Paper Folding Task

Starting with a square...

1. Construct a square with exactly 1/4 the area of the original square.

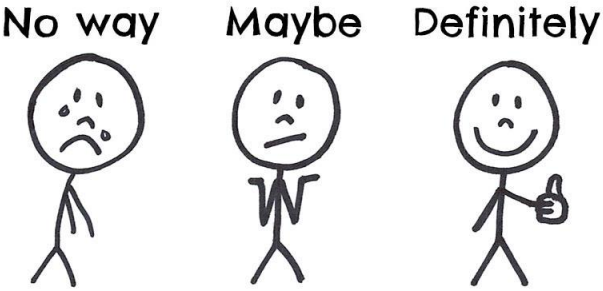
2. Construct a triangle with exactly 1/4 the area of the original square.

3. Construct another triangle with exactly 1/4 the area of the original square. This triangle should NOT be congruent to the first triangle.

4. Construct a square with exactly 1/2 the area of the original square.

Reflection Questions

Paper Folding Task



1. I can explain the properties of a square. 1 2 3 4 5

2. I know what area means. 1 2 3 4 5

3. I understand what 1/2 and 1/4 mean. 1 2 3 4 5

4. I know what congruent means. 1 2 3 4 5

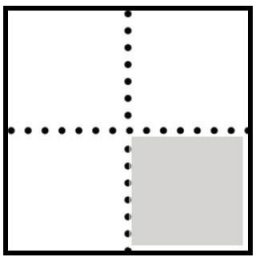
5. I keep trying when a problem is hard. 1 2 3 4 5

6. I know mistakes help my brain grow. 1 2 3 4 5

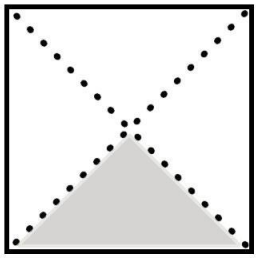
Paper Folding Task

Solution

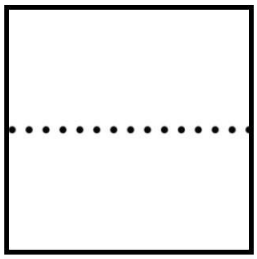
1. Fold the paper in half by bringing 2 opposite edges together twice.

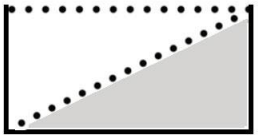


2. Fold the paper in half by bringing 2 opposite corners together twice.

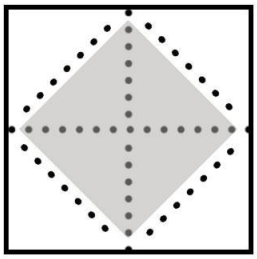


3. Fold the paper in half first by bringing opposite edges together, then make a crease between opposite corners.





4. Find center as in Step 1. Bring all 4 corners into center.



How do you know it's a square? It has 4 equal length sides and 4 right angles.

