Name ______________________________ Average Rate of Change HW

1) Function f(x) is shown in the table below. Find the average rate of change over the following intervals:

x	f (x)
1	21
2	18
3	16
4	10
5	8

a) $2 \le x \le 3$

Same as $[2,3]$

$(2,18)$ $(3,16)$

$\frac{16-18}{3-2} = \frac{-2}{1} = -2$

b) $4 \le x \le 5$

Same as $[4,5]$

$(4,10)$ $(5,8)$

$\frac{8-10}{5-4} = \frac{-2}{1} = -2$

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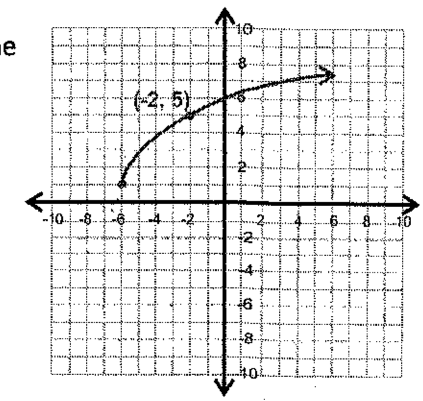
2) Given the graph of the function g(x), find average rate of change over the interval $[-6,-2]$



$(-6,1)$ $(-2,5)$

$\frac{5-1}{-2--6} = \frac{4}{4} = 1$

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you can use direct or synthetic substitution to evaluate or use tables of calculator

3) Given the function $j(x) = 5x^2 - 3x + 2$, find the average rate of change over the interval $[0,4]$

$j(0) = 5(0^2) - 3(0) + 2$
$= 0 - 0 + 2$
$= 2$

$(0,2)$

$j(4) = 5(4)^2 - 3(4) + 2$
$= 5(16) - 12 + 2$
$= 80 - 12 + 2$
$= 70$

$(4,70)$

$\frac{70-2}{4-0} = \frac{68}{4} = 17$

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4) A ball thrown in the air has a height of $h(t) = -16t^2 + 48t + 5$ feet after t seconds. Find the average rate of change of h between t = 1 and t = 3.

$(1,37)$ $(3,5)$

$\frac{5-37}{3-1} = \frac{-32}{2} = -16$

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      -16   48    5
           -16   32
  1 | -16   32 | 37

      -16   48    5
           -48    0
  3 | -16    0 |  5
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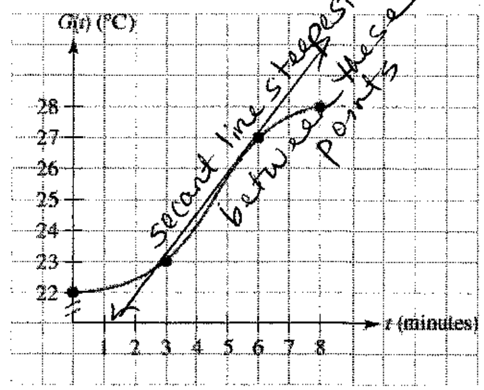
5) Nelson took a summer job, for five weeks, where he received a weekly salary plus tips. His take-home pay is recorded in the table at the right. What was the average rate of change in his weekly take-home pay from week 1 to week 5?

Week	Weekly Salary
1	\$60
2	\$65
3	\$72
4	\$75
5	\$80

$(1,60)$ $(5,80)$

$\frac{80-60}{5-1} = \frac{20}{4} = $ \$5 per week

6) John Quinn is relaxing on his vacation and measuring the temperature, in degrees Celsius, of the hotel's heated pool, as represented by the graph below. During which interval was the average rate of change in temperature the greatest?



1) 0 minutes to 3 minutes (0, 22) (3, 23)

2) 3 minutes to 6 minutes (3, 23) (6, 27)

3) 6 minutes to 8 minutes (6, 27) (8, 28)

1. $\frac{23-22}{3-0} = \frac{1}{3}$ 2. $\frac{27-23}{6-3} = \frac{4}{3}$ 3. $\frac{28-27}{8-6} = \frac{1}{2}$

This was greatest average rate of change

7) An astronaut drops a rock off the edge of a cliff on the Moon. The distance, d(t), in meters, the rock travels after t seconds can be modeled by the function $d(t) = 0.6t^2$. What is the average speed, in meters per second, of the rock between 5 and 12 seconds after it was dropped?

$d(5) = .6(5)^2$ $d(12) = .6(12)^2$

$d(5) = 15$ $d(12) = 86.4$

$\frac{86.4-15}{12-5} = \frac{71.4}{7} = \boxed{10.2 \text{ m/sec}}$

8) Functions f(x), g(x) and h(x) are shown in the table below. Order the functions from greatest to least by average rate of change on the interval $[0,3]$. f(x), h(x), g(x)

x	f(x)
0	-3
1	0
2	3
3	6

(0, -3) (3, 6)

$\frac{6--3}{3-0} = \frac{9}{3} = 3$

$g(x) = x^2 - x + 1$

$g(0) = 0^2 - 0 + 1$

$g(0) = 1$

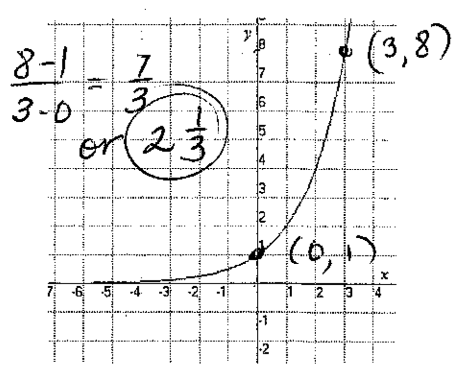
$g(3) = 3^2 - 3 + 1$

$g(3) = 9 - 3 + 1$

$g(3) = 7$

$\frac{7-1}{3-0} = \frac{6}{3} = 2$

h(X)



