Name: Richard

QUIZ 15

MATH 200
October 10, 2024

1. This problem concerns the function $f(x) = (x^2 - 2)\, e^{2x}$.

(a) Find the critical points of f.

$$f'(x) = (2x - 0)e^{2x} + (x^2-2)e^{2x} \cdot 2$$
$$= 2e^{2x}(x + x^2 - 2)$$
$$= 2e^{2x}(x^2 + x - 2)$$
$$= 2e^{2x}(x - 1)(x + 2) = 0$$

always positive

Critical points: $\boxed{x = 1 \qquad x = -2}$

(b) Find the intervals on which f increases and on which it decreases.

-2		1		
+ + +	+ + + +	+ + + +	$2e^{2x}$
− − −	− − − −	+ + + +	$x-1$
− − −	+ + + +	+ + + +	$x+2$
+ + +	− − − −	+ + + +	$f'(x) = 2e^{2x}(x-1)(x+2)$

f increases on $(-\infty, -2)$ and $(1, \infty)$
f decreases on $(-2, 1)$

(c) Use your answer from part (a) to identify the locations (x values) of any local extrema of f.

By 1st derivative test

local max at $x = -2$
local min at $x = 1$

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1. This problem concerns the function $f(x) = e^{(x^4-8x^2)}$.

(a) Find the critical points of f.

$$f'(x) = e^{x^4-8x^2}(4x^3-16x)$$
$$= e^{x^4-8x^2}\,4x(x^2-4)$$
$$= \underbrace{4e^{x^4-8x^2}}_{\text{always positive}} \cdot x(x-2)(x+2)$$

Critical points $\boxed{x=0 \quad x=2 \quad x=-2}$

(b) Find the intervals on which f increases and on which it decreases.

	-2	0	2	
+ +	+ + + + +	+ + + + +	+ + + +	$4e^{x^4-8x}$
− − −	− − − −	+ + + + +	+ + + +	x
− − −	− − −	− − − −	+ + + +	$x-2$
− − −	+ + + +	+ + + +	+ + + +	$x+2$
− −	+ + + +	− − −	+ + +	$f'(x)=4e^{x^4-8x} \cdot x(x-2)(x+2)$

$\boxed{\begin{array}{l} f \text{ increases on } (-2,0) \text{ and } (2,\infty) \\ f \text{ decreases on } (-\infty,-2) \text{ and } (2,\infty) \end{array}}$

(c) Use your answer from part (a) to identify the locations (x values) of any local extrema of f.

By 1st derivative test:

$\boxed{\begin{array}{l} \text{Local max at } x=0 \\ \text{Local min at } x=-2 \text{ and } x=2 \end{array}}$