Name: Richard

QUIZ 15

MATH 200
October 16, 2025

1. This problem concerns the function $f(x) = 5 - x^3e^x$.

(a) Find the critical points of f.

$$f'(x) = 0 - 3x^2e^x - x^3e^x$$
$$= x^2e^x(-3 - x)$$
$$= -x^2e^x(3 + x) = 0$$

$x = 0$ $\quad$ $x = -3$

$\boxed{\text{Critical Points: } 0, -3}$

	-3		0	
$- - -$		$- - - - - -$		$- - - - - - -$ $\quad -x^2e^x$
$- - -$		$+ + + + +$		$+ + + + + + +$ $\quad (3+x)$
$+ + + +$		$- - - - -$		$- - - - -$ $\quad f'(x) = -x^2e^x(3+x)$

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

f increases on $(-\infty, -3)$
f decreases on $(-3, \infty)$

(c) Use your answer from part (a) to identify the locations (x values) of any local extrema of f. For each such x, say whether there is a local max or local min there.

By 1st derivative test there is a local max at $x = -3$. No local minimum

Name: Richard

QUIZ 15

MATH 200
October 16, 2025

1. This problem concerns the function $f(x) = 3\sqrt[3]{x} - x$. $= 3x^{1/3} - x$

(a) Find the critical points of f.

$$f'(x) = 3 \cdot \frac{1}{3} x^{-2/3} - 1$$

$$f'(x) = x^{-2/3} - 1$$

$$f'(x) = \frac{1}{\sqrt[3]{x}^{2}} - 1 = 0$$

(f' is undefined at $x=0$ (division by 0) so $x=0$ is a critical point)

$$\frac{1}{\sqrt[3]{x}^{2}} = 1$$

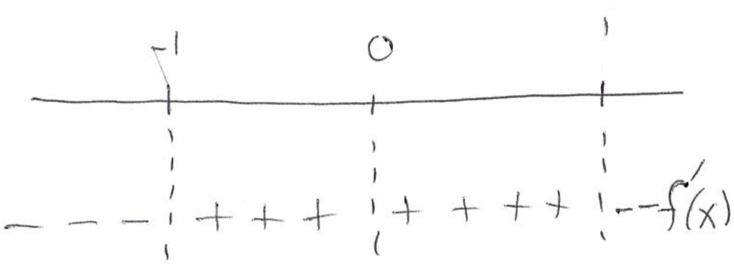
$$1 = \sqrt[3]{x}^{2}$$

$$\sqrt[3]{x} = \pm 1$$

$$\boxed{x = \pm 1}$$

$\boxed{\text{Critical points: } -1, 0, 1}$

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



Test points:

-8	$f'(-8) = \frac{1}{\sqrt[3]{-8}^{2}} - 1 = \frac{1}{4} - 1 < 0$
$-\frac{1}{8}$	$f'(-\frac{1}{8}) = \frac{1}{\sqrt[3]{-1/8}^{2}} - 1 = 4 - 1 > 0$
$\frac{1}{8}$	$f'(\frac{1}{8}) = \frac{1}{\sqrt[3]{1/8}^{2}} - 1 = 4 - 1 > 0$
8	$f'(8) = \frac{1}{\sqrt[3]{8}^{2}} - 1 = \frac{1}{4} - 1 < 0$

f decreases on $(-\infty, -1) \cup (1, \infty)$

f increases on $(-1, 1)$

(c) Use your answer from part (a) to identify the locations (x values) of any local extrema of f. For each such x, say whether there is a local max or local min there.

Local min at $x = -1$

Local max at $x = 1$