SPIRAL PROGRESSION in the K + 12 MATHEMATICS CURRICULUM

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Objective of the Presentation

To enable the participants to understand the underlying principles and nuances of the spiral progression model in teaching Mathematics

Coverage of the Presentation

- K + 12 Mathematics Curriculum Framework
- Spiral Progression Approach and its Benefits
- Example of a Lesson that Teaches Mathematics through Problem Solving
- Examples of Using the Spiral Progression Approach

The K + 12 Mathematics Curriculum Framework

Goals of Mathematics in K to 12

- Critical thinking
- Problem solving

How to Achieve these Goals

- Content
- Skills and process
- Values and attitudes
- Tools
- Context

Content

- Numbers and Number Sense
- Measurement
- Geometry
- Patterns and Algebra
- Statistics and Probability

Skills and Processes

- Knowing and Understanding
- Estimating
- Computing and Solving
- Visualizing and Modeling
- Representing and Communicating
- Conjecturing, Reasoning, Proving and Decision-Making
- Applying and Connecting

Values and Attitudes

- Accuracy
- Creativity
- Objectivity
- Perseverance
- Productivity

Tools

- Manipulative objects
- Measuring devices
- Calculators and Computers
- Smartphones and Tablet PCs
- Internet

Contexts

- Beliefs
- Environment
- Language
- Culture
- Learner's prior knowledge and experiences

Underlying Learning Principles and Theories

- Experiential and Situated Learning
- Reflective Learning
- Constructivism
- Cooperative Learning
- Discovery and Inquiry-based Learning

Spiral Curriculum

- Builds upon previously learned knowledge
- Deepens understanding of topics

Features

- Learners revisit a topic.
- The complexity of the topic increases with each revisit.
- New knowledge being developed in each revisit has a relationship with previously learned knowledge.

Benefits of Using Spiral Progression

- It helps reinforce learning.
- It allows a logical progression from simple to complex ideas.
- It encourages students to apply their previous learning to later topics and new situations.
- It helps learners appreciate the connections among the different content strands.

Problem Solving

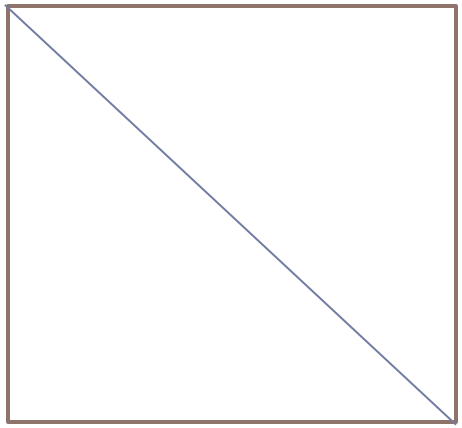
Problem solving should not only be a goal of learning mathematics. Problem solving should also be a means of learning mathematics.

Problem
(Grade 1)

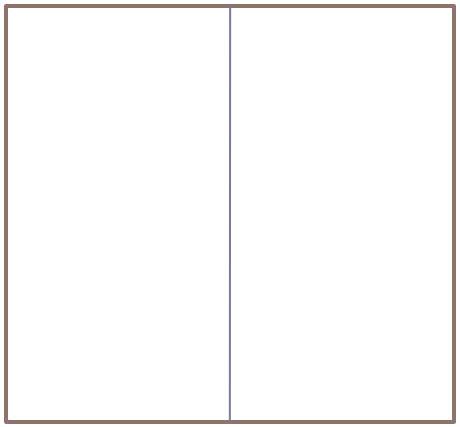
Karen has a piece of square paper. She wants to share one-half of the paper to Jun.

If you were Karen, how would you divide the paper?

