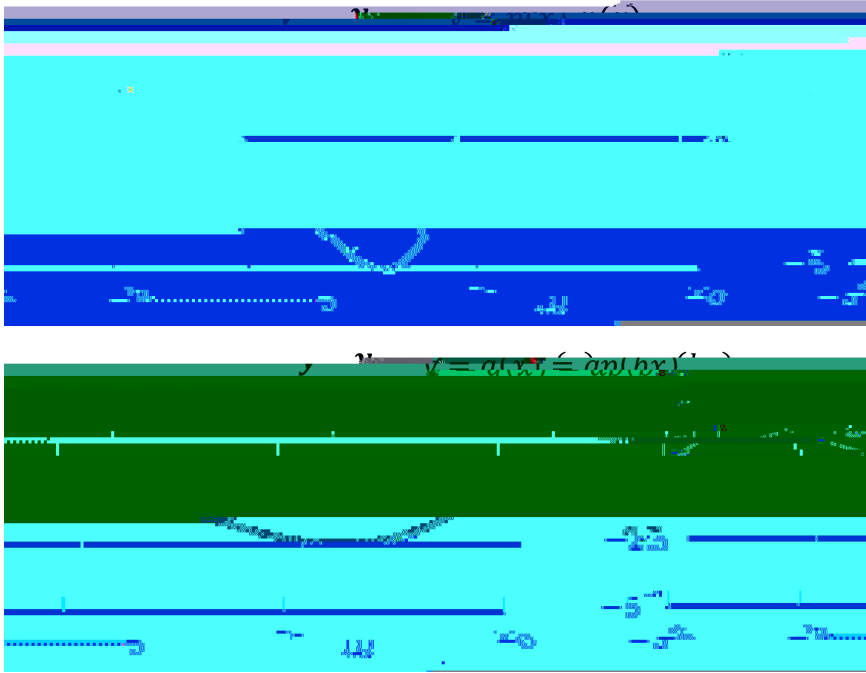


1. (20 pts) Parts (a) and (b) are not related.

(a) For $f(x) = \frac{1}{x-1}$ and $g(x) = \frac{1}{2-x}$, identify the composite function $(f \circ g)(x)$ and its domain.

Express the domain in interval form.

(b) The graphs below depict the functions $y = p(x)$ and $y = q(x)$, where q is a transformation of p of the form $q(x) = ap(bx)$. Find the values of a and b .



2. (30 pts) Evaluate the following limits. Support your answers by stating theorems, definitions, or other key properties that are used.

(a) $\lim_{x \neq 0} \frac{\sin(5x)}{x^2 + 2x}$

$$(b) \lim_{x \rightarrow 2} \frac{\frac{\rho}{x+1} - \frac{\rho}{3}}{x^2 + x - 6}$$

(c) $\lim_{x \rightarrow 0} x^4 \cos \frac{1}{2x}$

3. (30 pts) Consider the rational function $r(x) = \frac{3x^2 + 21x + 30}{x^2 + 2x - 15}$.

- (a) Identify all values of x at which $r(x)$ is discontinuous. At each such x value, explain why the function is discontinuous there.

(b) Identify the type of discontinuity associated with each x value identified in part (a). Support those classifications by evaluating the appropriate limits.

(c) Find the equation of each vertical asymptote of $y = r(x)$, if any exist. Support your answer in terms of your work in part (b).

- (d) Find the equation of each horizontal asymptote of $y = r(x)$, if any exist. Support your answer by evaluating the appropriate limits. (*Reminder: You may not use L'Hôpital's Rule or dominance of powers arguments to evaluate limits on this exam.*)

4. (20 pts) Parts (a) and (b) are not related.

(a) For what value of a is the following function $u(x)$ continuous at $x = 4$? Support your answer using the definition of continuity, which includes evaluating the appropriate limits.

$$u(x) = \begin{cases} \frac{x-4}{x^2-16} & ; x < 4 \\ \frac{1}{a-x} & ; x \geq 4 \end{cases}$$

- (b) Use the Intermediate Value Theorem to establish that the equation $v(x) = x - 2 \cos x = 0$ has at least one solution on the interval $(0; \pi/3)$. Verify that all conditions for applying the IVT to this particular problem are satisfied prior to using it.

END OF TEST

Your Initials _____

ADDITIONAL BLANK SPACE

If you write a solution here, please clearly indicate the problem number.