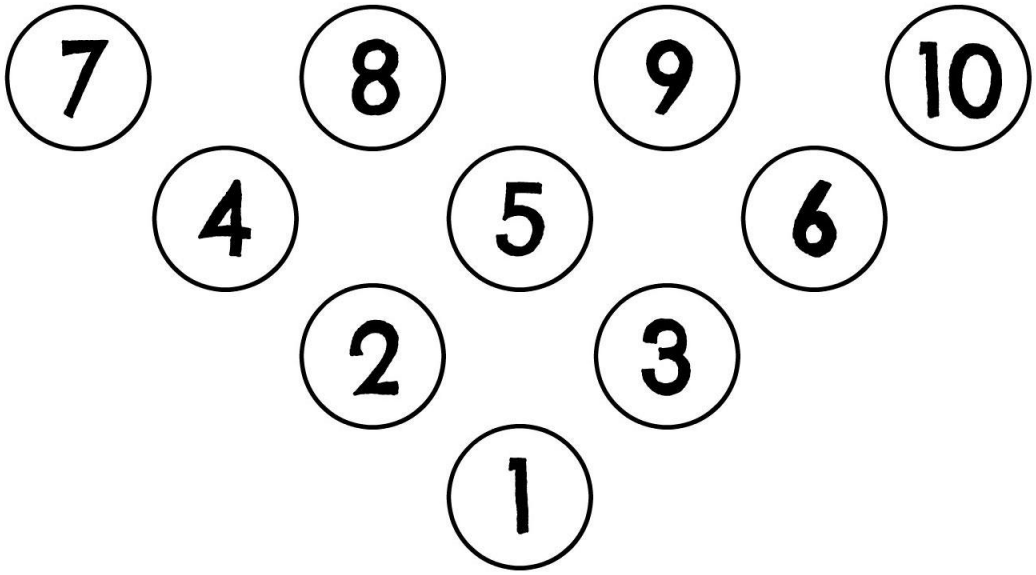
How do you know it has 1/4 the area? It was divided into 4 equal pieces.

Bowl-A-Fact

Use dice to select 3 random numbers:

☐ ☐ ☐

Combine these 3 numbers using any mathematical operations to "knock down" the pins below:



1 =

2 =

3 =

4 =

5 =

6 =

7 =

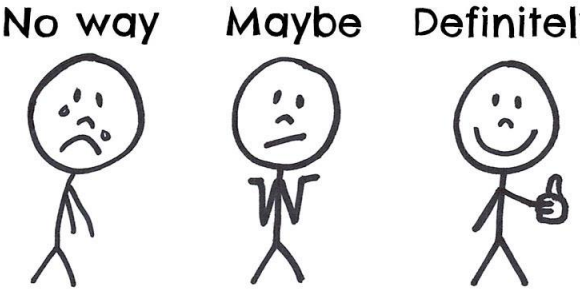
8 =

9 =

10 =

Reflection Questions

Bowl-A-Fact



1. I can add and subtract.	1	2	3	4	5
2. I know how to multiply.	1	2	3	4	5
3. I know how to divide.	1	2	3	4	5
4. I know how exponents work.	1	2	3	4	5
5. I understand how to find a square root.	1	2	3	4	5
6. I keep trying when a problem is hard.	1	2	3	4	5
7. I know mistakes help my brain grow.	1	2	3	4	5

Bowl-A-Fact

Solution

Remind students of the following operations:

Addition: 2 + 6 = 8,

Subtraction: 5 - 1 = 4

Multiplication: 3 x 2 = 6

Division: 4 divided by 2 = 4/2 = 2

Exponents: 2 to the power of 3 = 2^3 = 2x2x2 = 8

Square Root: square root of 4 = $\sqrt{4}$ = 2

Other helpful tips:

Any number times 1 stays the same.

1 to any power is still 1.

Doubles can become zero through subtraction.
Any number to the 0th power is 1.

Ice Cream Task

Imagine an ice cream shop.

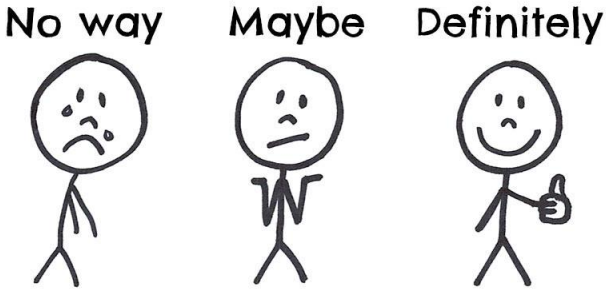
If they only served vanilla ice cream, there would only be 1 type of double scoop cone. (vanilla/vanilla)

If they served vanilla and chocolate, there would be 3 types of double scoop cones. (vanilla/vanilla, chocolate/chocolate, vanilla/chocolate)

How many possible double scoop cones would there be if they had 10 flavors?

