(1) No books and notes are allowed.
(2) Show your work in details.

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(1) (15 pts) Find $f \circ g \circ h$, where
\[ f(x) = \sqrt{x - 1}, \quad g(x) = x^2 + 2, \quad h(x) = x + 3. \]

(2) (15 pts) Find the absolute maximum and minimum of the function $f(x) = x^3 - 3x + 1$ on $[0, 3]$. 
(3) (20 pts) Compute the following limits if they exist.

(a) \( \lim_{x \to \infty} \frac{5 - 2x^2}{x^3 - 2x + 3} \)

(b) \( \lim_{x \to \infty} (\sqrt{x^2 + x} - x) \)

(c) \( \lim_{x \to 0} \sqrt{x^3 + x^2} \sin \frac{\pi}{x} \) (Hint: use Squeeze theorem)

(d) \( \lim_{\theta \to 0} \frac{\cos \theta - 1}{\sin \theta} \)
(4) (20 pts) Find the tangent line to the curve $x^2 + 2xy - y^2 + x = 2$
   at the point (1, 2).
(5) (15 pts) Use Intermediate Value Theorem and Mean Value Theorem to show that the equation $2x - 1 - \sin x = 0$ has exactly one solution.
(6) (15 pts) Compute the following integrals.

(a) \[ \int_{0}^{1} (x^2 + \sqrt{x}) \, dx \]

(b) \[ \int \sqrt{1 - 3x} \, dx \]

(c) \[ \int_{1}^{2} \frac{\cos(\pi / x)}{x^2} \, dx \]
(7) (40 pts) Sketch the graphs of each of the following functions. You must follow the steps A-H as in Sec. 4.5: (A) Domain (B) Intercepts (C) Symmetry (D) Asymptotes (E) Intervals of Increases and Decreases (F) Local maximum and minimum (G) Concavity and points of inflection (H) Sketch the curve.

(a) \( f(x) = x^3 + x \)
(b) $f(x) = x\sqrt{5 - x}$
(8) (20 pts) A cylindrical can without the top is made to contain $V$ m$^3$ of liquid. Find the dimensions that will minimize the cost of the metal to make the can. Suppose that the cost is proportional to the surface area of the can.
(9) (20 pts) A poster is to have an area of 180 in² with 1-inch margins at the bottom and sides and a 2-inch margin at the top. What dimensions will give the largest printed area?
(10) (20 pts) A baseball diamond is a square with side 90 ft. A batter hits the ball and runs toward first base with a speed of 24 ft/s.

(a) At what rate is his distance from second base decreasing when he is 30 ft from first base?

(b) At what rate is his distance from third base increasing at the same moment?