Count the Quilt Blocks

Paul and Tom were working on predicting the number of quilt blocks (unit squares) in the following pattern:

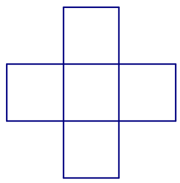

Fig. 1

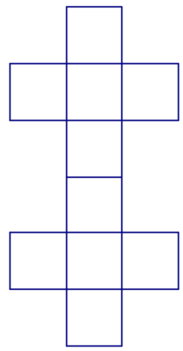

Fig. 2

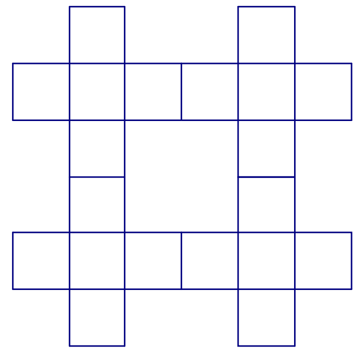

Fig. 3

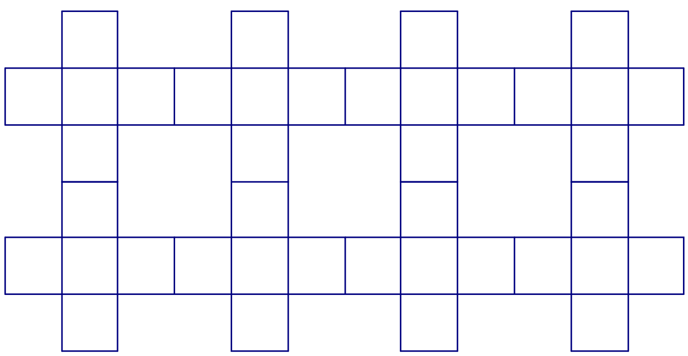

Fig. 4

1. Use the above figures, complete the following table:

Figure Number	1	2	3	4	5	6	7
Number of Unit Squares	5						

2. Is the relation between the “Figure Number” and the “Number of Unit Squares” a function? Why or Why not?

3. Write the first seven terms of the sequence for the number of unit squares.

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4. What kind of sequence is this? Justify your reasoning.

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5. If a_1 denotes the first term of the sequence and r represents the common ratio, then find the values of a_1 and r.

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6. Write the "**Recursive Formula**" to find the n^{th} term a_n for this sequence.

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7. Complete the following table:

Fig No. (n)	1	2	3	4	5	6	7
No. of unit squares (a_n)	5						
No. of unit squares (a_n) (in factored form & use prime factors	5*1						
No. of unit squares (a_n) (in exponential form in terms of the common ratio)							

Observe the conversation between Paul and Tom:

Paul: This one works a lot like the last quilt pattern to me. The only difference is that the pattern is doubling, so I knew it was exponential. I thought that it starts with 5 blocks and doubles, so the n[th] term of the sequence is $a_n = 5(2)^n$

Tom: I don't know about that. I agree that it is an exponential function—just look at that growth pattern. However, I used the numbers in the table and got $a_n = 5(2)^{n-1}$.

8. What is different about the process that Paul and Tom used to come to create their equations?

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9. Who is right? Why? Write the correct **explicit formula** to find the n[th] term a_n of the geometric sequence.

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10. Use the above explicit formula, find the number of unit squares in Fig. 8, Fig.12, and Fig.15?