Reflection Questions

Ice Cream Task



1. I'm comfortable counting large numbers. 1 2 3 4 5

2. I can count possible combinations systematically. 1 2 3 4 5

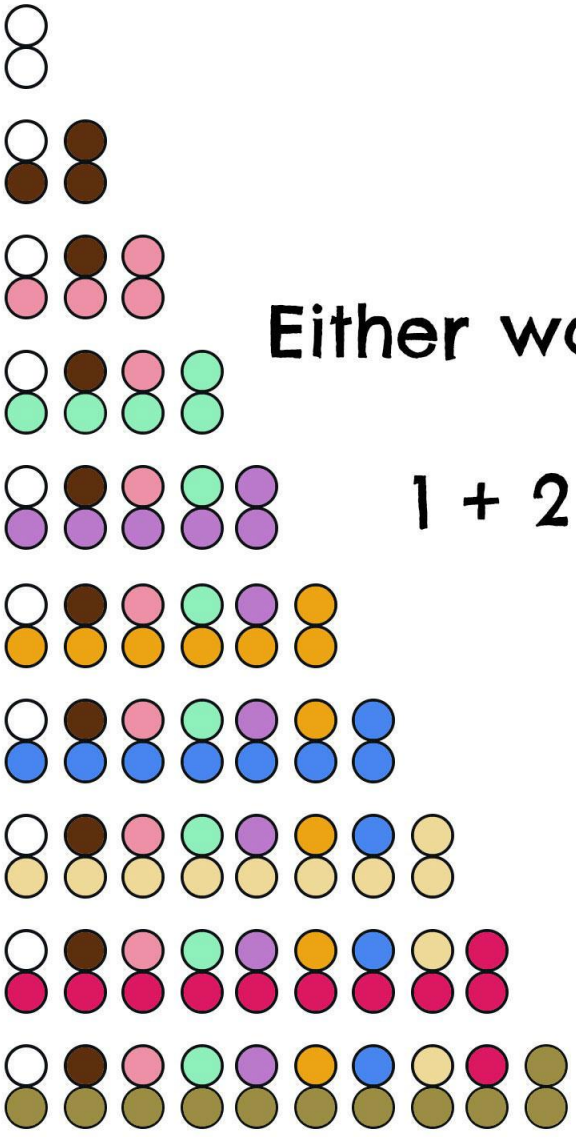
3. I keep trying when a problem is hard. 1 2 3 4 5

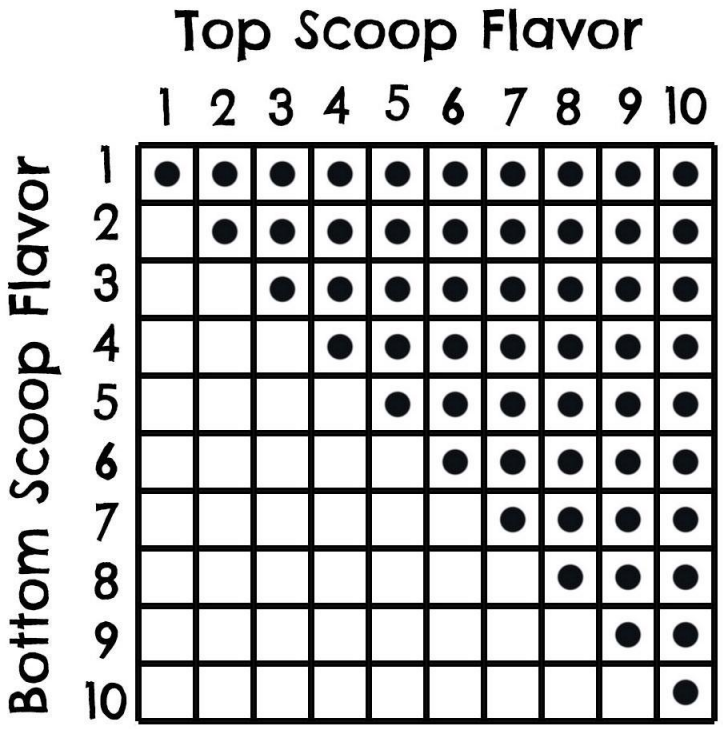
4. I know mistakes help my brain grow. 1 2 3 4 5

Ice Cream Task

Solution

Here are a couple different ways of thinking about the ice cream scoop task...





