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

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(1) (10 points) Let $c$ be a constant and

\[ f(x) = \begin{cases} 
  x - c & \text{if } x \geq 1 \\
  c - 3x & \text{if } x < 1
\end{cases} \]

For what values of $c$ is $f(x)$ continuous everywhere on $(-\infty, \infty)$? You must justify your answer. Also sketch the graph of $f(x)$ when it is continuous.
(2) (15 points) 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 the second base decreasing when he is halfway to first base?

(b) At what rate is his distance from third base increasing at the same moment?
(3) (10 points) Find the tangent line of the curve \( y = \sqrt{x} \) at the point \((4, 2)\). (Do not use the laws of derivative to find the slope. Compute it using its definition.)
(4) (20 points) Find the following limits if they exist.

(a) \( \lim_{x \to -3} \frac{x^2 - x - 12}{x + 3} \)

(b) \( \lim_{x \to \pi/4} \frac{\sin 2x}{\tan x} \)

(c) \( \lim_{x \to 0} \frac{\sin(3x)}{\sin(2x)} \)
(d) \( \lim_{{x \to 1}} \left( \frac{1}{x - 1} - \frac{2}{x^2 - 1} \right) \)

(e) \( \lim_{{x \to 4}} \frac{|x + 4|}{x + 4} \)
(5) (20 points) Find the first derivatives of the following functions.

(a) \( f(t) = \sqrt{t^2} + 2\sqrt{t^3} \)

(b) \( f(x) = \frac{x^5}{x^3 - 1} \)

(c) \( f(x) = \sin(\cos(\sqrt{x})) \)

(d) \( f(x) = \sqrt{x\sqrt{x}} \)
(6) (10 points) Let $F(x) = \sqrt{f(x)}$ and $G(x) = f(\sqrt{x})$. If $f(1) = 2$ and $f'(1) = 3$, find $F'(1)$ and $G'(1)$. 
(7) (15 points) Find the tangent line of the curve
\[ 2 \sin x \cos y = 1 \]
at the point \((\pi/4, \pi/4)\).