

Math 229, Section 9

Home take Examen C

Instructor: Racovitan Mihai

Due: Monday, 09/25/06

Name _____

Z-number _____

Instructions: Answer all questions in the space provided. You must show all work in order to receive full credit.

Ex. 1) Let $f(x) = \frac{1}{x^2 - 1}$ and $g(x) = \sqrt{2x + 1}$.

(a) (6 pts.) Find $f \circ g$.

(b) (6 pts.) Find the domain of $f \circ g$.

Ex. 2) (8 pts.) Express the following expression in the form $H(x) = (f \circ g \circ h)(x)$.
Emphasize the functions f , g and h . Check your answer .

$$H(x) = \cos^2(\sqrt{x} + 9)$$

Ex. 3) (6 pts. each) Is there a number a such that

$$\lim_{x \rightarrow 1} \frac{3x^2 - 2ax + a - 2}{x^2 + 4x - 5}$$

exists? If so, find the value a and the value of the limit.

Ex. 4) (a) (4 pts.) State the (ε, δ) -definition of the limit $\lim_{x \rightarrow a} f(x) = L$.

(b) (4 pts.) Use the (ε, δ) -definition of the limit to prove the following limit .

$$\lim_{x \rightarrow -1} (2 - 3x) = 5$$

Ex. 5) (4 pts. each) Let $f(x)$ be a function .

(a) State the difference quotient definition of the derivative of $f(x)$.

(b) Find the derivative of the function $f(x) = \frac{1}{x-1}$ by using the difference quotient definition of the derivative.

- (c) Find an equation of the tangent line to the curve $y = f(x) = \frac{1}{x-1}$ at the point $(-1, -\frac{1}{2})$.

Ex. 6) (6 pts. each) Evaluate each of the following limits. You must show how you evaluated the limit (the simplifications and the laws) to get full credit. Do not use the (ε, δ) -definition of the limit.

(a) $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$

(b) $\lim_{h \rightarrow 0} \frac{\sqrt{2h+9} - 3}{2h}$

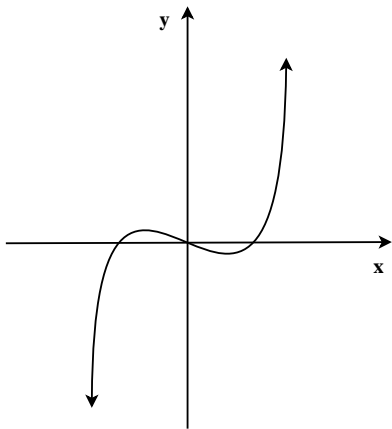
(c) $\lim_{x \rightarrow 1} \frac{3x+2}{x^2 - 3x + 4}$

(d) $\lim_{x \rightarrow 0} \frac{1}{2x(x^2 + 1)}$

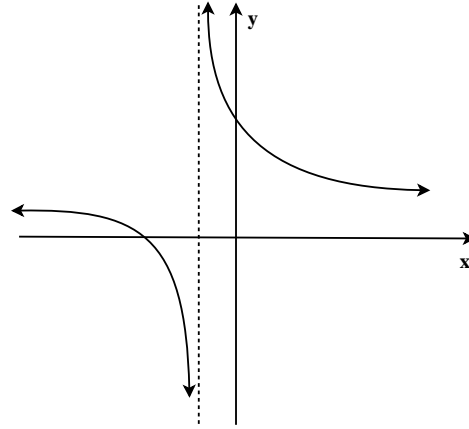
Ex. 7) (6 pts.) Prove that $\lim_{x \rightarrow 0} (\sqrt{x^2 + x}) \sin\left(\frac{\pi}{x}\right) = 0$.

Ex. 8) (8 pts.) Let $f(x) = \sqrt{3x + 1} - 4x^2 + 1$. Show that there is a root of $f(x)$ (i.e. a value of x with the property that $f(x) = 0$) on the interval $[0, 1]$.

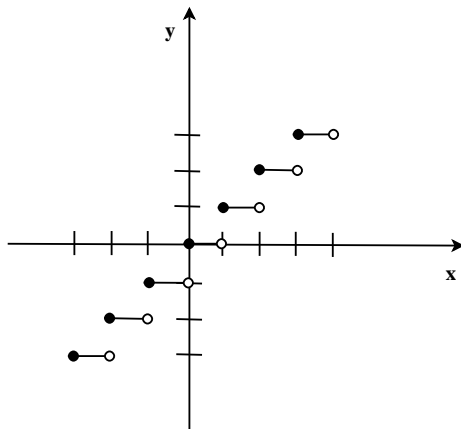
Ex. 9) (4 pts. each) Match the following graphs to the choice that fits the best.



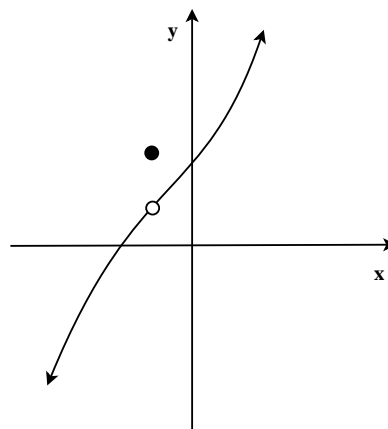
a) _____



b) _____



c) _____



d) _____

- i) continuous everywhere
- ii) jump discontinuity
- iii) infinite discontinuity
- iv) removable discontinuity
- v) essential discontinuity (other than infinite discontinuity)
- vi) nothing applies