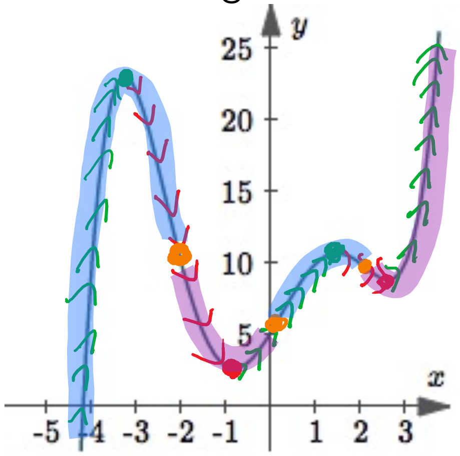
Name: Answers Date: Period:

Preparation for Tomorrow's Quiz

Answer the following based on the graph below:



a) State the intervals where the function is increasing and decreasing.

Increasing: $x<-3.5$ $-1<x<1$ $x>2.5$

Decreasing: $-3.5<x<-1$ $1<x<2.5$

b) State the x values where the function has a relative minimum or relative maximum

min $x=-1$ $x=2.5$ Max: $x=-3.5$ $x=1$

c) Estimate any points of inflection

$x=-2$ $x=0$ $x=2$

d) State the intervals where the function is concave up and concave down.

Concave Down: $-\infty<x<-2$ $0<x<2$

Concave up: $-2<x<0$ $x>2$

Determine whether the statements are true or false and provide a reason for your answer:

a) The first derivative is zero when x=-3.5

True: The tangent line is horizontal (zero slope)

b) The second derivative is zero when x=-3.5

False: The graph is concave down so $f''(x)$ is negative at $x=-3.5$

c) There are three points of inflection on the interval -5<x<3

True, the graph changes inflection 3 times

d) The first derivative is positive when x=2

False, the slope is negative

e) The second derivative is negative when x=-1

False, the graph is concave up at $x=-1$ so $f''(x)$ is positive

f) There are two relative minimums from -5<x<3

True, there are two points where the graph goes from decreasing to increasing

g) A graph of the first derivative will have 4 x-intercepts.

True, there are four points where the graph of $f(x)$ has a horizontal tangent line

h) The slope of the tangent line is increasing at x=-3

False, the graph is concave down so the slope is decreasing.

i) This function has an absolute maximum

False, as $x\to\infty$, $f(x)\to\infty$

For the functions $f(x)$ shown below:

a) State any relative extrema (min or max)

b) State the intervals where the function is increasing and decreasing.

c) State any points of inflection.
d) Determine the intervals where the function is concave up and concave down.
e) Use the information from parts a) – d) to create an accurate sketch of the function:

Level 2: (Try this one if you wan to build up to a level 3): $f(x) = x^2 - 12x + 27$

$f(x) = x^2 - 12x + 27$

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

$2x - 12 = 0$

$f''(x) = 2$

Always positive so always concave up

Level 3: $g(x) = -5x^4 - 7x^3 + 6x^2$

Level 3: $h(x) = \frac{1}{3}x^3 + x^2 + 3x$

Level 4: $p(x) = \frac{1}{3x-1}$

Level 4: $m(x) = x - 4\sqrt{x}$

Level 2:

