Complete the following patterns (NO CALCULATORS)

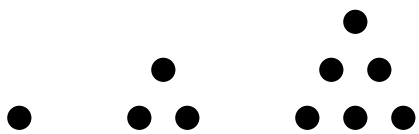
1.

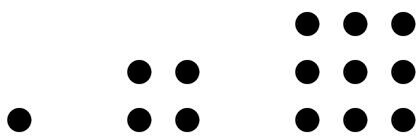
1 • 1	=	1
11 • 11	=	121
111 • 111	=	12321
1111 • 1111	=	1234321
11111 • 11111	=	123454321
111111 • 111111	=	___________

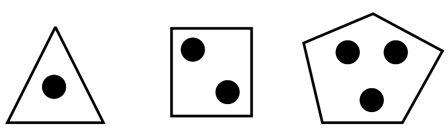
2.

3 • 4	=	12
33 • 34	=	1122
333 • 334	=	111222
3333 • 3334	=	11112222
33333 • 33334	=	1111122222
333333 • 333334	=	______________

Draw the next picture in each pattern

3.  ___________

4.  ___________

5.  ___________

Find the next number in each pattern

6. 1, 4, 8, 13, 19, 26, ___

7. 0, 1, 5, 14, 30, ___

8. 1, 6, 21, 66, 201, 606, ___

9. 0, 1, 5, 30, 155, 780, ___

10. 0, 1, 3, 6, 10, 15, ___

11. 0, 1, 1, 2, 3, 5, 8, 13, ___

Find the rule for each In-Out table. Write the rule using symbols and also as a sentence such as: "To find the Out, multiply the In by 3." Then fill in the missing "Out" value.

1.

In	Out
3	10
5	8
6	7
10	3
n	
12	

____

____

____

2

In	Out
1	3
5	11
6	13
10	21
n	
23	

____

____

____

3.

In	Out
2	1
5	10
6	13
12	31
n	
37	

____

____

____

4

In	Out
3	2
5	18
6	29
8	57
n	
11	

____

____

____

A snail is slowly climbing to the top of a forty foot flagpole. Each day the snail goes up three feet but then slides down two feet. How many days does it take the snail to reach the top of the flagpole?

Find a rule then find the missing items in each of the following In-Out machines. Express the rule in a complete sentence, describing how to find the out **in terms of the** in**.**

1.

IN	OUT
6	23
4	15
11	43
9	35
1	3
24	
	47

Rule:

2.

IN	OUT
CHP	BGO
IMT	HLS
WED	VDC
BUN	ATM
HOG	GNF
YET	
	FLY

Rule:

3.

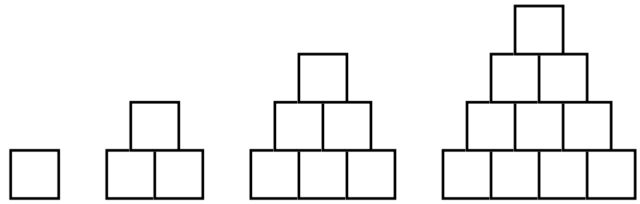
IN	OUT
11	123
12	143
5	27
8	63
14	195
10	
	51

Rule:

4.

IN	OUT
CAP	XXX
IMP	yyy
CMR	x x
BAR	Z Z
BMP	zzz
	YY
IAR	

Rule:



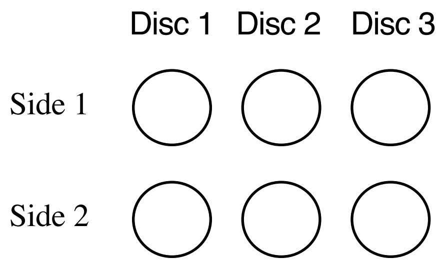
1. In the sequence above, use the height of the pyramid as the IN and the number of blocks in the pyramid as the OUT. Make an in/out table, find a rule and then find the number of blocks in a pyramid 25 rows high.

2. In the sequence above, use the height of the pyramid as the IN and the perimeter of the pyramid as the OUT. Assume that each side of the square has length 1. Make an in/out table, find a rule and then find the perimeter of a pyramid 25 rows high.

3. In the sequence above, use the height of the pyramid as the IN and the total length of all of the lines making up this drawing as the OUT. Assume that each side of the square has length 1. Make an in/out table, find a rule and then find the total length of all of the lines of a pyramid 25 rows high.

