Applying the First Derivative Test
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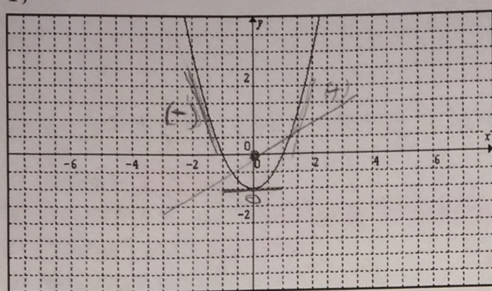
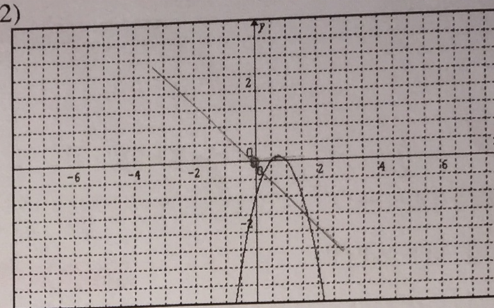
I. Use the graph to find the intervals in which the graph of f(x) is increasing or decreasing and sketch the derivative

1)



2)



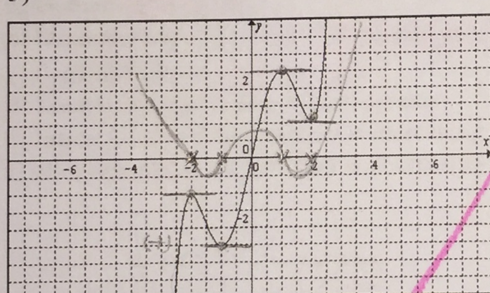
1)
f(x) is
increasing: $(0,\infty)$

f(x) is
decreasing: $(\infty,0)$

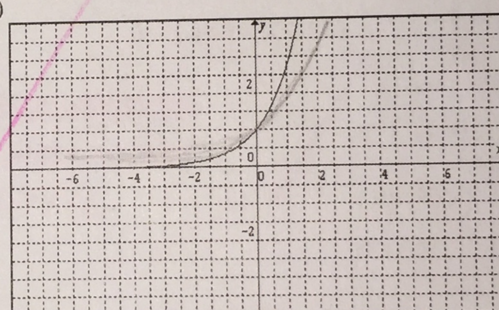
2)
f(x) is
increasing: $(-\infty,0)$

f(x) is
decreasing: $(0,\infty)$

3)



4)



$y = e^{2x}$
$y' = 2e^{2x}$

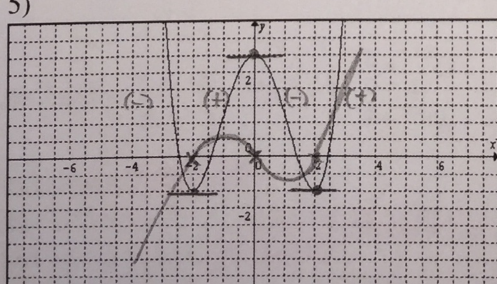
3)
f(x) is
increasing: $(-\infty,2)(-1,1)(2,\infty)$

f(x) is
decreasing: $(-2,-1)(1,2)$

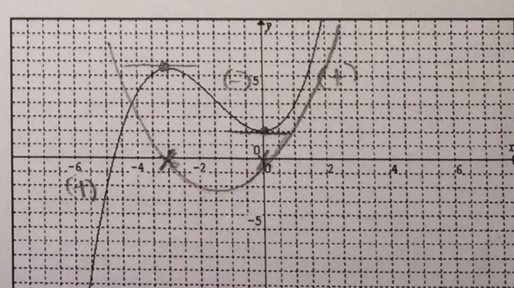
4)
f(x) is increasing: $(-\infty,\infty)$

f(x) is decreasing: X

5)



6)



5)
f(x) is
increasing: $(-2,0)(2,\infty)$

f(x) is
decreasing: $(-\infty,-2)(0,2)$

6)
f(x) is increasing: $(-\infty,-3)(0,\infty)$

f(x) is decreasing: $(-3,0)$

• For maximum and minimum "x" is critical value and "y" is the critical value in the original

