

How Many Vertices?

Justin had 6 green pattern block shapes. He placed them in a row on his desk with a space between each piece. How many vertices did Justin see?

Justin decided to connect his green pattern block pieces. Now how many vertices does Justin see?

How Many Vertices?

Suggested Grade Span

Pre K–2

Grade(s) in Which Task was Piloted

Grade K

Task

Justin had 6 green pattern block shapes. He placed them in a row on his desk with a space between each piece. How many vertices did Justin see?

Justin decided to connect his green pattern block pieces. Now how many vertices did Justin see?

Alternative Versions of Task

More Accessible Version:

Justin had a green pattern block and a blue pattern block on his desk. Which piece has more vertices? How many vertices did Justin see in all?

More Challenging Version:

Justin had 6 green pattern block pieces. He placed them in a row on his desk with a space between each block. How many sides and vertices did Justin see?

Justin decided to connect his green pattern block pieces to make a parallelogram. Now, how many sides and vertices did Justin see?

What regular shape can be made with 6 green pattern block pieces? How many sides and vertices does this shape have?

What do you notice about the number of sides and vertices in all 3 shapes?

NCTM Content Standards and Evidence

Geometry Standard for Grades Pre K–2

Instructional programs from pre-kindergarten through grade 12 should enable all students to —

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
 - *NCTM Evidence A:* Describe attributes and parts of two- and three-dimensional shapes

- **Exemplars Task Specific Evidence A:** This task requires students to understand the attribute of vertices.
- **NCTM Evidence B:** Investigate and predict the results of putting together and taking apart two- and three-dimensional shapes
- **Exemplars Task Specific Evidence B:** This task requires the student to analyze a shape “apart”, and then “together”.

Time/Context/Qualifiers/Tip(s) From Piloting Teacher

This is a short to medium length task.

Links

The Greedy Triangle by Marilyn Burns, School & Library Binding, March 1995, would complement this task well, and could be a great introduction to shapes and sides, and you could include vertices.

Common Strategies Used to Solve This Task

Most students will count each vertice as they look at each green triangle and find the total number of vertices. As they put the triangle together to make another shape, they need to look carefully for only vertices of the new shape.

Possible Solutions

Original Version:

6 triangles x 3 vertices = 18 vertices

1 parallelogram x 4 vertices = 4 vertices

More Accessible Version:

1 triangle = 3 vertices

1 square = 4 vertices

3 + 4 = 7 vertices in all.

More Challenging Version:

6 triangles x 3 vertices = 18 vertices and 18 sides

1 parallelogram x 4 vertices = 4 vertices and 4 sides

Six triangular pattern blocks can be put together to make a hexagon. A hexagon has six vertices and six sides.

The student should notice that the number of sides = the number of vertices.

Task Specific Assessment Notes

General Notes

An understanding of vertices is needed for this task. Pattern block pieces should be available.

Novice

The student may choose a strategy that will not lead to a solution of the task. There is no correct reasoning, nor justification for reasoning. Everyday, familiar language is used to communicate ideas and no connections are made.

Apprentice

A partially correct strategy is chosen, or a correct strategy for only solving part of the task is chosen. There is some relevant engagement in the task. Arguments are made with some mathematical basis and some correct reasoning is present. An attempt is made to construct mathematical representations to record and communicate problem solving.

Practitioner

A correct strategy is chosen for all parts of the task and a systematic approach and/or correct reasoning is used to solve the problem/s correctly. Appropriate and accurate mathematical representations are used to help solve or portray the problems.

Expert

An Expert solution will have all that a Practitioner has and evidence of analyzing the situation in mathematical terms. The Expert may extend the solution to other cases. Mathematical connections or observations are used to extend the solution. Abstract representations are constructed.

9 Yards

Novice

This strategy will not lead to a correct solution.

The student appears to be adding the numbered triangle to the previous vertices.

| triangle | vertices |
|----------|----------|
| 1 | 3 |
| 2 | 6 |
| 3 | 9 |
| 4 | 13 |
| 5 | 18 |
| 6 | 24 |

The student does not attempt the second part of the task.

Apprentice

The table is accurate and labeled.

How many vertices
 make a t-table.
 18 vertices
 triangle vertices

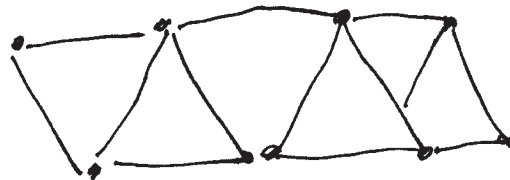
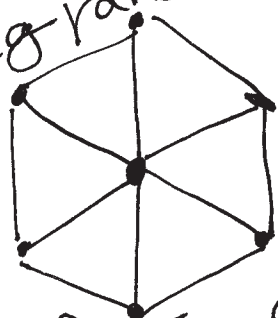
The problem is
 My Plan is to
 My answer

| | |
|---|----|
| 1 | 3 |
| 2 | 6 |
| 3 | 9 |
| 4 | 12 |
| 5 | 15 |
| 6 | 18 |

The strategy for the first part of the task leads to a correct solution.

Apprentice cont.

I rapid my answers
making a diagram
I have ~~5~~ 7
vertices I have 9
vertices.



The student counts all the vertices of the triangles even when they are not vertices of the new shape.

9 Yādūg

Practitioner

The student uses a strategy that leads to a solution.

