

1. [5 pts] The point $P = (0.5, 2)$ lies on the graph of $y = f(x) = \frac{1}{x}$. If Q is the point $(x, 1/x)$, find the slope of the secant line connecting the points P and Q when $x = 0.55$.

2. [25 pts] Compute the following limits: (a) $\lim_{x \rightarrow 5^-} \frac{6}{x-5}$ (b) $\lim_{x \rightarrow 1} \frac{\sqrt{x} - x^2}{1 - \sqrt{x}}$
 (c) $\lim_{x \rightarrow 2\pi/3} (\sin x + \cos x)^2 - 2 \sin x \cos x$ (d) $\lim_{t \rightarrow 1} \frac{t^3 - t}{t^2 - 1}$ (e) $\lim_{x \rightarrow 3^+} \frac{|x-3|}{3-x}$

3. [10 pts] Use the *definition of limit* (either the definition given in class or the δ - ϵ definition in the book) to show that $\lim_{x \rightarrow 5} 6x - 1 = 29$.

4. [10 pts] Given that $\lim_{x \rightarrow 3} f(x) = 7$ $\lim_{x \rightarrow 7} g(x) = 12$ $\lim_{x \rightarrow 3} h(x) = -2$.

Compute (a) $\lim_{x \rightarrow 3} f(x)^2 + h(x)^2$ (b) $\lim_{x \rightarrow 3} \left[\frac{g(f(x))}{3h(x)} \right]^3 + 1$

5. [10 pts] Given the function

$$g(x) = \begin{cases} c^2 - x^2 & \text{if } x < 4 \\ cx - 21 & \text{if } x \geq 4. \end{cases}$$

(a) State the values of $\lim_{x \rightarrow 4^-} g(x)$ and $\lim_{x \rightarrow 4^+} g(x)$.

(b) What value(s) of the constant c makes $g(x)$ continuous on $(-\infty, \infty)$?

6. [10 pts] Use the Intermediate Value Theorem to prove there is a root of the polynomial $x^3 + 3x + 1$. Find an interval which contains this root.

7. [15 pts] Use the *limit definition of derivative* to find $f'(a)$ for $f(x) = \frac{x}{2x-1}$. (No credit for any other method.)

8. [8 pts] Use the fact that the derivative of the function $f(x) = x^3 - x^2 + x - 1$ is $f'(x) = 3x^2 - 2x + 1$ to find the equation of the tangent line to the curve $y = f(x)$ at the point $(1, f(1))$.

9. [7 pts] If a ball is thrown into the air with a velocity of 40 ft/s, its height (in feet) after t seconds is given by $y = 40t - 16t^2$. Find the velocity when $t = 2$.