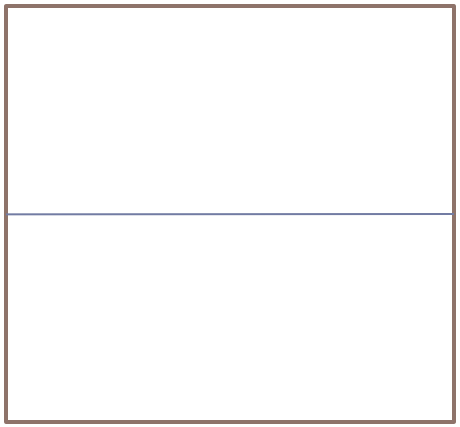
Different solutions:



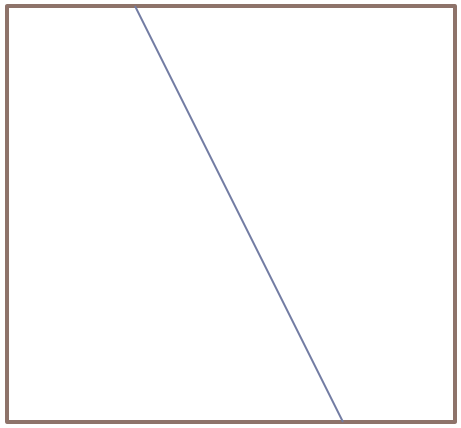
Solution 1



Solution 2