There are three circular discs. A number is written on each side of each disc. If you place the discs so that the number on only one face of each disc is visible, it is possible to get each of the following totals: 15, 16, 17, 18, 19, 20, 21, 22.

What are the numbers on each disc? Is there more than one solution? If so, explain how you can find other solutions. Is there a rule or method for finding additional solutions?



Give your solution(s) and show how you can get each number from 15 to 22 using the three discs. If you found a method for finding additional solutions, explain it.

Evaluate your work on this problem. Did you stop without finding any solutions? (Why?) Did you stop after you found one solution? (Why) Did you find several solutions, but no rule?

Cindy was given $5 for each test she passed, but she had to return $10 for each test she failed. At the end of three months, she passed four times as many tests as she failed and she had earned $20. How many tests did she PASS? Explain your reasoning.

Sigma Notation 1

Write out each of these summations problems as a string of numbers added together and find the given sum.

1. $\sum_{i=1}^{5}(2i) =$

5. $\sum_{k=1}^{5}6k =$

2. $\sum_{i=0}^{3}(3i \pm 1) =$

6. $\sum_{i=0}^{4}i^2 =$

3. $\sum_{k=1}^{4}9 =$

7. $\sum_{k=0}^{2}\frac{1}{k^2+1} =$

4. $\sum_{n=2}^{6}(5n)^2 =$

8. $\sum_{k=2}^{5}(k+1)(k \pm 3) =$

Use the summation notation to write the given sums.

9. $\frac{5}{1+1}+\frac{5}{1+2}+\frac{5}{1+3}+...+\frac{5}{1+15} =$

11. $1+3+5+7+9 =$

10. $4(1)+4(2)+4(3)+...+4(9) =$

12. $2+2+2+2 =$

Sigma Notation 2

Write out each of these summations problems as a string of numbers added together and find the given sum.

1. $\sum_{i=1}^{4}(3i) =$

5. $\sum_{k=3}^{6}5k =$

2. $\sum_{i=0}^{3}(5i+2) =$

6. $\sum_{i=1}^{4}i^3 =$

3. $\sum_{k=1}^{4}3 =$

7. $\sum_{k=1}^{3}\frac{1}{k^2+3} =$

4. $\sum_{n=2}^{5}(3n)^2 =$

8. $\sum_{k=2}^{5}(k+2)(k\pm 1) =$

Use the summation notation to write the given sums.

9. $\frac{2}{3+1}+\frac{2}{3+2}+\frac{2}{3+3}+...+\frac{2}{3+15} =$

11. $2+4+6+8+10 =$

10. $5(3)+5(4)+5(5)+...+5(9) =$

12. $7+7+7+7 =$

Perform the indicated operation(s). Simplify the answer.

1. $-13 + 5 =$
2. $4 - 9 =$
3. $-7 - 8 =$
4. $-4 + (-3) =$
5. $9 - (-4) =$
6. $16 - (-1) =$
7. $3 + (-5) =$
8. $-5 - 7 =$
9. $-5 + (-3) =$
10. $-3 - (-4) =$
11. $- 8 - (-7) =$
12. $-6 + (-3) =$
13. $-4 - (-1) =$
14. $8 - (-2) =$
15. $-3 + 5 - (-4) =$
16. $-5 + 2 - 5 =$
17. $-4 + (-8) - 3 =$
18. $-2 + 8 + (-4) =$

Perform the indicated operation(s). Simplify the answer.

1. $-3 \bullet 5 =$
2. $6 (-9) =$
3. $-7 \bullet 8 =$
4. $-4 \bullet (-3) =$
5. $16 \div (-4) =$
6. $21 \div (-6) =$
7. $3 \bullet (-5) =$
8. $-5 \div 15 =$
9. $-2 \bullet (-5) =$
10. $-3 \bullet (-4) =$
11. $\frac{-24}{-6} =$
12. $-6 / (-3) =$
13. $-\frac{32}{-4} =$
14. $8 / (-2) =$
15. $\frac{45}{-3} =$
16. $-\frac{-12}{-3} =$
17. $-4 / (-8) =$
18. $-12 \div 8 =$

Spiro has lived a fourth of his life as a boy; a fifth of his life as a youth; a third of his life as a man, and has spent 13 years in old age.