The problem is
how many vertices are there
1st to do a table
My Plan

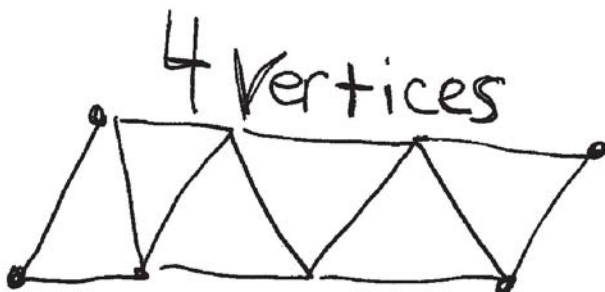
| Triangle | vertices |
|----------|----------|
| 1st | 3 |
| 2nd | 6 |
| 3rd | 9 |
| 4th | 12 |
| 5th | 15 |
| 6th | 18 |

The table is well organized and labeled.

The answer is 18

Practitioner cont.

The diagram supports
the solution.



The problem is how many vertices did Justin see?

My plan is to make

a table.

the vertices are +3

| triangle | vertices |
|----------|----------|
| 1 | 3 |
| 2 | 6 |
| 3 | 9 |
| 4 | 12 |
| 5 | 15 |
| 6 | 18 |

The table is accurate and labeled.

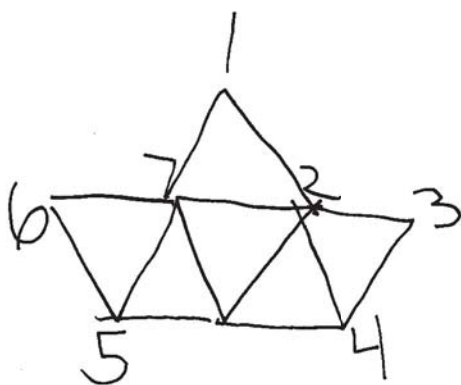
An observation that vertices increase by three is made.

The answer is 18 vertices.

Expert cont.

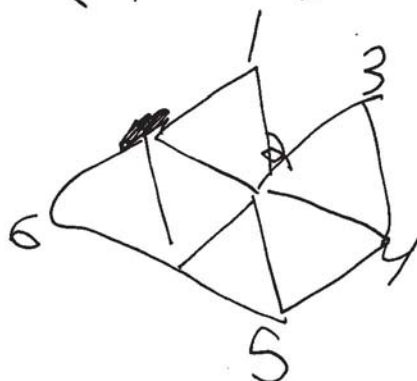
I am going to make a diagram

I found 7 vertices.



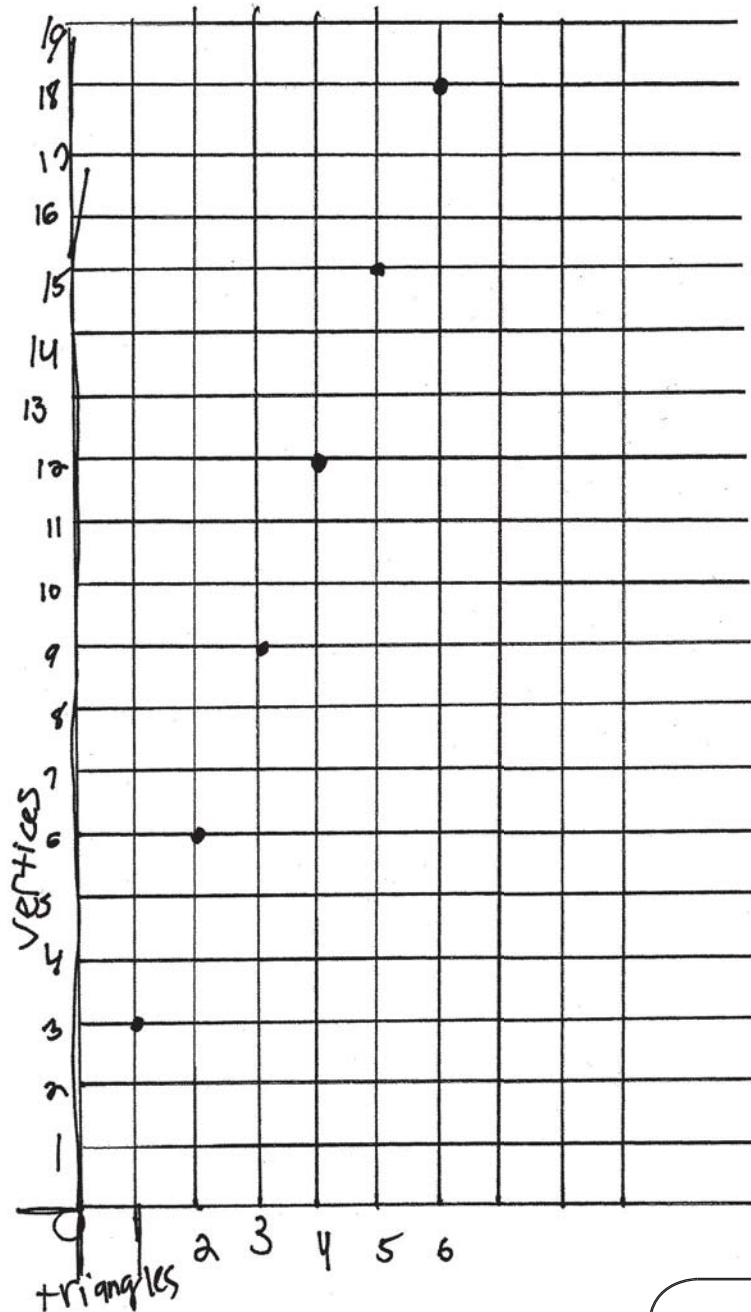
The student goes on to make more than one shape and makes an observation.

I found 6 vertices.



It is less when together

Expert cont.



The graph is a more abstract representation.

