Homework Guide

AP Calculus

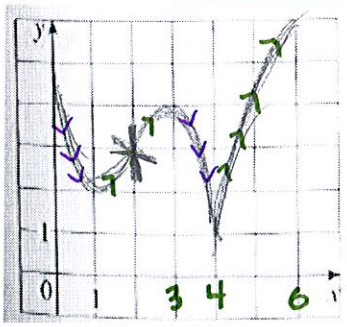
Name_____Pd.___

Intervals of Inc/Dec & Concavity (1)

Day 2 Curve Sketching

1-2: Use the given graph of f to find the following

1.



f(x)

a.) The open intervals of which f is increasing. (1,3) & (4,6)

b.) The open intervals of which f is decreasing. (0,1) & (3,4)

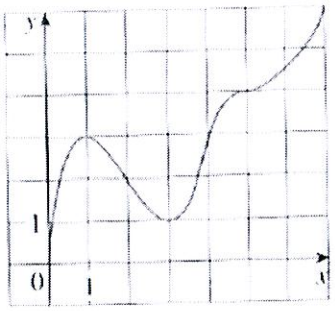
c.) The open intervals of which f is concave upward. (0,2)

d.) The open intervals of which f is concave downward. (2,4) & (4,6)

e.) The coordinates of the points of inflection. X (2,3)

Because changes from up to down there

2.



a.) The open intervals of which f is increasing.

b.) The open intervals of which f is decreasing.

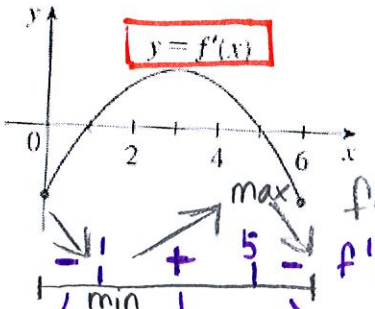
c.) The open intervals of which f is concave upward.

d.) The open intervals of which f is concave downward.

e.) The coordinates of the points of inflection.

3-4: The graph of the derivative f' of a function f is shown.

3.



max

f(x)

− 1 + 5 −

f'(x)

min

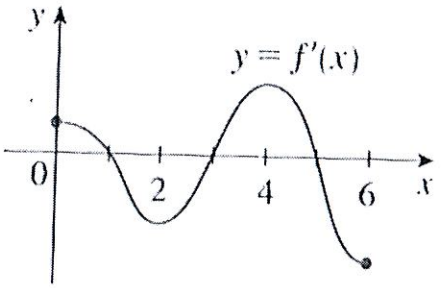
Below Above Below

a.) On what intervals is f increasing or decreasing? increasing (1,5)
decreasing (0,1) & (5,6)

b.) At what values of x does f have a local maximum or minimum?

minimum: X=1
maximum: X=5

4.



a.) On what intervals is f increasing or decreasing?

b.) At what values of x does f have a local maximum or minimum?

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5. In each part state the x-coordinate of the inflection points of f. Give a reason for your answers.

a.) The curve is the graph of f.

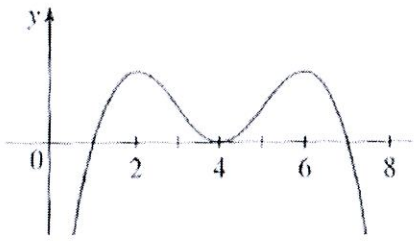
f changes concanty at X= 3 & X=5

b.) The curve is the graph of f'.

slopes of f' = f'' change at X= 2, 4, & 6

c.) The curve is the graph of f''.

f'' changes signs at X=1 & X=7



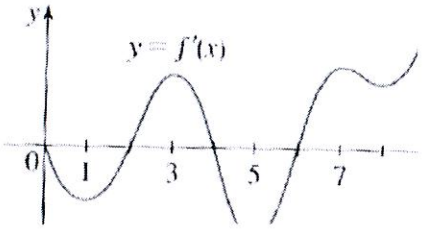
6. The graph of the first derivative f' of a function f is shown.

a.) On what intervals is f increasing or decreasing? Explain.

b.) At what values of x does f have a local maximum or minimum? Explain.

c.) On what intervals is f concave upward or concave downward? Explain.

d.)What are the x-coordinates of the inflection points of f? Why?