How old is Spiro?

Perform the indicated operation(s). Simplify the answer.

1. $-3 + 5 =$
2. $6 - 9 =$
3. $-7 \bullet 8 =$
4. $4 + (-3) =$
5. $9 + (-4) =$
6. $1 - (-6) =$
7. $3 \bullet (-5) =$
8. $-5 + 7 =$
9. $-2 + (-5) =$
10. $-3 \bullet (-4) =$
11. $- 6 - 7 =$
12. $-6 \div (-3) =$
13. $-4 - (-1) =$
14. $8 \div (-2) =$
15. $3 - 5 =$
16. $-5 + 2 =$
17. $-4 \div (-8) =$
18. $-2 + 8 =$
19. $-2 \bullet 8$
20. $-6 + 3 =$
21. $-2 + 6 - 3 =$
22. $-7 - 5 - 3 =$
23. $5 - 2 - 7 + 3 =$
24. $-3 \bullet 2 \bullet (-3) =$
25. $-2 + 3 + 4 - 5 =$
26. $-4 - (-3) + (-2) - 1 =$
27. $6 - 7 - 7 - 4 =$
28. $4 \bullet (-3)(-2) =$
29. $-2(-3)(-2)(-2) =$
30. $-3 - (-3) - (-3) =$
31. $-2 \bullet 5 \bullet (-3)(-2) =$
32. $6 - (-1) + (-5) - (-4) =$
33. $-2 \bullet (-3) =$
34. $-7 + (-4) - (-9) =$
35. $-24 \div (-4) \div (-2) =$
36. $-9 - 8 - 7 - 6 =$
37. $-3 \bullet 4(-2) =$
38. $2 + (-3) + 2 + (-5) =$
39. $4 - (-3) + 5 + (-7) =$
40. $3 \bullet (-2) \bullet 5 \bullet (-3) =$

Perform the following operations.

1. $4 - 3 + 1$ 1. __________

2. $24 \div 2 \bullet 3$ 2. __________

3. $4 - 3 - 1$ 3. __________

4. $14 - 8 + 3 - 1$ 4. __________

5. $(5 - 2) \bullet 3^2$ 5. __________

6. $9 - (4 - 2)^2$ 6. __________

7. $14 - 2 \bullet 5 - 3$ 7. __________

8. $24 \bullet 4 \div 2$ 8. __________

9. $18 - 3^2$ 9. __________

10. $28 - 2 \bullet 3^2 + 3^2$ 10. __________

11. $(21 - (16 - (5 - 3)))$ 11. __________

12. $15 - 9 + 5 - 3 + 1$ 12. __________

13. $72 \div 9 \div 4 \div 2$ 13. __________

14. $4 \bullet 9 - 5 - 3 + 1$ 14. __________

15. $(12 - 3^2)^2 - 4^2 \div 2$ 15. __________

A man goes into a store and says, “If you give me as much money as I have with me now, I will spend $10 in your store.” The proprietor agrees and the man spends the money.

He goes into a second store and again says, “If you give me as much money as I have with me now, I will spend $10 in your store.” Again, the proprietor agrees and the man spends the money.

In a third store, he repeats his proposition, the proprietor agrees, and the man spends the money.

At this point the man has no money left.

How much money did the man have to begin with? Explain your answer.

Perform the following operations.

1. $8 - 3 + 1$ 1. __________

2. $28 \div 7 \bullet 2$ 2. __________

3. $8 - 6 \div 2$ 3. __________

4. $18 - 8 + 3 - 1$ 4. __________

5. $5 + 2 \bullet 3^2$ 5. __________

6. $9 - (5 - 2)^2$ 6. __________

7. $18 - 2 \bullet 5 + 3$ 7. __________

8. $9 \bullet 8 \div 2$ 8. __________

9. $3\,(5 - 3)^2$ 9. __________

10. $36 \div 4 \bullet 3^2 + 3^2$ 10. __________

11. $(25 - (23 - (5 - 3)))$ 11. __________

12. $25 - 9 + 5 - 3 + 1$ 12. __________

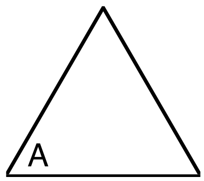
13. $128 \div 8 \div 4 \div 2$ 13. __________

14. $8 \bullet 9 - 5 - 3 + 1$ 14. __________

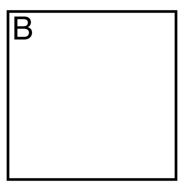
15. $(15 - 3^2)^2 - 4^2 \div 2$ 15. __________

In each figure,**without measuring the angles**, *calculate* the degree measure of each labeled angle. Assume that each figure is regular; that is, that all sides of the figure are the same length and all the angles of the figure have the same measure. In some figures segments are drawn from the **center** to each **vertex**.

