Algebra 1
Rate of Change

Name: _____
Date: _____ Period: ____

Warm-Up

$f(x) = -2x + 4$	$g(x) = 3^x - 1$	$h(x) = x^2 + 7$

1. $h(-3) =$ _____   2. $g(0) =$ _____   3. $f(x) = -10$; $x =$ _____   4. $f(4) - g(1) =$ _____

REMINDERS

Rate of Change: describes how one quantity _____ as another quantity _____.

Average Rate of Change Formula: [ ]

Positive ROC: _____

Negative ROC: _____

Linear functions have a _____ rate of change, meaning values increase or decrease at the SAME rate over a period of time.

Non-Linear functions DO NOT have a constant rate of change, meaning values increase or decrease at different rates over a period of time.

Horizontal Lines have _____ rate of change.

Vertical Lines have _____ rate of change.

SLOPE BETWEEN TWO POINTS

1. (4, 6) and (-2, -4)   2. (7, 5) and (7, -8)   3. (-5, 10) and (1, -2)

TABLES

Find the slope of the line represented by the table. Then describe the function as increasing, decreasing, horizontal, or vertical.

1.
x	y
-2	3
-1	5
0	7
1	9
2	11

2.
x	y
-5	10
-3	6
-1	2
1	-2
3	-6

3.
x	y
-4	6
-2	6
0	6
2	6
4	6

4.
x	y
5	2
5	4
5	6
5	8
5	10

m = _____

m = _____

m = _____

m = _____

description:

description:

description:

description:

RATE OF CHANGE OVER INTERVAL

1. f(x) = 3 – 2x over the interval [2, 3].

2. k(x) = 3x + 4 over the interval [-2, 3].

3. k(x) = 3x + 4 over the interval [4, 6].

4. g(x) = 0.5^x over the interval [-1, 0].

5. g(x) = 0.5^x over the interval [-3, 0].

WORD PROBLEMS

1. The table shows the cost per pound of Granny smith apples.

Describe the rates of change show by the data.

Weight (lb)	1	2	3	4
Cost ($)	1.49	2.98	4.47	5.96

Describe the rate(s) of change shown by the data.

_____

_____

3. The table shows the distance of a courier from her destination.

Time (PM)	2:15	2:30	2:45	3:00
Distance (miles)	5.4	5.4	5.0	0.5

What is the rate of change from 2:15 PM to 2:30 PM? What does this rate of change mean?

_____

_____

2. The table shows Gabe's height on his birthday for five years.

Age	9	11	12	13	15
Height (in)	58	59.5	61.5	65	69

Find the rate of change during each time interval.

9 – 11 years:

11 – 12 years:

12 – 13 years:

13 – 15 years:

Describe the rates of change shown by the data.

_____

_____

When did the greatest rate of change occur?

_____

When was the rate of change the least?

_____

During which two time periods were the rates of change the same?

_____

Algebra 1
Rate of Change

Name: Key
Date: _____ Period: _____

Warm-Up

$f(x) = -2x + 4$	$g(x) = 3^x - 1$	$h(x) = x^2 + 7$

1. $h(-3) = \underline{16}$

$h(-3) = (-3)^2 + 7$
$= 9 + 7$
$= 16$

2. $g(0) = \underline{0}$

$g(0) = 3^0 - 1$
$= 1 - 1 = 0$

3. $f(x) = -10;\ x = \underline{7}$

$-2x + 4 = -10$
$\underline{\quad -4 \quad -4}$
$\dfrac{-2x}{-2} = \dfrac{-14}{-2}$
$\boxed{x = 7}$

4. $f(4) - g(1) = \underline{-6}$

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

REMINDERS

Rate of Change: describes how one quantity <u>changes</u> as another quantity <u>changes</u>.

Average Rate of Change Formula: $\boxed{m = \dfrac{y_2 - y_1}{x_2 - x_1}}$ or $\dfrac{\Delta y}{\Delta x}$ "the change in y over the change in x"

Positive ROC: <u>As x increases, y increases.</u> ↗

Negative ROC: <u>As x increases, y decreases.</u> ↘

Linear functions have a <u>CONSTANT</u> rate of change, meaning values increase or decrease at the SAME rate over a period of time.

Non-Linear functions DO NOT have a constant rate of change, meaning values increase or decrease at different rates over a period of time.

Horizontal Lines have <u>0</u> rate of change.

Vertical Lines have <u>undefined</u> rate of change.   VUX HOY

SLOPE BETWEEN TWO POINTS

1. $(4, 6)$ and $(-2, -4)$

$m = \dfrac{-4 - 6}{-2 - 4} = \dfrac{-10}{-6} = \boxed{\dfrac{5}{3}}$

2. $(7, 5)$ and $(7, -8)$

$m = \dfrac{-8 - 5}{7 - 7} = \dfrac{-13}{0}$
$\boxed{\text{undefined}}$

3. $(-5, 10)$ and $(1, -2)$

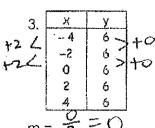$m = \dfrac{-2 - 10}{1 + 5} = \dfrac{-12}{6} = \boxed{-2}$

TABLES

Find the slope of the line represented by the table. Then describe the function as increasing, decreasing, horizontal, or vertical.