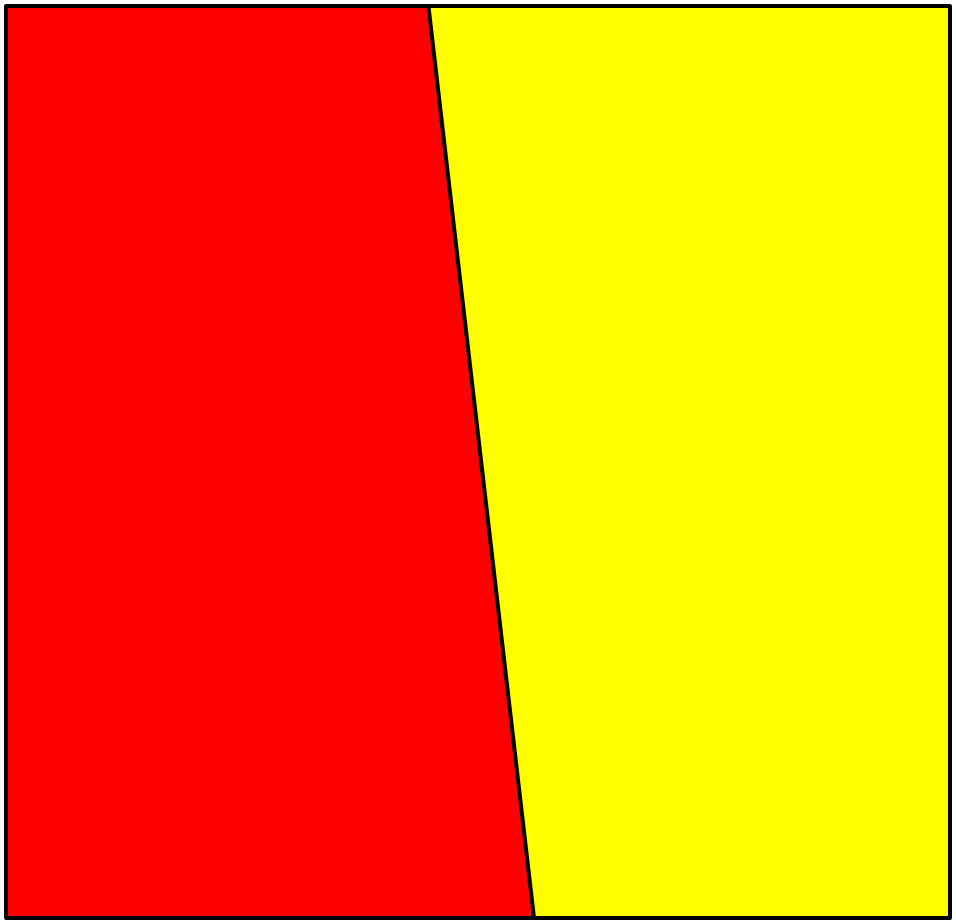


Solution 3



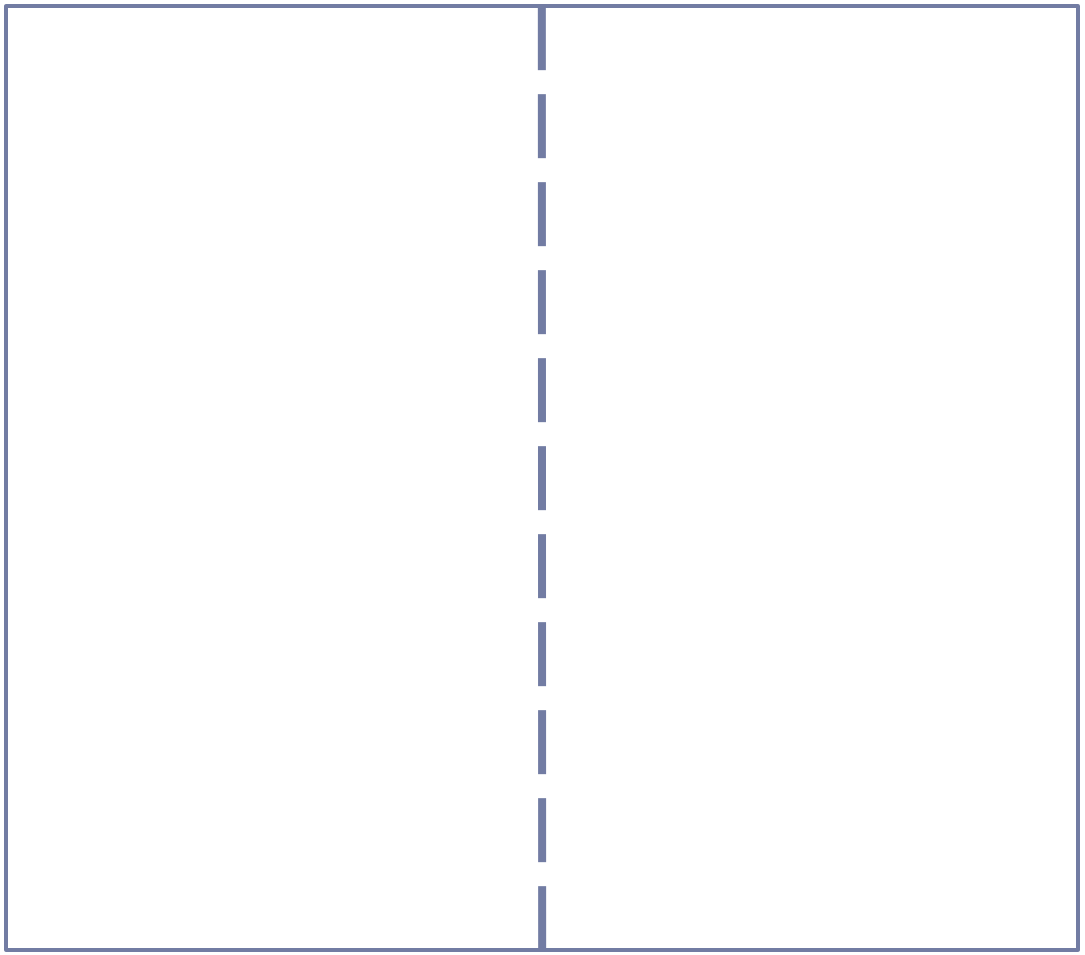
Solution 4

Verification of Solution 4