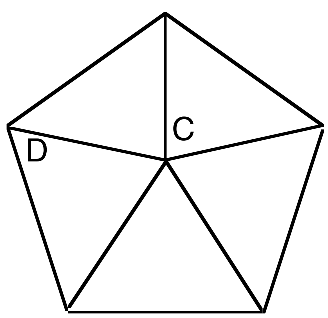
1. Triangle



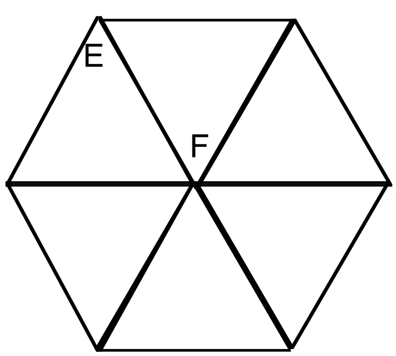
2. Quadrilateral



3. Pentagon



4. Hexagon



ANSWERS

m∠A =

m∠B =

m∠C =

m∠D =

m∠E =

m∠F =

m∠G =

m∠H =

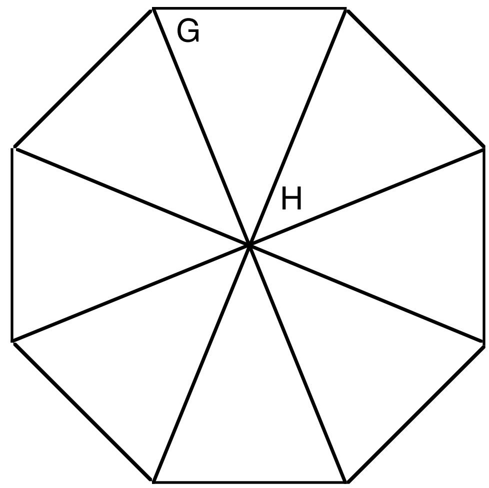
m∠J =

m∠K =

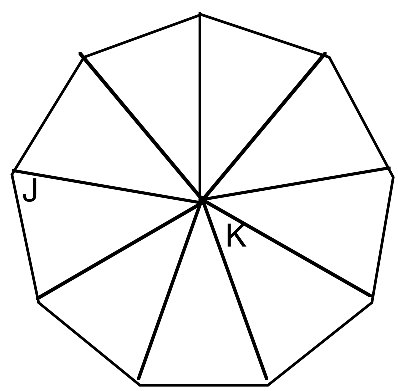
m∠L =

m∠M =

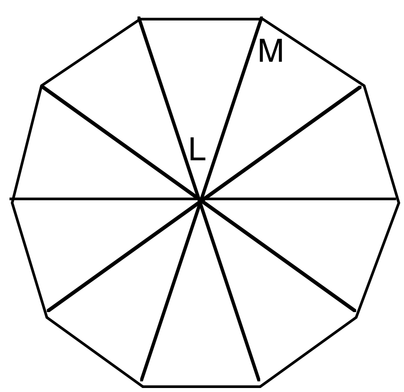
5. Octagon



6. Nonagon



7. Decagon



Use the information you found about each figure to fill in the following table.

Name of polygon	Measure of one interior angle	Sum of measures of all interior angles
Triangle		
Quadrilateral		
Pentagon		
Hexagon		
Octagon		
Decagon		
n-gon		
dodecagon (12 sides)		
20-gon		

The Tukatoome Tile

**In her will to her favorite niece,
Aunt Tuka left a valuable piece,
But the piece, a tile with a unique design,
Was mixed with some others with similar lines.**

**So the niece had to follow the words of the will,
That told of the tile and how it was filled.
With shapes of differing numbers of angles,
A problem the niece had to untangle.**

**Is the real tile X, Y, or Z?
The will will tell as you can see.
So take your time; think for a while,
Then find the real Tukatoome tile.**

