

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

(a) Find the critical points of  $f$ .

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

always positive

Critical points:

$x = 1$

$x = -2$

(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 1<sup>st</sup> derivative test

local max at  $x = -2$

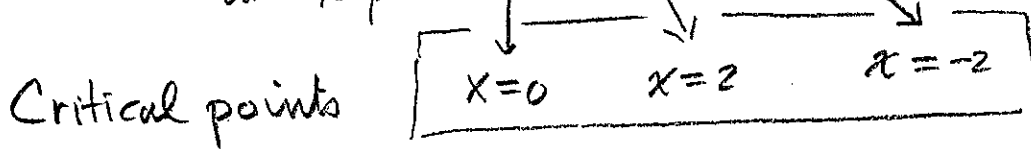
local min at  $x = 1$

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

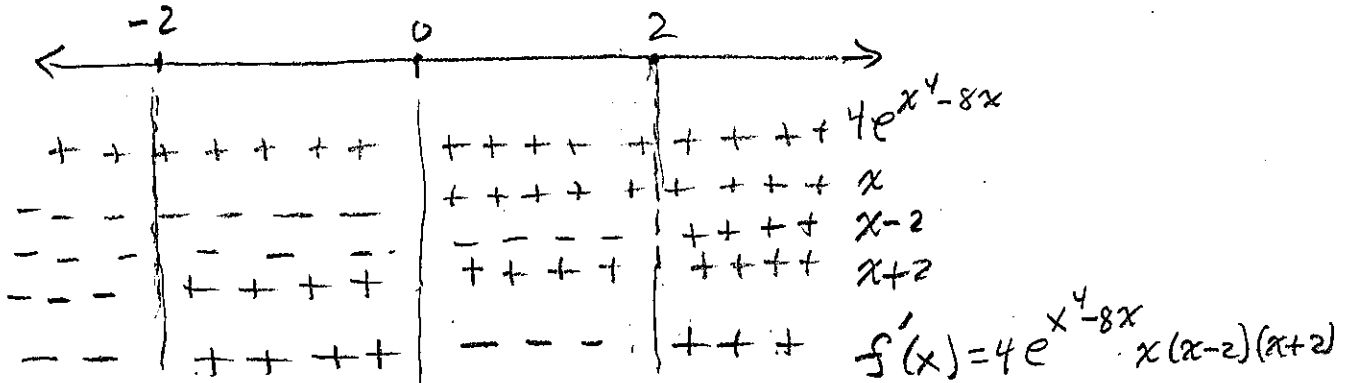
(a) Find the critical points of  $f$ .

$$\begin{aligned} f'(x) &= e^{x^4 - 8x^2} (4x^3 - 16x) \\ &= e^{x^4 - 8x^2} 4x(x^2 - 4) \\ &= 4e^{x^4 - 8x^2} \cdot x(x-2)(x+2) \end{aligned}$$

always positive



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



$f$  increases on  $(-2, 0)$  and  $(2, \infty)$   
 $f$  decreases on  $(-\infty, -2)$  and  $(0, 2)$

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

By 1<sup>st</sup> derivative test:

Local max at  $x=0$   
 Local min at  $x=-2$  and  $x=2$