

1. [12 pts] In your bluebook, write **T** if the statement is true and write **F** if the statement is false. No justification required and no partial credit given.

(a) If x is any real number, then $\sqrt{x^2} = x$.

(b) If $r(x) = \frac{p(x)}{q(x)}$ is a rational function and $q(b) \neq 0$, then $\lim_{x \rightarrow b} r(x) = r(b)$.

(c) All continuous functions are differentiable for all x values in their domain.

(d) Let $f(x)$ be a function such that $f(a) < 0 < f(b)$ with $a < b$. Then the graph of f must cross the x -axis somewhere between a and b .

2. [15 pts] Let $g(x) = \frac{x^3 + 5x^2 + 6x}{2x^3 - 2x^2 - 4x}$.

(a) Write the domain of $g(x)$ in interval notation.

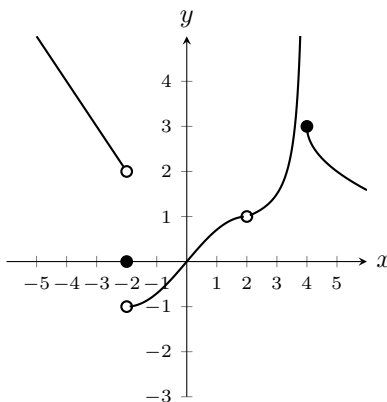
(b) Find all horizontal asymptotes of $g(x)$. Justify your answer using limits.

(c) Find all vertical asymptotes of $g(x)$. Justify your answer using limits.

3. [16 pts] Using the graph of $f(x)$ in the figure below, compute the following:

a. $\lim_{x \rightarrow -2^-} f(x)$ b. $\lim_{x \rightarrow -2^+} f(x)$ c. $\lim_{x \rightarrow -2} f(x)$ d. $\lim_{x \rightarrow 2} f(x)$

e. $f(2)$ f. $\lim_{x \rightarrow 4^-} f(x)$ g. $\lim_{x \rightarrow 4^+} f(x)$ h. $\lim_{x \rightarrow 4} f(x)$



CONTINUED ON THE BACK

4. (a) [6 pts] What three conditions must be met for a function $f(x)$ to be continuous at the point a ?
 (b) [18 pts] Determine where the following functions are continuous, writing your answer using interval notation.

i. $f(x) = \sin(\cos(\sin x)) - \cos(\sin(\cos x))$

ii. $f(x) = \frac{x+2}{|x+2|}$

iii. $f(x) = \begin{cases} \frac{\cos 5x}{x} & x \neq 0 \\ 1 & x = 0 \end{cases}$

5. [12 pts] Find the following limits.

(a) $\lim_{x \rightarrow \pi/4} \frac{\sin 2x}{2x}$

(b) $\lim_{x \rightarrow -\infty} \cos \frac{1}{x}$

6. Let $f(x) = \frac{1}{x+2}$. If you need to compute any derivatives, you must use the definition.

- (a) [5 pts] Find the average rate of change of f over the interval $[3, 8]$. Simplify your answer. What geometric property of the graph of $f(x)$ does this average rate of change represent?
 (b) [6 pts] Find the instantaneous rate of change of f at $x = 2$. What geometric property of the graph of $f(x)$ does this instantaneous rate of change represent?
 (c) [6 pts] Find the slope/intercept form of the tangent line to the graph of $y = f(x)$ at the point $x = 2$.
 (d) [4 pts] The graph of $f(x)$ is shown in the figure below. In your bluebook, sketch a graph of $f'(x)$.

