Key

Math 1 Name________________________

2-4 Homework Date__________

1. Linear functions can be used to describe the action of springs that stretch, like those in telephone cords, and springs that compress, like those in a mattress or a bathroom scale. Hooke's Law in science says that, for an ideal coil spring, the relationship between weight and length is perfectly linear, within the elastic range of the spring.

The table below shows data from an experiment to test Hooke's Law on different coil springs.

Spring 1		Spring 2		Spring 3		Spring 4	
Weight (ounces)	Length (inches)	Weight (ounces)	Length (inches)	Weight (ounces)	Length (inches)	Weight (ounces)	Length (inches)
0	12	0	5	0	18	0	12
4< 4	14 >2	2< 2	7 >2	3< 3	15 >-3	4< 4	10 >-2
8	16	4	9	6	12	8	8
12	18	6	11	9	9	12	6
16	20	8	13	12	6	16	4

a. Identify the length of the spring with no weight applied.

Spring 1	Spring 2	Spring 3	Spring 4
12	5	18	12

b. What is the rate of change of the length of the spring as weight is increased? Indicate units.

Spring 1	Spring 2	Spring 3	Spring 4
$\frac{1}{2}$ in/oz.	1 in/oz	−1 in/oz	$-2/4 = -\frac{1}{2}$ in/oz

c. Decide whether the experiment was designed to measure spring *stretch* or spring *compression*.

Spring 1	Spring 2	Spring 3	Spring 4
Stretch	Stretch	Compress	Compress

d. Write a recursive equation to show how the spring length changes with each addition of one ounce of weight.

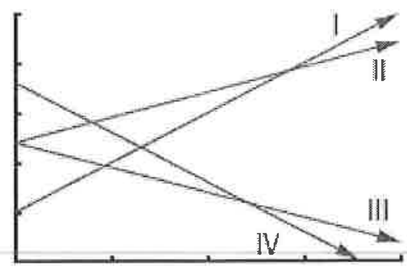
Spring 1	Spring 2	Spring 3	Spring 4
$\begin{cases} a_0 = 12 \\ a_n = a_{n-1} + \frac{1}{2} \end{cases}$	$\begin{cases} b_0 = 5 \\ b_n = b_{n-1} + 1 \end{cases}$	$\begin{cases} c_0 = 18 \\ c_n = c_{n-1} - 1 \end{cases}$	$\begin{cases} d_0 = 12 \\ d_n = d_{n-1} - \frac{1}{2} \end{cases}$

e. Match the spring to the rule that gives its length ℓ in inches when a weight of w ounces is applied.

$\ell = 12 - \frac{1}{2}w$ $\quad \ell = 12 + \frac{1}{2}w$ $\quad \ell = 5 + w$ $\quad \ell = 18 - w$

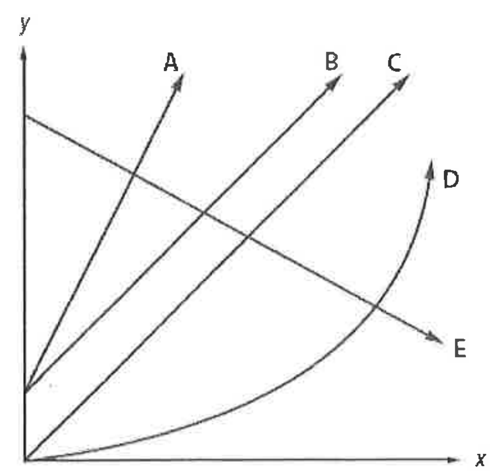
Spring 1	Spring 2	Spring 3	Spring 4
$l = 12 + \frac{1}{2}w$	$l = 5 + w$	$l = 18 - w$	$l = 12 - \frac{1}{2}w$

f. Match the spring to the graph in the diagram below that shows ℓ as a function of w.