To my niece:

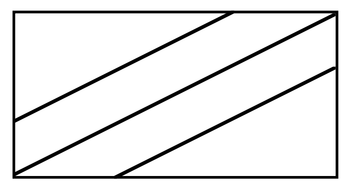
*My tile has figures of many sides,
All have more than meet the eyes.
Some are hidden and hard to see,
So, be sure to count then carefully.*

*The tile is worth 60 million they say,
And its value iss found in the following way
Three million for a triangle; for a quadrilateral, four.
Five million for a pentagon; for a six-side figure, one more.*

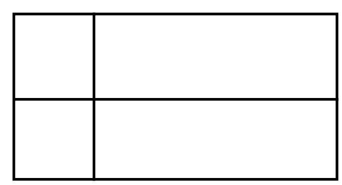
Good luck,

Aunt Tuka

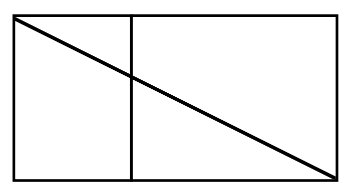
X



Y



Z



In a game of darts, three darts are thrown at the target. Depending on where the dart hits the target, a player may get 1, 3, 5, or 9 points. HOW MANY DIFFERENT SCORES are possible assuming that each of the three darts hits the target somewhere? Explain.

The chart below illustrates how sales for an item has decreased as price of the article increased.

Price	Number Sold	Income (Price)*(Number Sold)
$1	85,000	$85,000
$2	80,000	$160,000
$3	75,000	$225,000

If the pattern shown continues,

1. What price should be charged in order to produce the greatest income?

2. What is the greatest income possible for this product?

Explain your answer.

An auditorium has eight doors. In how many different ways is it possible for Arlene to enter by one door and leave by another?

Explain your answer.

A magician said to a volunteer from the audience, "Pick a number, but don't tell me what it is. Add 15 to it. Multiply your answer by 3. Subtract 9. Divide by 3. Subtract 8. Now tell me your answer."

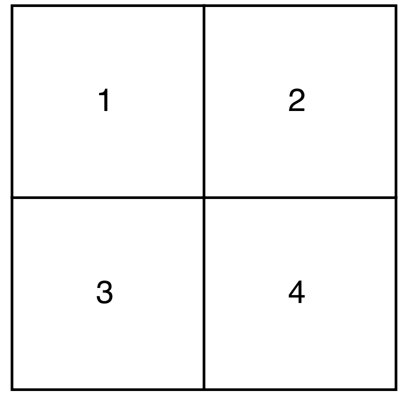
"Thirty-two," replied the volunteer.

Then the magician immediately guessed the number that the volunteer had originally chosen.

1. What was the volunteer's number?

2. How did the magician know so quickly? (The magician couldn't possibly have worked backward that fast.)

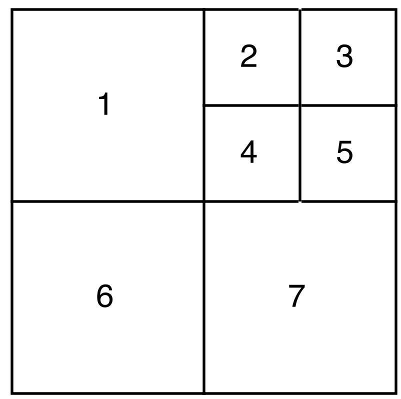
Can you divide a square into a certain number of smaller squares? That may depend on exactly how many smaller squares you want.



The first diagram at the right shows that any square can be divided into four smaller squares. The second diagram shows that any square can be divided into seven smaller squares.

Notice that the smaller squares don't have to be the same size, but keep in mind that the smaller squares must all be squares, not simply rectangles.

The task of this activity is to investigate what number of smaller squares are possible. For example, you can probably see that there is no way to divide a square into just two smaller squares.



1. Start with specific cases. Is it possible to divide a square into three smaller squares? Five? Six? Eight? (The cases of four and seven squares are shown in the diagrams.) Continue to do this at least up to thirteen smaller squares.

Now reflect on what you have done and just imagine continuing the process. Would there be any numbers beyond thirteen for which you couldn't divide a square into that many smaller squares? What patterns can you find to help with this question?

2. What is the largest "impossible" case? How do you know that all cases beyond this are possible?