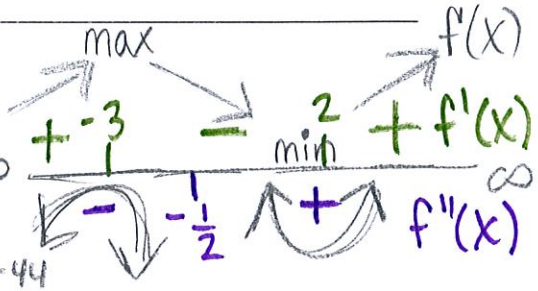


7-10: Find a)-c) for each of the following:

7. $f(x) = 2x^3 + 3x^2 - 36x$

a.)Find the intervals on which f is increasing or decreasing.

increasing: $(-\infty, -3)$ & $(2, \infty)$ decreasing $(-3, 2)$



b.)Find the local maximum and minimum values of f.

max (-3, 81) minimum (2, -44)

$f(-3) = 2(-27) + 3(9) - 36(-3) = 81$ $f(2) = 2(8) + 3(4) - 36(2) = -44$

c.)Find the intervals of concavity and the inflection points.

Concave up $(-\frac{1}{2}, \infty)$ Concave down $(-\infty, -\frac{1}{2})$ Point of Inflection $(-\frac{1}{2}, \frac{37}{2})$

$f'(x) = 6x^2 + 6x - 36$

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

$0 = 6(x-2)(x+3)$

$x = 2 \quad x = -3$

$f'(-4) = 6(-)(-) = +$

$f'(0) = 6(-)(+) = -$

$f'(3) = 6(+)(+) = +$

$f''(x) = 12x + 6$

$0 = 12x + 6$

$12x = -6$

$x = -\frac{1}{2}$

$f''(-1) = -$

$f''(0) = +$

$f(-\frac{1}{2}) = 2(-\frac{1}{8}) + 3(\frac{1}{4}) - 36(-\frac{1}{2})$

$= \frac{37}{2}$

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8. $f(x)=4x^3+3x^2-6x+1$

a.)Find the intervals on which f is increasing or decreasing.

b.)Find the local maximum and minimum values of f.

c.)Find the intervals of concavity and the inflection points.

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9. $f(x)=x^4-2x^2+3$

a.)Find the intervals on which f is increasing or decreasing.

increasing: $(-1,0)\&(1,\infty)$ dec: $(-\infty,-1)\&(0,1)$

b.)Find the local maximum and minimum values of f.

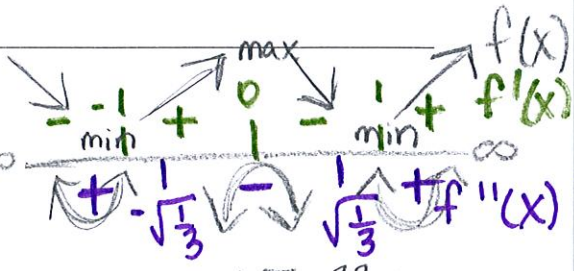
max: $(0,3)$ $f(0)=3$ min: $(\pm1,2)$ $f(\pm1)=1-2+3=2$

c.)Find the intervals of concavity and the inflection points.

concave up: $(-\infty,-\sqrt{1/3})$ $(\sqrt{1/3},\infty)$ concave down: $(-\sqrt{1/3},\sqrt{1/3})$

POI $=(\pm\sqrt{1/3},\frac{22}{9})$

$f(\pm\sqrt{1/3})=\frac{1}{9}-2(\frac{1}{3})+3=\frac{22}{9}$



$f'(x)=4x^3-4x$

$0=4x(x^2-1)$

$4x=0$ $x^2-1=0$

$x=0$ $x=\pm1$

$f'(-2)=(-)(+)$

$f'(-\frac{1}{2})=(-)(-)$

$f'(\frac{1}{2})=(+)(-)$

$f'(2)=(+)(+)$

$f''(x)=12x^2-4$

$0=12x^2-4$

$x^2=1/3$

$x=\pm\sqrt{1/3}$

$f''(-1)=+$

$f''(0)=-$

$f''(1)=+$

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10. $f(x)=x^3-12x^2+36x$

a.)Find the intervals on which f is increasing or decreasing.

b.)Find the local maximum and minimum values of f.

c.)Find the intervals of concavity and the inflection points.

