

SHOW WORK and JUSTIFY your answer to all parts using appropriate calculus! NO CALCULATORS!!

1. Consider the function such that $f(x) = \frac{x^2 - 1}{x^2 - x - 2}$

A) Find the domain of f . Use appropriate interval notation in your answer. 3 pts.

domain of $f =$ _____

B) Determine all roots of f . 2 pts.

roots of $f:$ _____

C) Is f continuous on $(-\infty, \infty)$?.....**Yes** or **No** ? (**circle one!**) 10 pts.

Determine the (x, y) coordinates where the graph of f has a *removable discontinuity (hole)*: $(x, y) =$ _____

Also, determine the equations of any vertical asymptotes: _____

Do a few steps of limit calculations below to fill in the answer boxes that indicate the behavior of the graph of f on each side of the vertical asymptote by considering appropriate limits:

1. $\lim_{x \rightarrow \boxed{}} f(x) \rightarrow \boxed{}$

2. $\lim_{x \rightarrow \boxed{}} f(x) \rightarrow \boxed{}$

D) Showing appropriate supporting limit calculations, determine the equations of any horizontal asymptotes: 3 pts.

Answer: _____

E) Determine $f'(x)$ and the intervals where the graph of f is increasing and where it is decreasing. 5 pts.

$f'(x) =$

Decreasing: _____

Increasing: _____

F) Determine $f''(x)$ and the intervals where the graph of f is concave up and where it is concave down. 5 pts.

$f''(x) =$

Concave down: _____

Concave up: _____

G) *Circle True or False for each.* 3 pts.

- i) The function f has no critical points.....**True** or **False** ?
- ii) The function f has no local or global extrema.....**True** or **False** ?
- iii) The graph of f has no inflection points.....**True** or **False** ?

H) On the back of this sheet, draw a detailed graph of f showing all features asked for in parts A)—F). 4 pts.