Either way, the solution is:

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = \boxed{55}$$

Note that if the order of the scoops mattered (i.e. if vanilla/chocolate was different from chocolate/vanilla), then there would be 100 possibilities.

Painted Cube Task

Imagine a cube made up of smaller cubes.

If you had a 5x5x5 cube (a cube with 5 smaller cubes on each edge) and you painted the outside...

1. How many of the small cubes would have 3 painted faces?

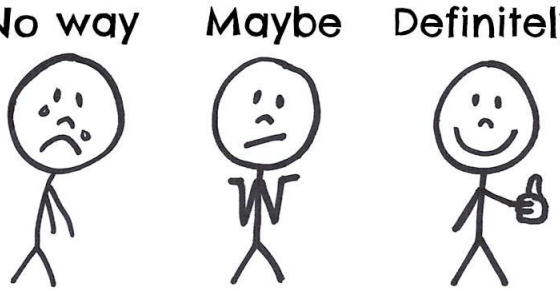
2. How many of the small cubes would have 2 painted faces?

3. How many of the small cubes would have 1 painted face?

4. How many of the small cubes would have no painted faces?

Reflection Questions

Painted Cube Task



1. I understand what volume means. 1 2 3 4 5

2. I understand what surface area means. 1 2 3 4 5

3. I know how to find the volume of a cube. 1 2 3 4 5

4. I know how to find the surface area of a cube. 1 2 3 4 5

5. I keep trying when a problem is hard. 1 2 3 4 5

6. I know mistakes help my brain grow. 1 2 3 4 5

Painted Cube Task

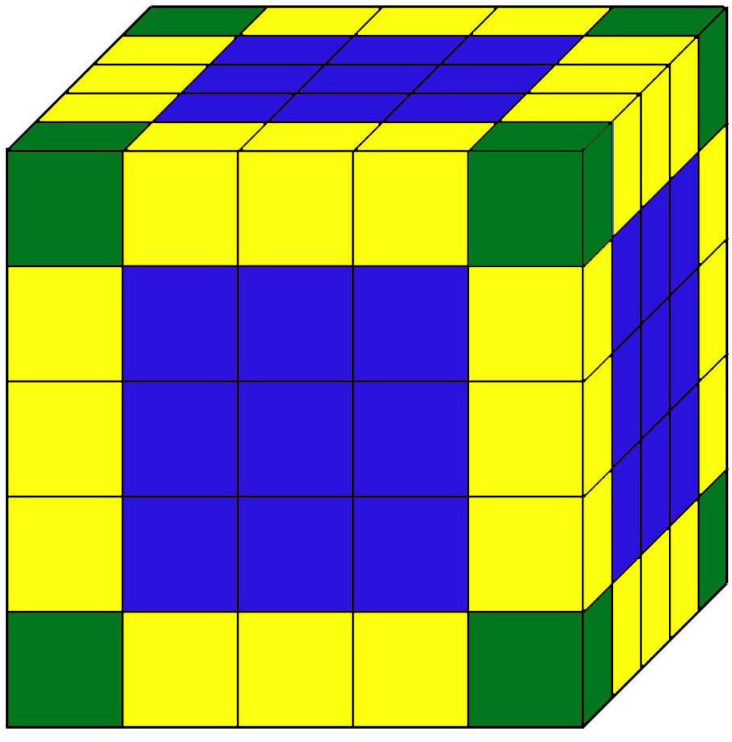
Solution

3 painted faces = 8 corners

2 painted faces =
3 per edge x 12 edges = 36

1 painted face =
9 per face x 6 faces = 54

no painted faces = 3x3x3 interior cube
= 27 (not shown)