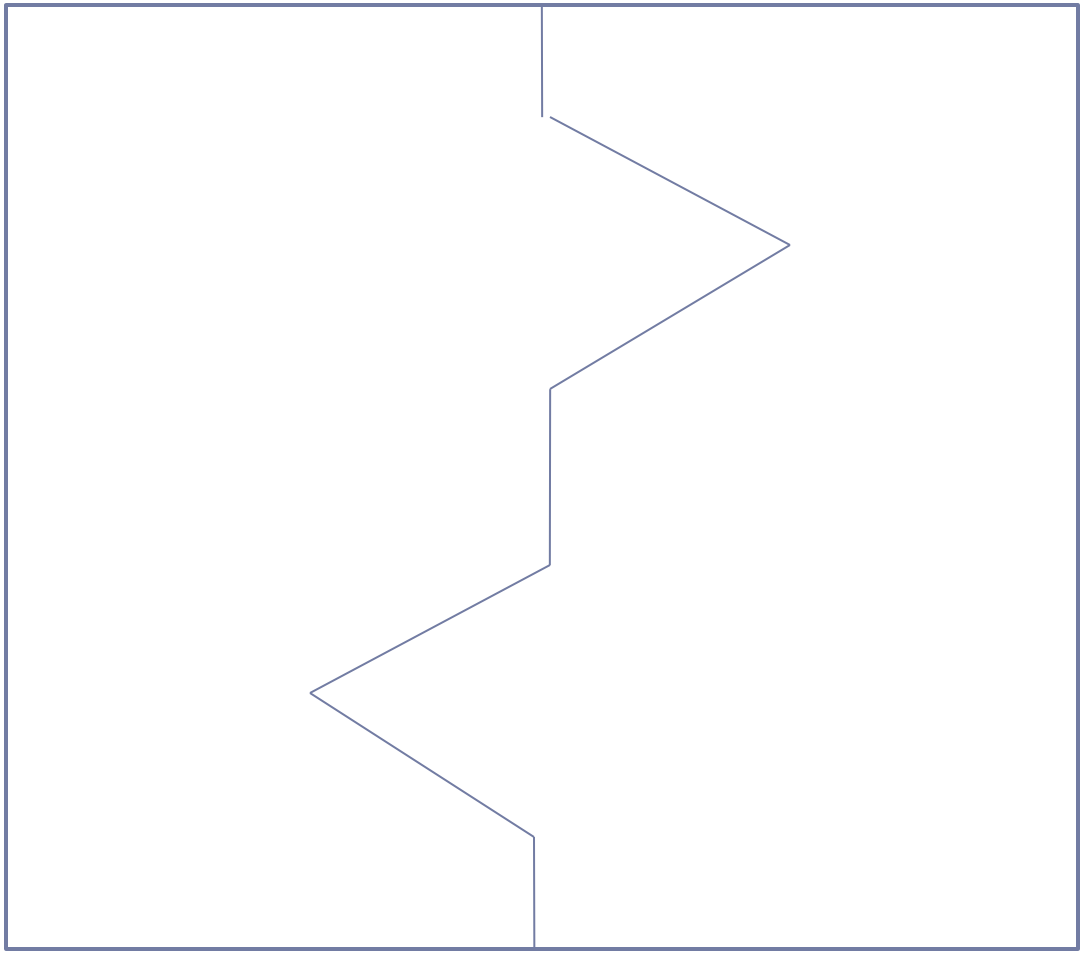


Other ways :

Start with folding a sheet of square paper this way



Example:

