

PRINT NAME: _____

STUDENT ID NUMBER: _____

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

Problem	Score	Problem	Score
1 (15)		2 (15)	
3 (20)		4 (20)	
5 (15)		6 (15)	
7 (40)		8 (20)	
9 (20)		10 (20)	
Total (200)			

(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) $\lim_{x \rightarrow \infty} \frac{5 - 2x^2}{x^3 - 2x + 3}$

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

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

(d) $\lim_{\theta \rightarrow 0} \frac{\cos \theta - 1}{\sin \theta}$

4

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

(c) $\int_1^2 \frac{\cos(\pi/x)}{x^2} dx$

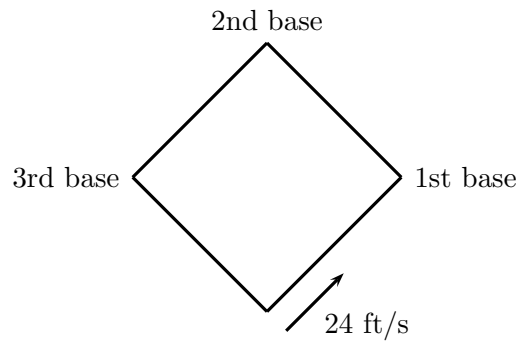
- (7) (40 pts) Sketch the graphs of each of the following functions. You must follow the steps A-H as in Sec. 4.5: (A) Domain (B) Intercepts (C) Symmetry (D) Asymptotes (E) Intervals of Increases and Decreases (F) Local maximum and minimum (G) Concavity and points of inflection (H) Sketch the curve.
- (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 m³ 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 in^2 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?