

1. (20pts) Consider $g(x) = \frac{-3}{(x+4)^2}$
- (a) (6pts) Is $g(x)$ even, odd, or neither? Justify your answer mathematically.
 - (b) (6pts) State the domain and range of $g(x)$ in interval notation. No explanation is required.
 - (c) (8pts) Sketch a graph of $y = g(x)$. Be sure to **clearly label** the coordinates of all asymptotes and intercepts on your graph.
2. (18pts) Evaluate the following derivatives.
- (a) (10pts) Compute $f'(2)$ if $f(x) = 7x^2$. Use the *limit definition of the derivative*.
 - (b) (8pts) Find $h'(-1)$ if $h(t) = -(8t + t^3)^2$. Use any differentiation rules.
3. (20pts) Consider the function $f(x) = \tan x - \csc x$
- (a) (12pts) Evaluate $f'(x)$ when $x = \frac{\pi}{3}$
 - (b) (8pts) Find the equation of the line tangent to the graph of $y = f(x)$ at $x = \frac{\pi}{3}$. You may leave your answer in point-slope form if you wish.
4. (18pts) For the following problem, consider the function

$$f(x) = \begin{cases} \frac{x^2 + 4x - 21}{x^2 - x - 6} & \text{if } x < 3 \\ 2 & \text{if } x = 3 \\ \frac{x - 3}{\sqrt{3x} - 3} & \text{if } x > 3 \end{cases}$$

- (a) (6pts) State the mathematical definition of continuity.
 - (b) (12pts) Use your definition from part (a) to determine if the function $f(x)$ is continuous when $x = 3$.
5. (24pts) For this problem, consider the rational function:

$$R(x) = \frac{-x^2 + 4x + 12}{x^2 + 8x + 12}$$

- (a) (16pts) For the following, justify your answers by calculating appropriate limits. You **may not** use dominance of powers arguments.
 - i. Find all horizontal asymptotes of $R(x)$ if any.
 - ii. Find all vertical asymptotes of $R(x)$ if any.
 - iii. Find all removable discontinuities of $R(x)$ if any.
- (b) (8pts) Find $R'(0)$.