

**Question 1:**

(a)[4 points] Let  $f(x) = \frac{1}{\sqrt{x+2}}$  and  $g(x) = \frac{1}{x^2}$ . Find and simplify  $(g \circ f)(x)$  and state the domain.

(b)[4 points] Let  $f(x) = \frac{1}{x}$ . Evaluate and simplify  $\frac{f(1+h) - f(1)}{h}$ .

(c)[2 points] Let  $H(x) = 5\sqrt{\tan x} - \tan^5 x$ . Find functions  $f$  and  $g$  such that  $H = f \circ g$ .

**Question 2:**

(a)[5 points] Evaluate  $\lim_{x \rightarrow 3} \frac{\sqrt{x+22} - 5}{x-3}$ .

(b)[5 points] Evaluate  $\lim_{t \rightarrow 4} \frac{t^2 - t - 12}{t^2 - 6t + 8}$ .

Question 3:

(a)[5 points] Evaluate  $\lim_{x \rightarrow -2} \frac{\left(\frac{1}{4x} + \frac{1}{8}\right)}{x + 2}$ .

(b)[5 points] Evaluate  $\lim_{x \rightarrow -2^-} \frac{x^2 - 2}{x - 2}$ .

**Question 4:**

(a)[5 points] Evaluate  $\lim_{x \rightarrow 0} \frac{\sin(2x)}{6x - \sin(3x)}$ .

(b)[5 points] Use the Intermediate Value Theorem to show that the equation  $\sqrt{\frac{x}{\pi}} = \cos\left(\frac{x}{2}\right)$  has a solution on the interval  $[0, \pi]$ .

**Question 5:**

(a)[5 points] Determine  $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right)$ . The Squeeze Theorem may help here.

(b)[5 points] Determine if the function

$$f(x) = \begin{cases} \frac{1+x^3}{\sqrt{x+3}}, & \text{if } x \geq 1 \\ 4x^{17} - x - 2, & \text{if } x < 1 \end{cases}$$

is continuous at  $x = 1$ .