Spring 1	Spring 2	Spring 3	Spring 4
II	I	IV	III

2. Given below are five functions and at the right five graphs. Without doing any calculating or graphing yourself, match each function with the graph that most likely represents it. In each case, explain the clues that helped you make the match.



a. $f(x) = x$ → Matches Graph C Explanation: y-int. of 0 + is linear

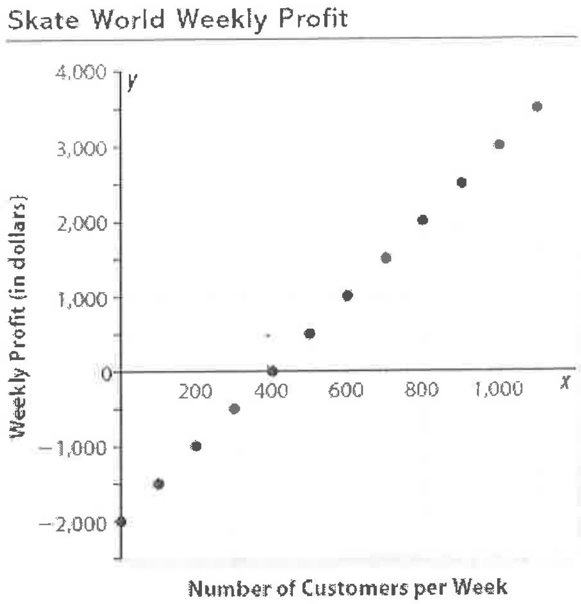
b. $f(x) = 2x + 2$ → Matches Graph A Explanation: y-int of 2 + higher slope (steeper)

c. $f(x) = 0.1x^2$ → Matches Graph D Explanation: Only quadratic (parabola) equation

d. $f(x) = x + 2$ → Matches Graph B Explanation: Like A, but less steep (smaller slope)

e. $f(x) = 9 - 0.5x$ → Matches Graph E Explanation: Linear + decreasing (negative slope)

3. The graph below shows the relationship between weekly profit and the number of customers per week for Skate World Roller Rink.



a. Determine the slope and y-intercept of the line that fits this data.

Slope: $\frac{\text{Rise}}{\text{Run}} = \frac{500}{100} = \$5$ per customer

y-int: (0, −2000)

b. Explain what the slope and y-intercept of the line tell you about the relationship between Skate World profit and the number of customers per week.

Slope: They make an extra \$5 profit for each additional customer.

y-intercept:

If no one shows up, they lose \$2000 that week.

4. Recall the formulas for circumference of a circle and for area of a circle. They are listed below.

$$C = 2\pi r \qquad A = \pi r^2$$

a. Is circumference a linear function of the radius of a circle? In other words, is the C equation linear? Explain how you know.

Yes, 2π is the slope. $y = mx + b$
$C = 2\pi r + 0$

b. Based on the equation, how does the circumference of the circle change as the radius increases?

As radius increases by 1, circumference increases by 2π.

c. Is the area formula a linear equation? Explain how you know.

No, the independent variable (r) is squared.

d. What does the formula tell you about how the area changes as the radius increases?

Area increases a lot as radius increases due to the r being squared.

5. Which of the situations below involve linear functions and which do not? Explain your reasoning. *Remember:* $d = rt$.

a. If a race car averages 150 miles per hour, the distance (d) covered is a function of the driving time (t).

~~150 = dt~~ → Linear with a slope of ~~d~~ 150

$d = 150t$

b. If the length of a race is 150 miles, the time t to complete the race is a function of the average speed s.

Same as r

$150 = rt$

$t = \frac{150}{s}$ → Not linear -Dividing by ind. variable.

c. If the length of a race is 150 miles, average speed ~~s~~ r for the race is a function of race time t.

$150 = rt$

$r = \frac{150}{t}$ → Not linear

Review

6. Which term of the sequence $\{9, 5.5, 2, \ldots\}$ is ~~-1543.5~~ -162.5?

$-162.5 = 9 + (n-1)(-3.5)$

$\frac{-171.5}{3.5} = \frac{(n-1)(-3.5)}{-3.5}$

$49 = n-1$

$50 = n$

$\boxed{50^{th} \text{ term}}$