$\frac{8-1}{3-0} = \frac{7}{3}$ or $2\frac{1}{3}$

9) A new bacterial spray is tested on a bacteria culture. The table shows the population, P, of the bacterial culture t minutes after the spray is applied. Identify the two minute interval with the greatest decrease of bacteria. ____________. What is the average rate of change on this interval? ____________.

t (min)	P
0	800
1	799
2	782
3	737
4	652
5	515
6	314
7	125
8	37

Greatest Average Rate of Change (decrease by 195/minute)

between 0 and 2 minutes: decreased by 9/min

between 1 and 3 minutes: " 31/min

2 and 4 minutes: 65/min

3 and 5 111/min

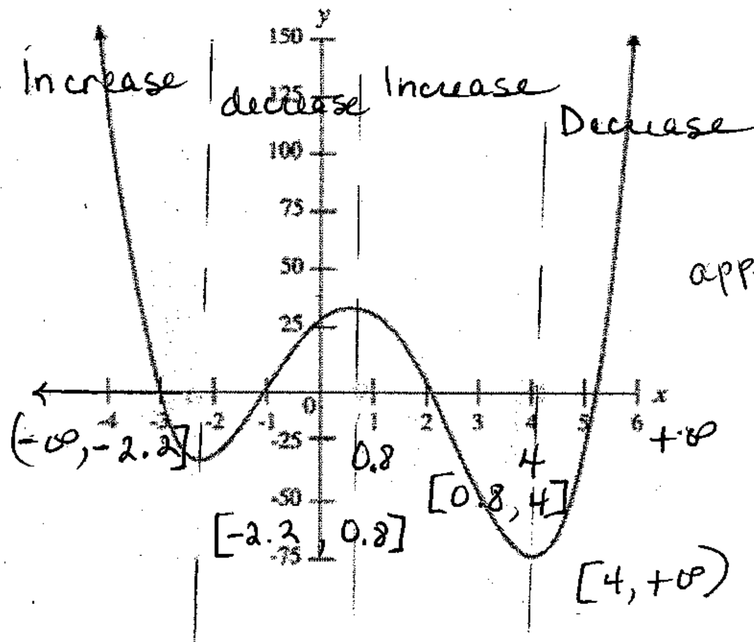
4 and 6 169/min

5 and 7 195 min

6 and 8 138.5 min

GRAPH'S ANATOMY

Analyze the graphs by applying the unit vocabulary.



Odd or even degree? $3+1=4$ EVEN (arrows match)

Positive or negative leading coefficient? positive

Domain all $\mathbb{R}$ Range $[-75, +\infty)$

extrema 3 least possible degree 4

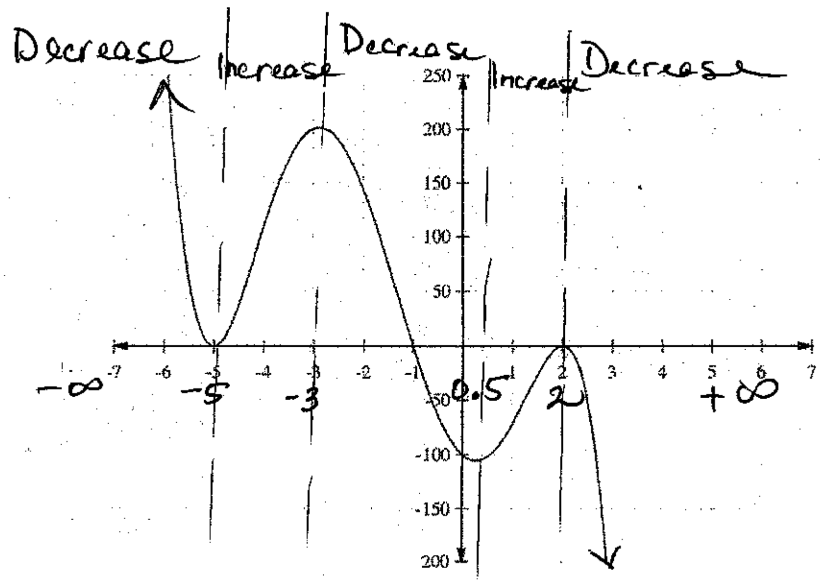
approximate x-intercepts $-3, -1, 2.1, 5.2$ y-intercept $(0, 28)$

intervals of increase $[-2.2, 0.8], [4, +\infty)$

intervals of decrease $(-\infty, -2.2], [0.8, 4]$

end behavior as $x \to +\infty$, $f(x) \to +\infty$
as $x \to -\infty$, $f(x) \to +\infty$

Absolute extrema? yes; there is an absolute minimum



Odd or even degree? ODD (arrows mismatched)

Positive or negative leading coefficient? negative (decreasing left to right)

Domain all $\mathbb{R}$ Range all $\mathbb{R}$

extrema 4 least possible degree 5

x-intercepts $-5, -1, 2$ y-intercept -100

intervals of increase $(-\infty, -5], [-3, 0.5], [2, +\infty)$

intervals of decrease $[-5, -3], [0.5, 2]$

end behavior as $x \to +\infty$, $f(x) \to -\infty$
as $x \to -\infty$, $f(x) \to +\infty$

Absolute extrema? no; never for an odd degree function