

# MATH 141: Quiz 7

Name: key

Directions:

- \* Show your thought process (commonly said as "show your work") when solving each problem for full credit.
- \* If you do not know how to solve a problem, try your best and/or explain in English what you would do.
- \* Good luck!

1. Find all local minima and maxima of the function

$$f(x) = \frac{x^2 + 1}{x}$$

First Derivative Test.

① find potential locations of local extrema.

$$f'(x) = \frac{x \cdot \frac{d}{dx}[x^2 + 1] - (x^2 + 1) \frac{d}{dx}[x]}{x^2}$$

$$= \frac{x \cdot 2x - (x^2 + 1) \cdot 1}{x^2}$$

$$= \frac{2x^2 - x^2 - 1}{x^2}$$

$$= \frac{x^2 - 1}{x^2}$$

$$x^2 \cdot \frac{(x-1)(x+1)}{x^2} = 0 \cdot x^2$$

$$(x-1)(x+1) = 0$$

$$(x = -1, 1)$$

$$= \frac{(x-1)(x+1)}{x^2}$$

② solve  $f'(x) = 0$

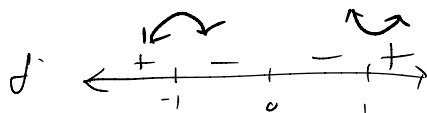
③ find where  $f'(x)$  DNE.

Denominator can't be 0 so

$$x^2 = 0$$

$$(x = 0)$$

② Discriminate the potential locations of local extrema with sign diagram



$$f'(-2) = \frac{(-2-1)(-2+1)}{+} = +$$

$$f'(\frac{1}{2}) = \frac{- \cdot +}{+} = -$$

$$f'(-\frac{1}{2}) = \frac{- \cdot +}{+} = -$$

$$f'(2) = \frac{+ \cdot +}{+} = +$$

$$\therefore, \text{local maximum of } f(-1) = \frac{(-1)^2 + 1}{-1} = \frac{1+1}{-1}$$

$$= -2$$

$$\text{local minimum of } f(1) = \frac{1^2 + 1}{1} = 2$$

2. Determine the intervals of concavity of

$$f(x) = 2x^3 - 9x^2 + 12x - 3$$

① Find inflection points

$$f'(x) = 6x^2 - 18x + 12$$

$$f''(x) = 12x - 18 = 6(2x - 3)$$

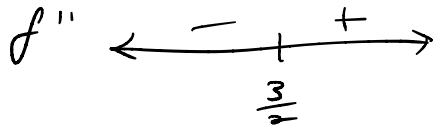
② solve  $f''(x) = 0$

$$6(2x - 3) = 0$$

$$2x - 3 = 0$$

$$x = \frac{3}{2}$$

② Sign diagram of  $f''$


$$f'' \quad \leftarrow \quad - \quad \mid \quad + \quad \rightarrow$$
$$\quad \quad \quad \frac{3}{2}$$

$$f''(0) = 6 \cdot (2 \cdot 0 - 3) = -$$

$$f''(2) = 6 \cdot (2 \cdot 2 - 3) = +$$

③ find where  $f''(x)$  DNE

not applicable,  $f''(x)$  has domain  $\mathbb{R}$ .

Concave up on  $(\frac{3}{2}, \infty)$

Concave down on  $(-\infty, \frac{3}{2})$