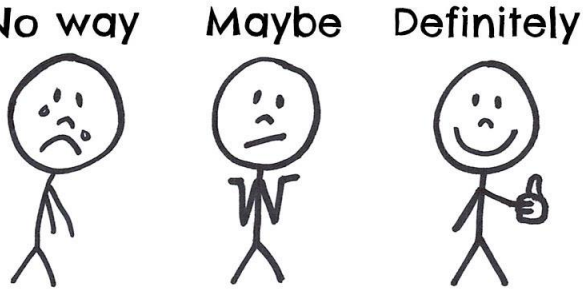


Farmer's Fence Task

Imagine a farmer has 36 pieces of fencing each 1-meter long. How can he make the biggest possible enclosure?

Reflection Questions

Farmer's Fence Task

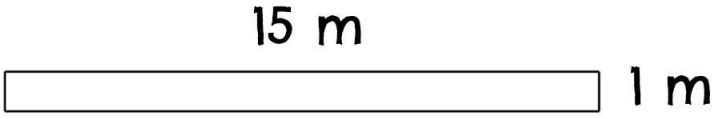


1. I know what area means.	1	2	3	4	5
2. I know what perimeter means.	1	2	3	4	5
3. I can find the perimeter and area of a rectangle.	1	2	3	4	5
4. I understand why trigonometry is useful.	1	2	3	4	5
5. I keep trying when a problem is hard.	1	2	3	4	5
6. I know mistakes help my brain grow.	1	2	3	4	5

