HW 36

Name _____ Period _____ Date _____

Investigation • Wind Chill

In this investigation you'll use the relationship between temperature and wind chill to explore the concept of rate of change and its connections to tables, scatter plots, recursive routines, equations, and graphs.

The data in the table represent the approximate wind chill temperatures in degrees Fahrenheit for a wind speed of 20 mi/h. Use this data set to complete each task.

Temperature (°F)	Wind Chill (°F)
-5	-28.540
0	-21.980
1	-20.668
2	-19.356
5	-15.420
15	-2.300
35	23.940

Step 1 Define the input and output variables for this relationship.

input (x) → Temp
output (y) → windchill

Step 2 Complete the third and fourth columns of the table by recording the changes between consecutive input and output values. Then find the rate of change.

Input	Output	Change in input values	Change in output values	slope/rule ~~Rate of change~~
-5	-28.540			
0	-21.980	5	6.56	$\frac{+6.56}{+5} = 1.312$
1	-20.668	1	1.312	$\frac{1.312}{1} = 1.312$
2	-19.356		1.312	$\frac{+1.312}{+1} = 1.312$
5	-15.420	3	3.936	$\frac{3.936}{3} = 1.312$
15	-2.300	10	13.12	$\frac{13.12}{10} = 1.312$
35	23.940	20	26.24	$\frac{26.24}{20} = 1.312$

Step 3 Write a linear equation in intercept form (~~y=a+bx~~) that relates wind chill to temperature.

$y = b + mx$

$y = -21.980 + 1.312x$

Rewrite your linear equation: $y = \underset{b}{\underline{-21.980}} + \underset{m}{\underline{1.312}}\,x$

Step 4 What is the real-world meaning of ***a*** and of ***b***?

a: The windchill at 0° temp

b: the increase in windchill per Temperature increase.

Step 5 Explain how to use your equation to find the wind chill if the weather report indicates an actual temperature of 22° with 20 mi/h winds. Find the wind chill.

$22 = x$

$y = -21.980 + 1.312(22) = \boxed{6.884 \text{ wind chill}}$

Step 6 Explain how to use your equation to find the actual temperature if the weather report indicates a wind chill of 9.5° with 20 mi/h winds. Find the actual temperature.

$9.5 = y$

$9.5 = -21.980 + 1.312x$

$+21.980 \quad +21.980$

$\frac{31.48}{1.312} = \frac{1.312x}{1.312}$

$\boxed{x = 23.99°F}$

Step 7 The table below shows an input-output relationship between a cell phone bill and the number of minutes used.

Number of minutes used	Total cell phone bill
28	20.84
50	21.50
72	22.16
150	24.50
500	35

+22 +22 +78 +350

+0.66 +.66 +2.34 +0.50

a. Define the input and output variables for this relationship.

x (input) → # minutes

y (output) → total bill

b. Write a linear equation in intercept form that relates number of minutes used and cell phone bill.

$\frac{0.66}{22} = 0.03$ (slope) y-int is 20

$\boxed{y = 0.03x + 20}$

c. What will be the total cell phone bill if 250 minutes are used?

$250 = x$

$y = (0.3)(250) + 20 = \boxed{\$95}$

d. How many minutes were used if the cell phone bill is $41.90?

$y = 41.90$

$41.90 = 0.03x + 20$

$-20 \quad -20$

$\frac{21.90}{0.03} = \frac{0.03x}{0.03}$

$730 = x$

$\boxed{730 \text{ minutes used}}$

Lesson 3.5 • Linear Equations and Rate of Change

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1. Complete the table of output values for each equation.

a. $y = 24 - 3x$

Input x	2	11	−1	7.5	9.4
Output y	18	-9	27	1.5	-4.2

b. $L2 = 8 - 0.75 \cdot L1$

Input list L1	4	12	0.8	$-0.\overline{3}$	36
Output list L2	5	-1	7.4	8.25	-19

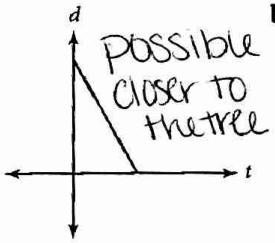
2. Use the equation $d = 1032 - 210t$ to approximate the distance in miles and time in hours of a pilot from her destination.

a. Find the distance d for $t = 4.8$ h. $1032 - 210(4.8) = 24$ miles

b. Find the time t for a distance of 770 mi. $770 = 1032 - 210t$, $-1032 \quad -1032$ $\rightarrow \frac{-262}{-210} = \frac{-210t}{-210}$ $\boxed{t = 1.25 \text{ hrs}}$

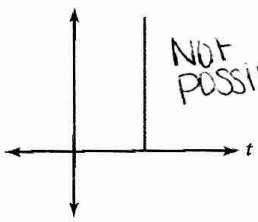
3. Tell whether each graph is a possible model for a person's distance from a tree. If it is a possible model, describe the rate of change shown in the graph. If it is not a possible model, explain why not.

a.



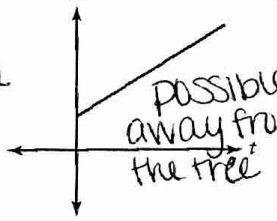
possible closer to the tree

b.



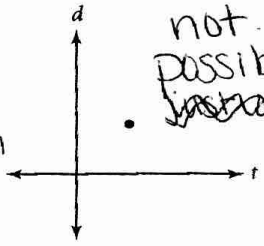
Not possible

c.



possible away from the tree

d.



not possible

4. Each table shows a different input-output relationship.

i.

Input	Output
2	7
3	9
4	11
5	13
6	15

+1, +1, +1, +1 ; +2, +2, +2, +2 ; $\frac{2}{1} = 2$

ii.

Input	Output
−5	22
−2	10
1	−2
4	−14
7	−26

+3, +3, +3, +3 ; −12, −12, −12, −12 ; $\frac{-12}{3} = -4$

iii.

Input	Output
−8	4
−3	−1
2	−6
7	−11
12	−16

+5, +5, +5, +5 ; −5, −5, −5, −5 ; $\frac{-5}{5} = -1$

a. Find the rate of change, or slope, for each table. i) 2 ; ii) −4 , iii) −1

b. For each table, find the output value that corresponds to an input value of 0. What is this output value called? i) 3 ii) 2 iii) −4 The y-intercept.

c. Use your results from 4a and b to write an equation in slope–intercept form for each table. i) $y = 2x + 3$ ii) $y = -4x + 2$ iii) $y = -x - 4$

d. Use calculator lists to verify that your equations actually produce the table values. ✓