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Answers:

1 a $(1,3)$ & $(4,6)$ b $(0,1)$ & $(3,4)$ c $(0,2)$ d $(2,4)$ & $(4,6)$ e $(2,3)$

2 a $(0,1)$ & $(3,7)$ b $(1,3)$ c $(2,4)$ & $(5,7)$ d $(2,4)$ & $(5,7)$ e $(2,2),(4,3)$ & $(5,4)$

3 a Increasing: $(1,5)$
Decreasing: $(0,1)$ & $(5,6)$

b Minimum: $x=1$
Maximum: $x=5$

4 a Increasing: $(0,1)$ & $(3,5)$
Decreasing: $(1,3)$ & $(5,6)$

b Minimum: $x=3$
Maximum: $x=1$ & $x=5$

5 a $x=3$ & $x=5$ b $x=2,4,$ & 6 c $x=1$ & $x=7$

6 a Increasing: $(2,4)$ & $(6,9)$
Decreasing: $(0,2)$ & $(4,6)$

b Minimum: $x=4$
Maximum: $x=2$ & 6

c Concave Up: $(1,3),(5,7),$ & $(8,9)$
Concave Down: $(0,1),(3,5),$ & $(7,8)$

d $x=1,3,5,7,$ & 8
Because at those x-values $f''(x)$ changes signs.

7 a Increasing: $(-\infty,-3)$ & $(2,\infty)$
Decreasing: $(-3,2)$

b Minimum: (*where*,min*imum value*) $(2,-44)$
Maximum: (*where*,max*imum value*) $(-3,81)$

c Concave Up: $\left(-\frac{1}{2},\infty\right)$
Concave Down: $\left(-\infty,\frac{1}{2}\right)$

Point of Inflection
$\left(-\frac{1}{2},\frac{37}{2}\right)$

8 a Increasing: $(-\infty,-1)$ & $\left(\frac{1}{2},\infty\right)$
Decreasing: $\left(-1,\frac{1}{2}\right)$

b Minimum: (*where*,min*imum value*) $\left(\frac{1}{2},-\frac{3}{4}\right)$
Maximum: (*where*,max*imum value*) $(-1,6)$

c Concave Up: $\left(-\frac{1}{4},\infty\right)$
Concave Down: $\left(-\infty,-\frac{1}{4}\right)$

Point of Inflection
$\left(-\frac{1}{4},\frac{21}{8}\right)$

9 a Increasing: $(-1,0)$ & $(1,\infty)$
Decreasing: $(-\infty,-1)$ & $(0,1)$

b Minimum: (*where*,min*imum value*) $(\pm1,2)$
Maximum: (*where*,max*imum value*) $(0,3)$

c Concave Up: $\left(-\infty,-\sqrt{\frac{1}{3}}\right)$ & $\left(\sqrt{\frac{1}{3}},\infty\right)$
Concave Down: $\left(-\sqrt{\frac{1}{3}},\sqrt{\frac{1}{3}}\right)$

Point of Inflection
$\left(\pm\sqrt{\frac{1}{3}},\frac{22}{9}\right)$

10 a Increasing: $(-\infty,2)$ & $(6,\infty)$
Decreasing: $(2,6)$

b Minimum: (*where*,min*imum value*) $(6,0)$
Maximum: (*where*,max*imum value*) $(2,32)$

c Concave Up: $(4,\infty)$
Concave Down: $(-\infty,4)$

Point of Inflection
$(4,16)$