

TASK 2.3.1: FORMAL DEVELOPMENT OF SLOPE**Solutions**

For this activity, we are assuming that two hexagons are wrapped in clear plastic packages and cannot be separated. Simulate these packages by placing two yellow hexagon-shaped pattern blocks in groups of two and stack them one pair at a time, recording the height to the nearest five-tenths of a centimeter in Table I.

We are investigating the relationship between the height (h) of the stack of hexagons and the number (n) of pairs of hexagons as represented in Figure I.

n = the number of pairs of hexagons in the stack

h = the height of the stack

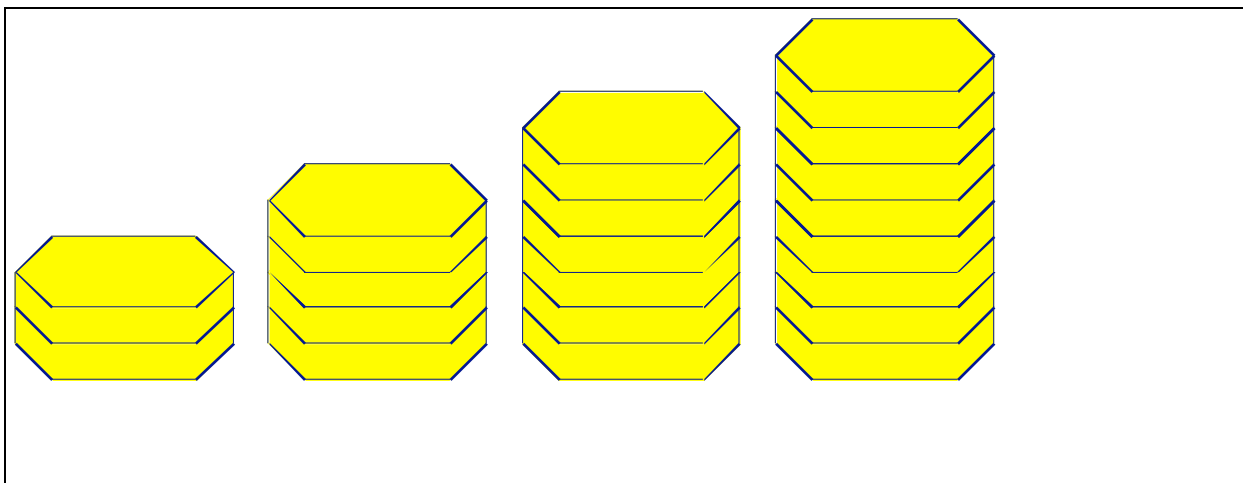


Figure I

1. Determine how tall a stack of 12 pairs of these hexagons is, using estimation or a method of measurement.

Participants may have rulers available and measure one pair and use computation to determine the height of 12 pairs of hexagons. They may estimate the height of one pair and then use computation, or they may estimate the height of one pair and also estimate the height of a stack of 12 pairs. Participants may come up with other common sense methods to answer this question. (These stacks of hexagons are “shrink wrapped” together and sold as one unit. Units cannot be separated.)

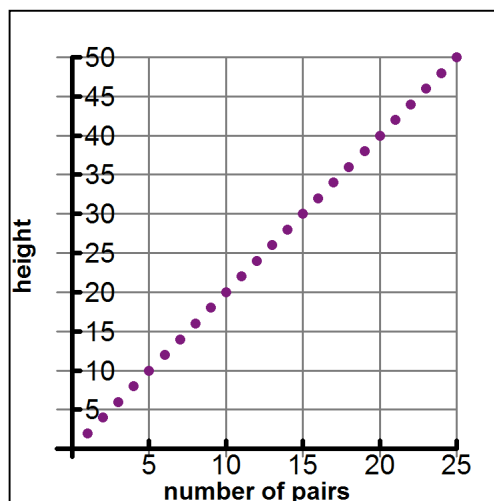
2. Complete Table I.

Table I*
Stacks of Hexagons

Number of Pairs (L_1)	Process	Height of Stack (L_2) (cm)
1	$2(1)$	2
2	$2(2)$	4
3	$2(3)$	6
4	$2(4)$	8
5	$2(5)$	10
...
n	$2(n)$	$2n$

* These data are based on hexagon blocks that are each 1 cm high. Participants' charts may vary depending on the height of their hexagon blocks.

3. Using graph paper, graph this function for the values $n = 1$ to $n = 25$. Label the axes appropriately. Is this graph discrete or continuous? Justify your answer.



The graph is discrete, because possible values for the independent variable are non-negative integers. Or, the set of possible values for the independent variable is disconnected.

Algebra I: Strand 2. Linear Functions; Topic 3. Y=MX; Task 2.3.1

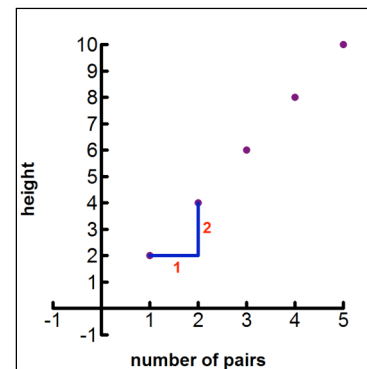
4. What is the change in height as you move from the second to third pair of hexagons in Table I? Using your graph, show how to find this same change from 2 to 3 different pairs. In Table I what happens to the height between 3 and 4 pairs? How do you see that on the graph?

