find constants $a$ and $b$ so that the polynomial $p(x) = x^3 + ax + b$ has a local minimum at $(2, -9)$

(II) Find

$$\int \left( x^3 - x^2 - 2x + \frac{5}{\sqrt{x}} \right)$$

(III) Find the equation of the line tangent to the curve $y = \sqrt{x} - \frac{2}{x}$ at $x = 4$. 
Module 2 - Problem 3

(I) Use the limit definition to find $f'(x)$ for $f(x) = x^2 + 2x + 1$

(II) An open box is made by cutting squares of side $w$ inches from the four corners of a sheet of cardboard that is 24" $\times$ 32" and then folding up the sides.

(a) Find $V(w)$ the volume of the box in terms of $w$. (Remember to draw the cardboard with the sides cut out to help you find the volume).

(b) What should $w$ be to maximize the volume of the box? (i.e. Find the local maximum point of $V(w)$ from part(a)).