This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of notes.

Do not share notes.

Graphing calculators are not allowed.

In order to receive credit, you must show your work. Do not do computations in your head. Instead, write them out on the exam paper.

Place a box around **YOUR FINAL ANSWER** to each question.

If you use a trial and error (or guess and check) method when an algebraic method is available, you will not receive full credit.

If you need more room, use the backs of the pages and indicate to the reader that you have done so.

Raise your hand if you have a question.
(12 points) Compute the following integrals. Give your answers in exact form.

(a) (4 points) \[ \int_{1}^{8} \frac{2x + 5}{\sqrt{x^2}} \, dx \]

(b) (4 points) \[ \int_{0}^{\pi} \frac{\sin t}{1 + \cos^2 t} \, dt \]

(c) (4 points) \[ \int y^3 \sqrt{y^2 - 7} \, dy \]
(10 points) A model car travels along a straight track. Its velocity is given by the function \( v(t) = \sin \left( \frac{\pi t^2}{9} \right) \), where \( t \) is in seconds and \( v \) is in feet per second. Use the Midpoint Rule and \( n = 6 \) to estimate the total distance traveled by the car between \( t = 1 \) and \( t = 4 \) seconds.

(6 points) Let \( f(x) = \int_0^{x^2-4x} e^{\sqrt{t}} \, dt \). Find the interval on which \( y = f(x) \) is increasing.
4. (10 points) Compute the total area bounded by the curves $y = x^2$ and $y = x^3 - 6x^2 + 10x$. 
(12 points) Let $R$ be the region in the first quadrant bounded by $y = \frac{9}{x^2}$ and $y = 13 - 4x$. Set up the following integrals.

DO NOT EVALUATE.

(a) (6 points) Set up an integral that computes the volume of the solid generated by rotating $R$ around the $x$-axis using the method of washers.

(b) (6 points) Set up an integral that computes the volume of the solid generated by rotating $R$ around the line $x = -2$ using the method of shells.