2 cm; from the point for $n = 2$ move one unit to the right, two units up to reach the point for $n = 3$

2 cm; from the point for $n = 3$ move one unit to the right, two units up to reach the point for $n = 4$

5. Draw the horizontal and vertical movement on the graph from first pair to the second pair. Record on the graph the measurement of each vertical and horizontal distance. For each movement from one point to the next point, determine the ratio of the number of centimeters added to the height for each additional pair of hexagons. What do you notice about each of these values?

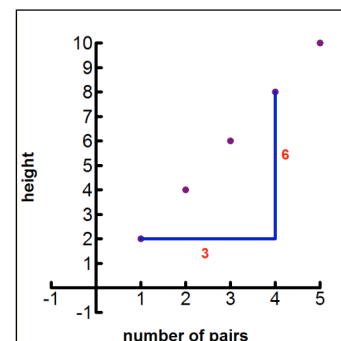
$$\frac{\text{rise}}{\text{run}} = \frac{2\text{cm}}{1\text{pair}}; \text{ they are all the same, } 2 \text{ cm.}$$



6. On the graph determine the vertical and horizontal change between the first pair and the fourth pair. Draw this horizontal and vertical change between the first pair and fourth pair. For the movement from the first to the fourth, determine the ratio of height to number of pairs of hexagons. What do you notice?

$$\frac{\text{rise}}{\text{run}} = \frac{6\text{cm}}{3\text{pair}} = \frac{2\text{cm}}{1\text{pair}};$$

The ratio simplifies to the same ratio, 2 cm, as # 5.



Algebra I: Strand 2. Linear Functions; Topic 3. Y=MX; Task 2.3.1

7. Choose any other pair of data points and find the ratio of the change in height to the change in numbers of pairs of hexagons. What do you notice about all of these numbers?

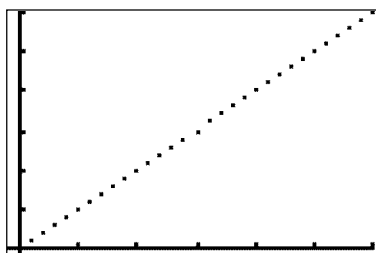
Specific points selected will vary. However, all of the ratios simplify to $\frac{2\text{cm}}{1\text{pair}}$ or 2 cm.

8. Using the graphing calculator put the number, n , of pairs of hexagons in L_1 and the height, h , of the stack in L_2 .

L1	L2	L3	3
1	2		
2	4		
3	6		
4	8		
5	10		
6	12		
7	14		
L3(1)=			

9. Using the graphing calculator, create a scatter plot and investigate the vertical change and the horizontal change. Compare the scatter plot to your paper and pencil graph.

The graphs are the same. The y-intercept is 0 and the slope is $\frac{2\text{cm}}{1\text{pair}}$ or 2 cm



Math notes

Teacher need first to understand slope as rate of change, then to make connections with slope as the ratio of differences in the vertical values compared to the difference of the horizontal values. This helps build the conceptual understanding of slope as “rise over run”.

Teaching notes

The height of the hexagons will depend on the types of hexagon pattern blocks you use. Make sure participants are using only one type of hexagon to build their stacks so that there are not mixing measurements.

The data may not be strictly linear due to measurement errors and round off. This may be a good time to talk about estimation of measurement vs. actual measurement. For ease of use, samples here are based on each hexagon measuring 1 cm tall.

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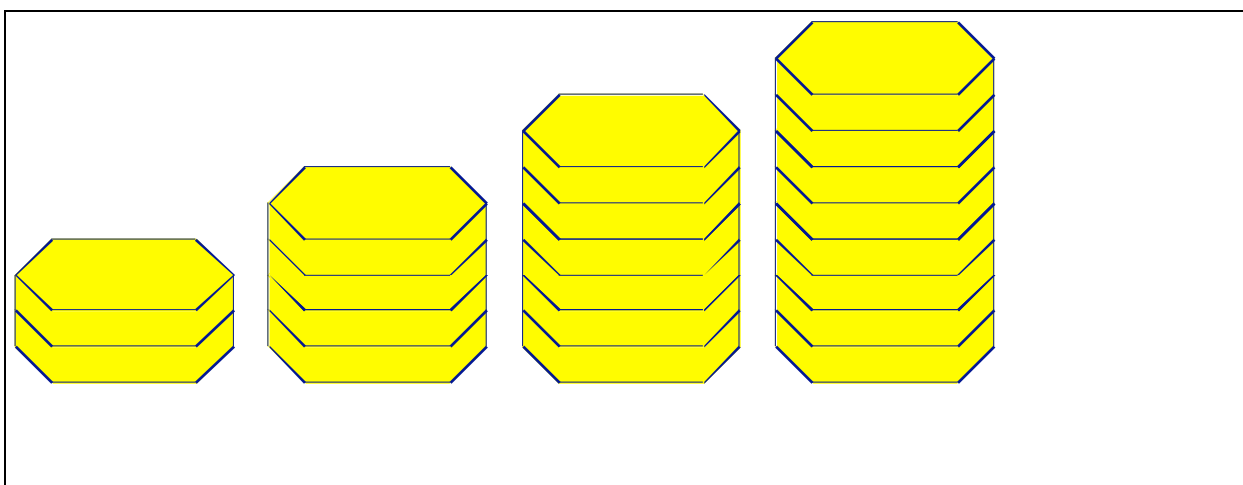


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- What is the change in height as you move from the second to third pair of hexagons in Table I? Using your graph, show how to find this same change from 2 to 3 different pairs. In Table I what happens to the height between 3 and 4 pairs? How do you see that on the graph?
- Draw the horizontal and vertical movement on the graph from first pair to the second pair. Record on the graph the measurement of each vertical and horizontal