Number of squares in Fig.8, a_8= ______________________________

Number of squares in Fig.12, a_{12} = ____________________________

Number of squares in Fig.15, a_{15}= ____________________________

11. Which figure will have 327,680 unit squares? Explain your reasoning.

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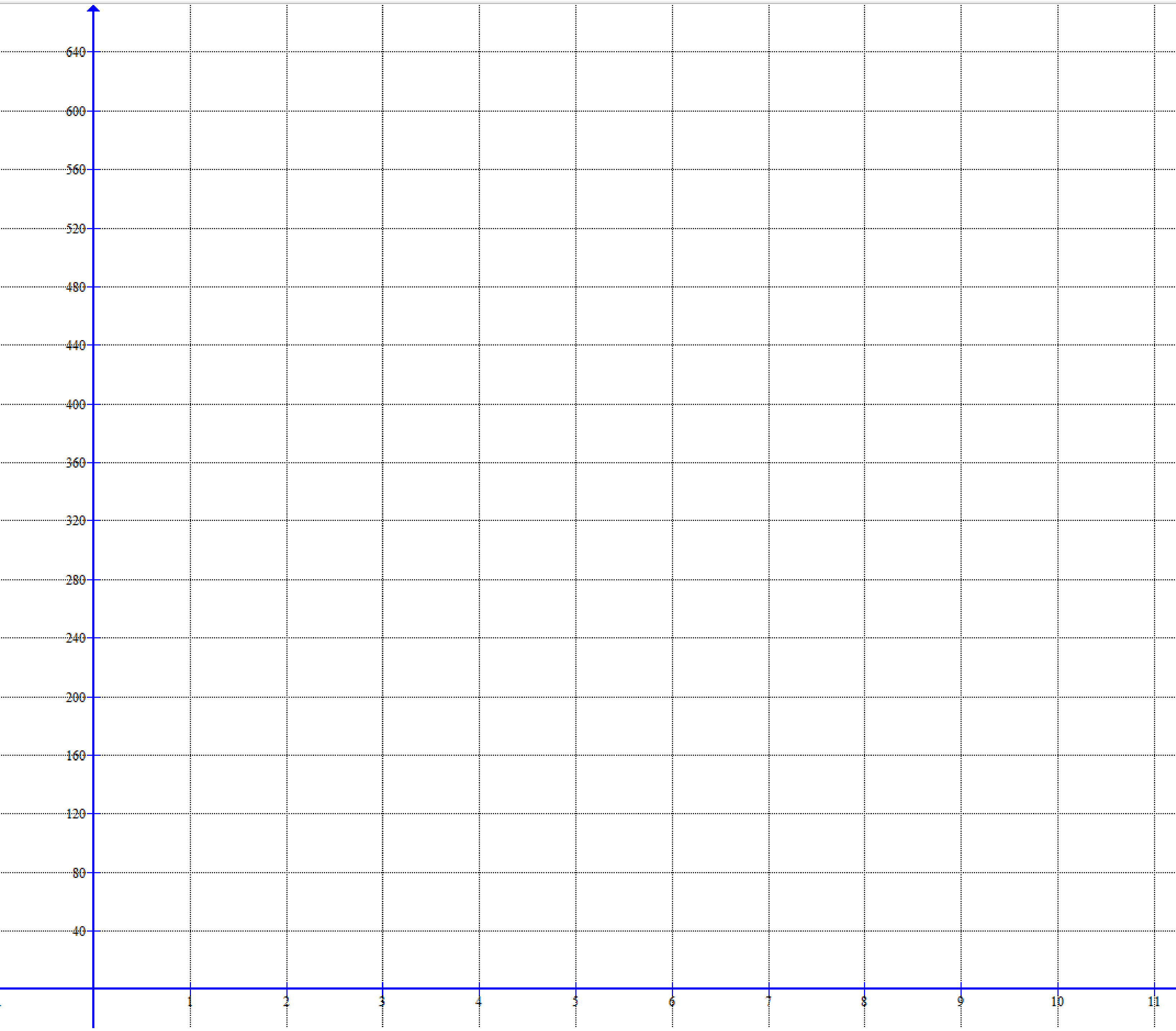
12. Complete the following table and graph the sequence:

Figure Number (n)	1	2	3	4	5	6	7	8
Number of unit squares (a_n)								



13. Should we connect the points on the graph? Explain your reasoning.

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14. Use technology, derive the **exponential function** f(x) for this sequence.

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15. What can you conclude about the recursive formula, explicit formula, and the function form of this geometric sequence?

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16. Write a real life example for a geometric sequence and express it as an exponential function.

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Practice problems:

17. http://www.regentsprep.org/Regents/math/ALGEBRA/AE7/ExpDecayP.htm