② Find all local extrema of $f(x) = \frac{3}{2}x^4 - x^6$

$$f'(x) = 6x^3 - 6x^5 = 6x^3(1-x^2) = 6x^3(1-x)(1+x)$$

$\boxed{\text{critical points: } x=0 \quad x=1 \quad x=-1}$

	-1	0	1	
$- - - -$	$- - -$	$+++$	$++++$	$6x^3$
$++++$	$+++$	$+++$	$- - - -$	$(1-x)$
$- - - -$	$+++$	$+++$	$++++$	$(1+x)$
$+++$	$- - -$	$+++$	$- - -$	$f'(x) = x^3(1-x)(1+x)$

f has a local max of $f(-1) = -\frac{1}{2}$ at $x = -1$
f has a local max of $f(1) = -\frac{1}{2}$ at $x = 1$
f has a local min of $f(0) = 0$ at $x = 0$

⑧ Find all local extrema of $f(x) = e^{x^3-12x}$

$$f'(x) = e^{x^3-12x}(3x^2-12) = e^{x^3-12x}3(x^2-4) = e^{x^3-12x}\cdot 3(x-2)(x+2)$$

From this we read of the $\boxed{\text{critical points: } x=2 \text{ \& } x=-2}$

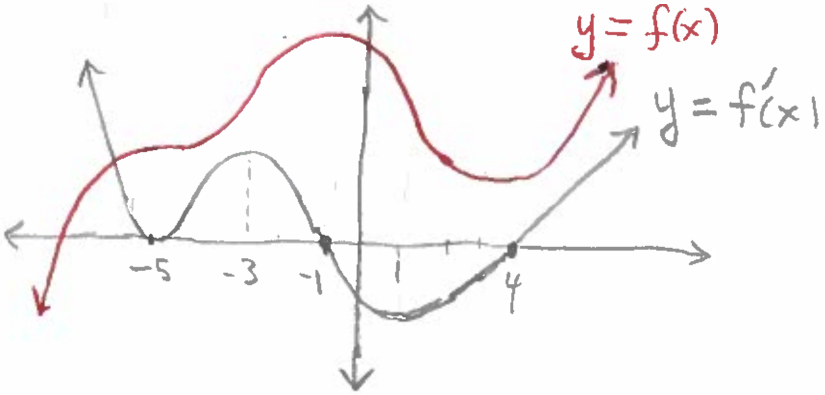
	-2	2	
$+++$	$+++++++$	$++$	e^{x^3-12x}
$- - -$	$- - - - - -$	$++$	$3(x-2)$
$- - -$	$++++++$	$++$	$(x+2)$
$+++$	$- - - - - -$	$++$	$f'(x) = e^{x^3-12x}3(x-2)(x+2)$

f has a local max of $f(-2) = e^{16}$ at $x = -2$

f has a local min of $f(2) = e^{-16}$ at $x = 2$

Chapter 31

20 The graph of the derivative of $f(x)$ is sketched.



(a) f ~~increases~~ on $(-\infty,-5)\cup(5,-1)\cup(4,\infty)$ because $f'(x)$ is positive on these intervals

(b) f decreases on $(-1,4)$ because $f'(x)$ is negative on that interval.

(c) Critical points of f: $\boxed{-5, -1, 4}$ because these make $f'(x)=0$.

(d) f has a local max. at $x=-1$ because f' changes from + to - there.

(e) f has a local min. at $x=4$ because f' changes from - to + there

(f) A possible graph of f is sketched above.