Farmer's Fence Task

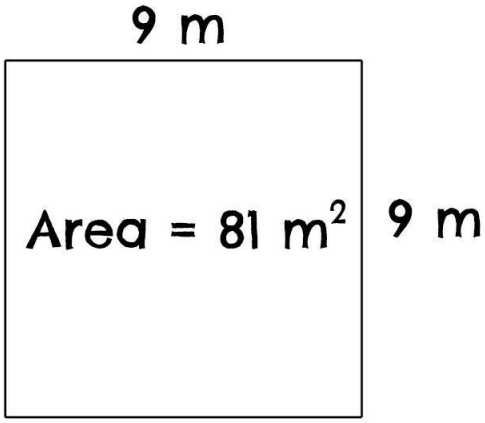
Solution

Rectangle



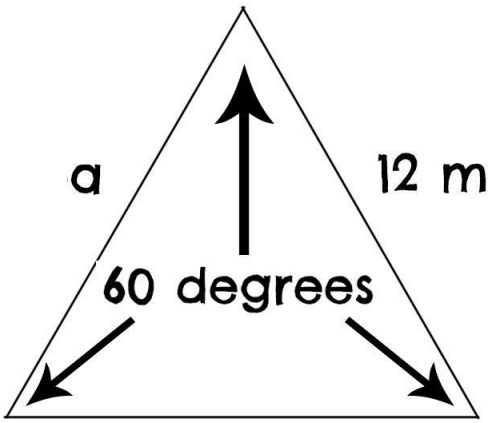
Area = 15 m^2

Square



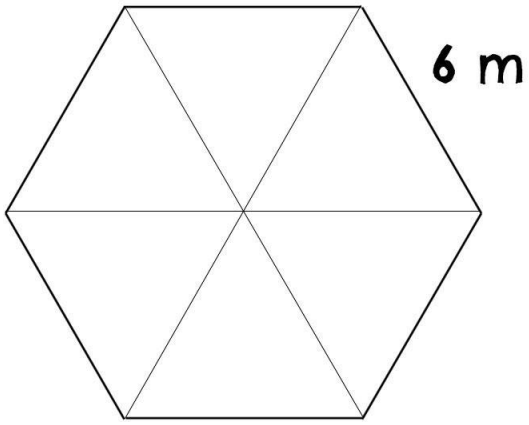
Equilateral Triangle

Area $\approx$ 0.433 x a^2



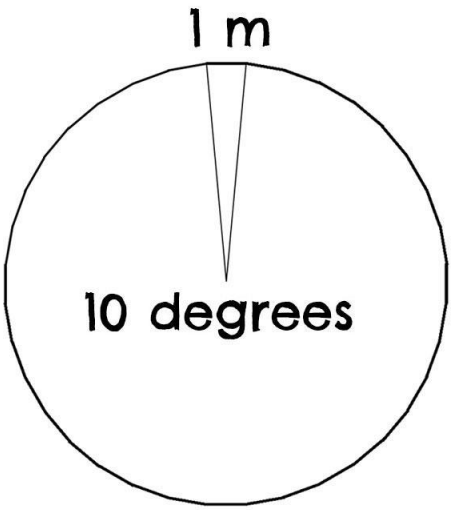
Area $\approx$ 0.433 x 12^2 $\approx$ 62.35 m^2

Hexagon



Area $\approx$ 6 x 0.433 x 36

$\approx$ 93.53 m^2



Correct Answer:

36-sided shape

Area of 1 triangle $\approx$ 1/2 x 1 x 0.5/tan(5)

Area of 36-sided shape $\approx$

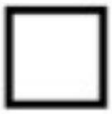
36 x 2.86 $\approx$ 102.87 m^2

Could also use perimeter (36 m) to estimate radius!

Growing Shapes Task

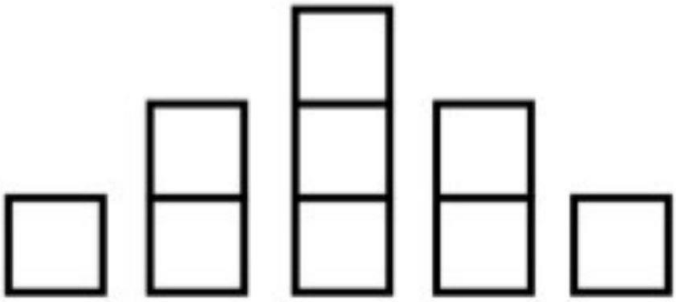
How do you see the shapes growing?

Case 1:

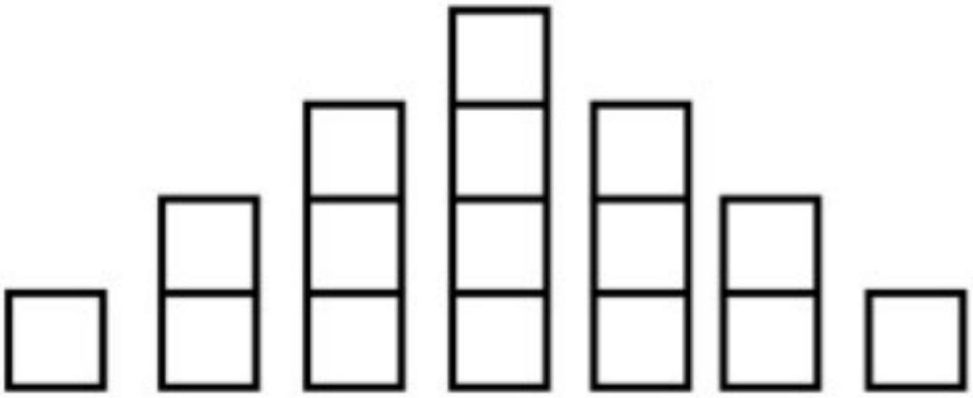


Case 2:

Case 3:



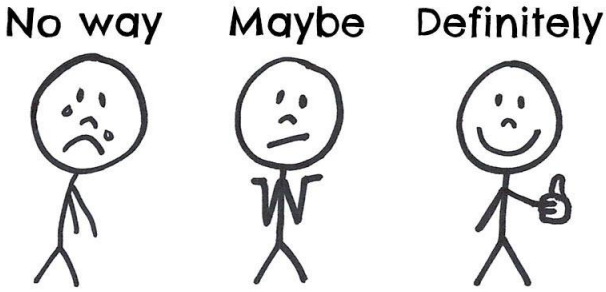
Case 4:



How many squares would be in Case 100?