1.
x	y
-2	3
-1	5
0	7
1	9
2	11

$m = \dfrac{2}{1} = 2$

description: positive

2.
x	y
-5	10
-3	6
-1	2
1	-2
3	-6

$m = \dfrac{-4}{2} = -2$

description: Negative

3.
x	y
-4	6
-2	6
0	6
2	6
4	6

$m = \dfrac{0}{2} = 0$

description: Horizontal

4.
x	y
5	2
5	4
5	6
5	8
5	10

$m = \dfrac{2}{0} = \text{undefined}$

description: Vertical

RATE OF CHANGE OVER INTERVAL

1. $f(x) = 3 - 2x$ over the interval [2, 3].

$f(2) = 3 - 2(2)$ $f(3) = 3 - 2(3)$
$= 3 - 4$ $= 3 - 6$
$= -1$ $= -3$
$\boxed{(2, -1)}$ $\boxed{(3, -3)}$

$x_1\ y_1$ $x_2\ y_2$
$(2, -1)$ $(3, -3)$
$m = \dfrac{-3 + 1}{3 - 2} = \dfrac{-2}{1} = \boxed{-2}$

2. $k(x) = 3x + 4$ over the interval [-2, 3].

$k(-2) = 3(-2) + 4$ $k(3) = 3(3) + 4$
$= -6 + 4$ $= 9 + 4$
$= -2$ $= 13$
$(-2, -2)$ $(3, 13)$

$(-2, -2)$ $(3, 13)$
$m = \dfrac{13 + 2}{3 + 2} = \dfrac{15}{5} = \boxed{3}$

They are the same because linear functions have a CONSTANT R.O.C.

3. $k(x) = 3x + 4$ over the interval [4, 6].

$k(4) = 3(4) + 4$ $k(6) = 3(6) + 4$
$= 12 + 4$ $= 18 + 4$
$= 16$ $= 22$
$(4, 16)$ $(6, 22)$

$(4, 16)$ $(6, 22)$
$m = \dfrac{22 - 16}{6 - 4} = \dfrac{6}{2} = \boxed{3}$

4. $g(x) = 0.5^x$ over the interval [-1, 0].

$g(-1) = 0.5^{-1}$ $g(0) = 0.5^0$
$= 2$ $= 1$
$(-1, 2)$ $(0, 1)$

$(-1, 2)$ $(0, 1)$
$m = \dfrac{1 - 2}{0 + 1} = \dfrac{-1}{1} = \boxed{-1}$

5. $g(x) = 0.5^x$ over the interval [-3, 0].

$g(-3) = 0.5^{-3}$ $g(0) = 0.5^0$
$= 8$ $= 1$
$(-3, 8)$ $(0, 1)$

$(-3, 8)$ $(0, 1)$
$m = \dfrac{1 - 8}{0 + 3} = \boxed{\dfrac{-7}{3}}$

Different because NON-linear functions do NOT have a constant rate of change.

WORD PROBLEMS

Write the correct answer.

1. The table shows the cost per pound of Granny Smith apples.

Weight (lb)	1	2	3	4
Cost ($)	1.49	2.98	4.47	5.96

Describe the rate(s) of change shown by the data.

<u>positive slope</u>
$m = 1.49$

3. The table shows the distance of a courier from her destination.

Time (p.m.)	2:15	2:30	2:45	3:00
Distance (mi)	5.4	5.4	5.0	0.5

What is the rate of change from 2:15 p.m. to 2:30 p.m.? What does this rate of change mean?

$ROC = 0$
The courier did not get any closer to it's destination

2. The table shows Gabe's height on his birthday for five years. Find the rate of change during each time interval.

Age	9	11	12	13	15
Height (in.)	58	59.5	61.5	65	69

$\dfrac{59.5 - 58}{11 - 9} = \dfrac{1.5}{2} = \boxed{0.75}$

$\dfrac{61.5 - 59.5}{12 - 11} = \dfrac{2}{1} = \boxed{2}$

$\dfrac{65 - 61.5}{13 - 12} = \dfrac{3.5}{1} = \boxed{3.5}$

$\dfrac{69 - 65}{15 - 13} = \dfrac{4}{2} = \boxed{2}$

<u>positive slope</u>
<u>not linear</u>

When did the greatest rate of change occur? <u>btw ages 12 and 13</u>
When was the rate of change the least?
<u>btw ages 9 and 11 (0.75)</u>

During which two time periods were the rates of change the same?
<u>btw ages 11/12 and 13/15</u>