$f(x) = x^2 - 12x + 27$

x	y
6	-9

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

$2x - 12 = 0$

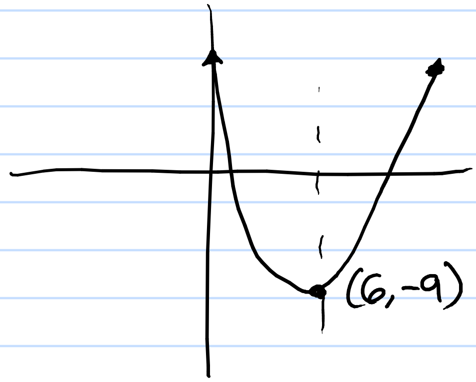
$x = 6$

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

Relative min at $x=6$

$f''(x) = 2$

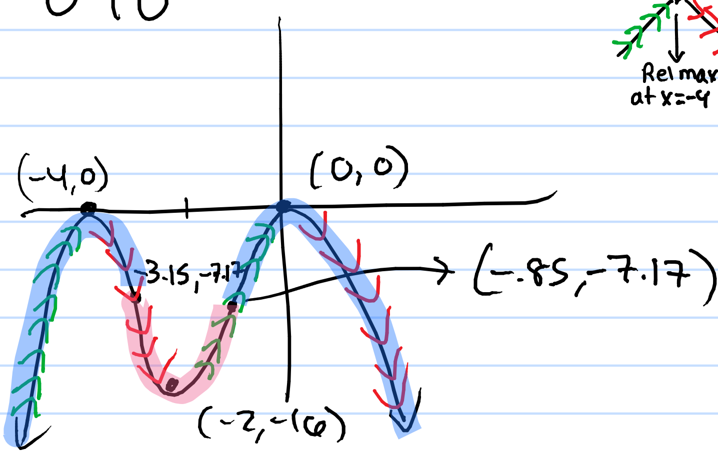
Always positive, so always concave up.



Level 3:

$g(x) = -x^4 - 8x^3 - 16x^2$

x	g(x)
-4	0
-3.15	-7.17
-2	-16
-.85	-7.17
0	0



$g'(x) = -4x^3 - 24x^2 - 32x$

$-4x(x^2 + 6x + 8)$

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

$x=0 \quad x=-4 \quad x=-2$

x		-4		-2		0	
$g'(x)$	$+$	0	$-$	0	$+$	0	$-$

Rel max at $x=-4$

Rel min at $x=-2$

Rel max

Increasing:
$x < -4$
$-2 < x < 0$

Decreasing
$-4 < x < -2$
$x > 0$

$g''(x) = -12x^2 - 48x - 32$

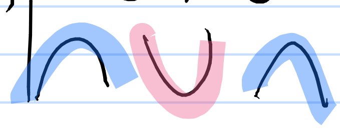
$-4(3x^2 + 12x + 8)$

graph to find zeroes

$x = -3.15$

$x = -.85$

x		-3.15		-.85	
$g''(x)$	$-$	0	$+$	0	$-$



Concave Down:
$x < -3.15$
$x > -.85$

Concave Up:
$-3.15 < x < -.85$

Level 3:

$h(x) = \frac{1}{3}x^3 + x^2 - 3x$

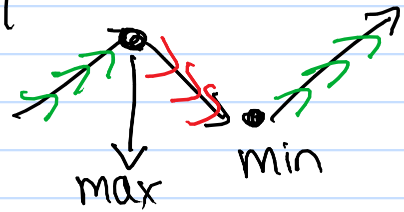
x	
-3	9
-1	3.66
1	-1.66

$h'(x) = x^2 + 2x - 3$

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

$x = -3 \quad x = 1$

x		-3		1	
$h'(x)$	+	0	−	0	+



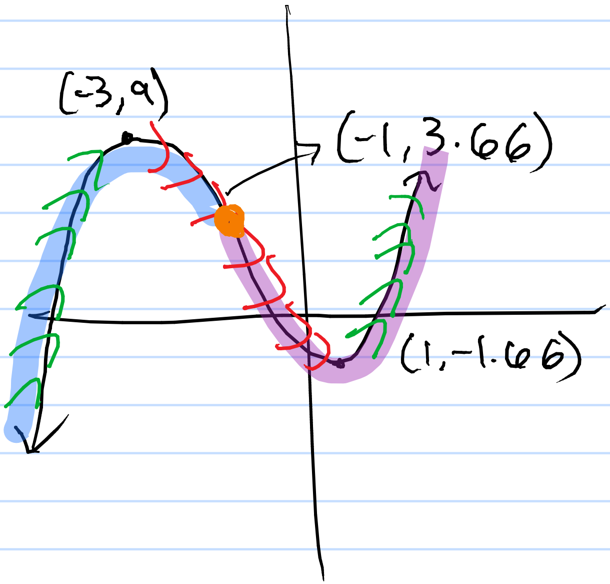
$h''(x) = 2x + 2$

$0 = 2x + 2$

$x = -1$

x		-1	
$h''(x)$	−	0	+

POI



Increasing: $x < -3 \quad x > 1$

Decreasing: $-3 < x < 1$

Concave Up: $x > 1$

Concave Down: $x < -1$