Reflection Questions

Growing Shapes Task

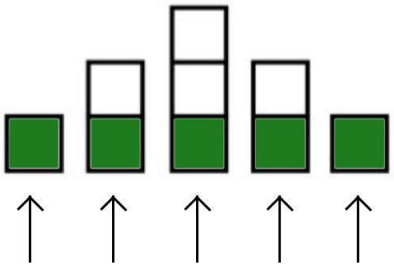


1. I'm comfortable thinking about patterns.	1	2	3	4	5
2. I can think about how the pattern changes.	1	2	3	4	5
3. I understand why variables are useful.	1	2	3	4	5
4. I keep trying when a problem is hard.	1	2	3	4	5
5. I know mistakes help my brain grow.	1	2	3	4	5

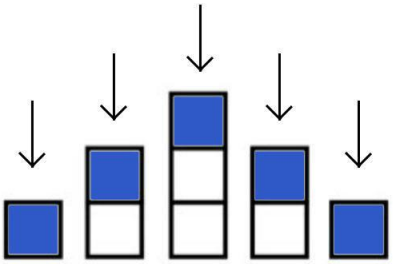
Growing Shapes Task

Solution

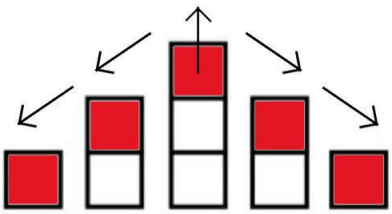
Bowling Alley Method
Squares are added in a line like pins at a bowling alley



Raindrop Method
Squares fall from the sky



Volcano Method
Middle column grows and squares flow like lava



For more ideas, see Mathematical Mindsets by Jo Boaler

To solve this problem you could add:

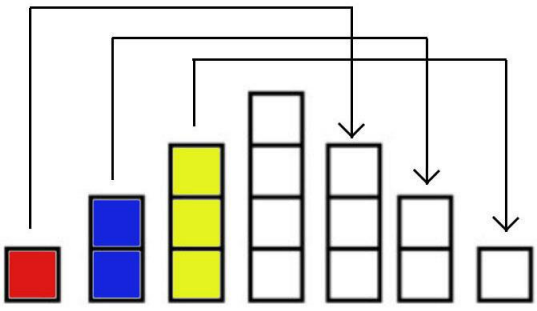
$1 + 2 + 3 + 4 + 5 + \ldots$
$\quad + 98 + 99 + 100 + 99 + 98 + \ldots$
$\quad\quad 5 + 4 + 3 + 2 + 1$

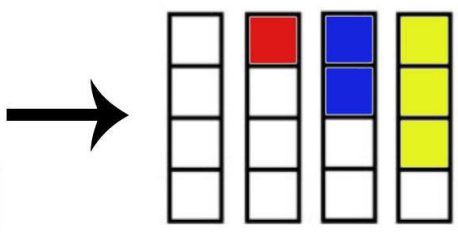
$= \boxed{10{,}000}$

OR you could make a table and notice the pattern:
The number of squares is the Case Number squared.

Case Number	# of Squares
1	1
2	4
3	9
4	16
5	25
⋮	⋮
100	10000
n	n^2

Another way to think about it:





Number of squares is the height of the middle column squared

Group Work

Roles

Recorder: _____

Writes down group's ideas and shows group's work.

Task Manager: _____

Makes sure everyone stays on task.

Includer: _____

Makes sure everyone has a chance to speak and share their thoughts and ideas.

Understander(s): _____

_____

Makes sure everyone understands everyone else's ideas and suggestions.