Replace in derivative for intervals in incre/decre

II. For each of the following functions find:

1) $f(x)=x^3-6x^2+9x+1$

a) Domain $\boxed{(-\infty,\infty)}$

b) Derivative of $f(x)$ $\boxed{f'(x)=3x^2-12x+9}$

c) Critical Values $\boxed{x=3,1}$

d) Maximum and minimum coordinates $\boxed{\text{min } (3,1) \quad \text{max } (1,5)}$

e) Intervals where the function is increasing $\boxed{(-\infty,1)\cup(3,\infty)}$

f) Intervals where the function is decreasing $\boxed{(1,3)}$

$0=3x^2-12x+9$

$0=3(x^2-4x+3)$

$0=(x-3)(x+1)$

1   3

intervals $(-\infty,1)$ $(1,3)$ $(3,\infty)$

	0	2	4
sign $f'(x)$	+	−	+
in/de	in	de	in

max min

2) $y=\dfrac{1}{3}x^3+\dfrac{1}{2}x^2-6x+8$ $\quad -9+\frac{9}{2}+18+8$

a) Domain $\boxed{(-\infty,\infty)}$

b) Derivative of $f(x)$ $\boxed{f'(x)=x^2+x-6}$

c) Critical Values $\boxed{x=-3,2}$

d) Maximum and minimum coordinates $\boxed{\text{min } (2,2/3) \quad \text{max } (-3,43/2)}$

e) Intervals where the function is increasing $\boxed{(-\infty,-3),(2,\infty)}$

f) Intervals where the function is decreasing $\boxed{(-3,2)}$

$0=x^2+x-6$

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

−3   2

$(-\infty,-3)$ $(-3,2)$ $(2,\infty)$

intervals $(-\infty,-3)$ $(-3,2)$ $(2,\infty)$

	−4	1	3
sign $f'(x)$	+	−	+
inc/dc	in	de	in

max min

3) $f(x)=x^3+x^2-5x-5$ $\quad \frac{-125}{27}+\frac{25}{9}-\frac{25}{3}-5$

a) Domain $\boxed{(-\infty,\infty)}$

b) Derivative of $f(x)$ $\boxed{f'(x)=3x^2+2x-5}$

Deriva = 0 → c) Critical Values $\boxed{x=-5/3,1}$

d) Maximum and minimum coordinates $\boxed{\text{min } (1,-8) \quad \text{max } (-5/3,\ -40/27)}$

e) Intervals where the function is increasing $\boxed{(-\infty,-5/3)\cup(1,\infty)}$

f) Intervals where the function is decreasing $\boxed{(-5/3,1)}$

$0=3x^2+2x-5$

$0=(3x+5)(x-1)$

−5/3   1

$(-\infty,-5/3)$ $(-5/3,1)$ $(1,\infty)$

int. $(-\infty,-5/3)$ $(-5/3,1)$ $(1,\infty)$

	−2	0	2
sign $f'(x)$	+	−	+
in/de	in	de	in

max min

4) $f(x)=x^4-8x^2+1$ $\quad 16-32-2=-15 \quad 2=-15 \quad 0=1$

a) Domain $\boxed{(-\infty,\infty)}$

b) Derivative of $f(x)$ $\boxed{f'(x)=4x^3-16x}$

c) Critical Values $\boxed{x=\pm 2,0}$

d) Maximum and minimum coordinates $\boxed{\text{min } (-2,-15)\ (2,-15) \quad \text{max } (0,1)}$

e) Intervals where the function is increasing $\boxed{(-2,0)\ (2,\infty)}$

f) Intervals where the function is decreasing $\boxed{(-\infty,-2)\ (0,2)}$

$0=4x^3-16x$

$0=4x(x^2-16)$

$0=x(x-4)(x+4)$

−2   0   2

$(-\infty,-2)$ $(-2,0)$ $(0,2)$ $(2,\infty)$

int	−3	1	1	3
sign $f'(x)$	−	+	−	+
in/de	dc	in	de	in

max

min min

5) $g(x)=\dfrac{x^4}{4}-\dfrac{x^3}{3}-3x^2+1$ $\quad \frac{81}{4}-9-27+1 \quad -2=-13/3 \quad 0=1 \quad 3=-59/4$

a) Domain $\boxed{(-\infty,\infty)}$

b) Derivative of $f(x)$ $\boxed{f'(x)=x^3-x^2-6x}$

c) Critical Values $\boxed{x=3,-2,0}$

d) Maximum and minimum coordinates $\boxed{\text{min } (0,1) \quad \text{max } (-2,-13/3)\ (3,-59/4)}$

e) Intervals where the function is increasing $\boxed{(-\infty,-2)\ (0,3)}$

f) Intervals where the function is decreasing $\boxed{(-2,0)\ (3,\infty)}$

$0=x^3-x^2-6x$

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

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

−2   0   3

$(-\infty,-2)$ $(-2,0)$ $(0,3)$ $(3,\infty)$

int	−3	−1	1	4
sign $f'(x)$	+	−	+	−
in/de	in	de	in	de

max max

min