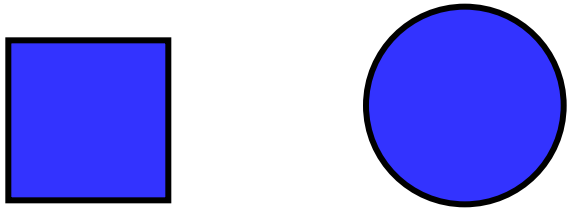


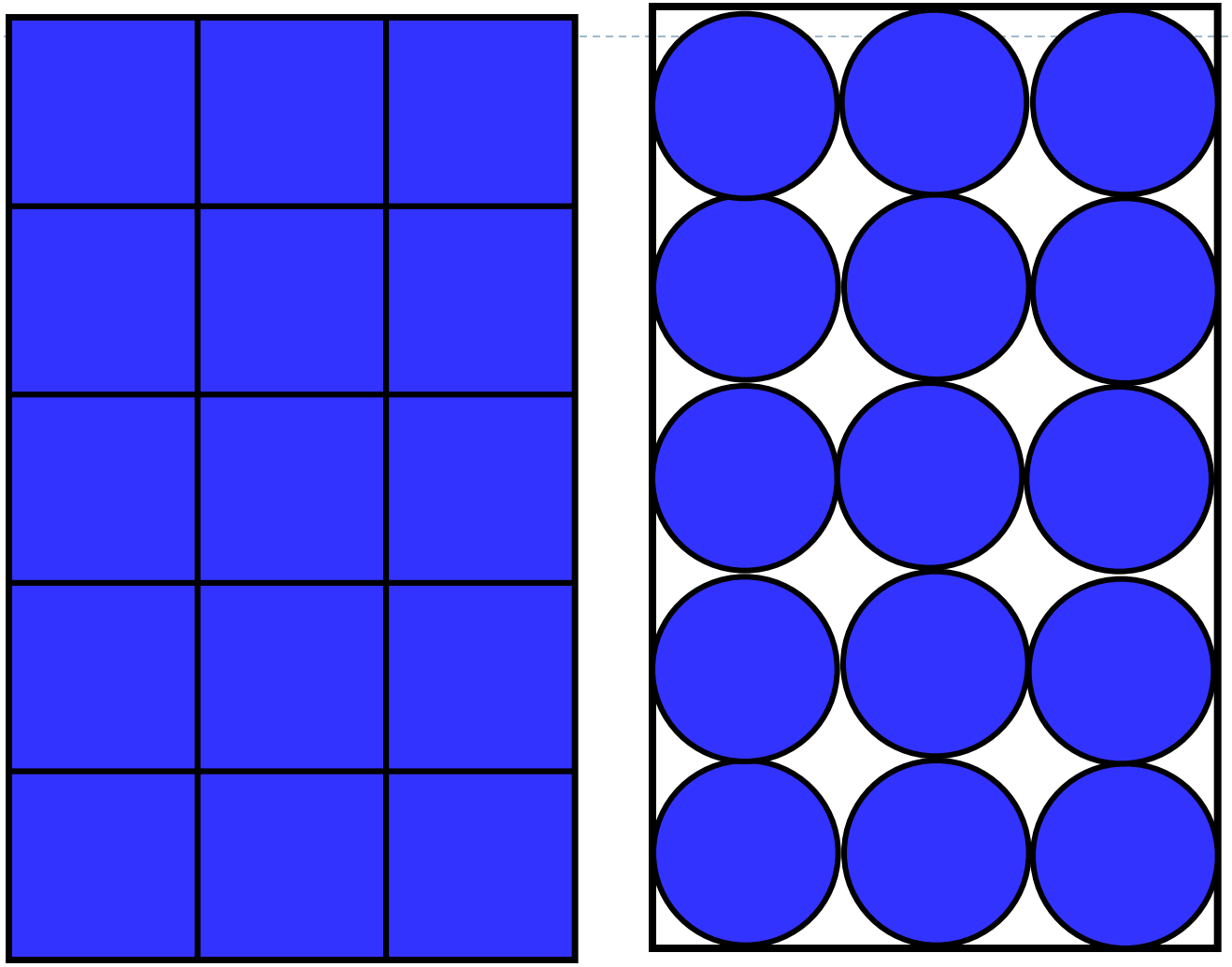
Area Measurement in the K +12 Curriculum

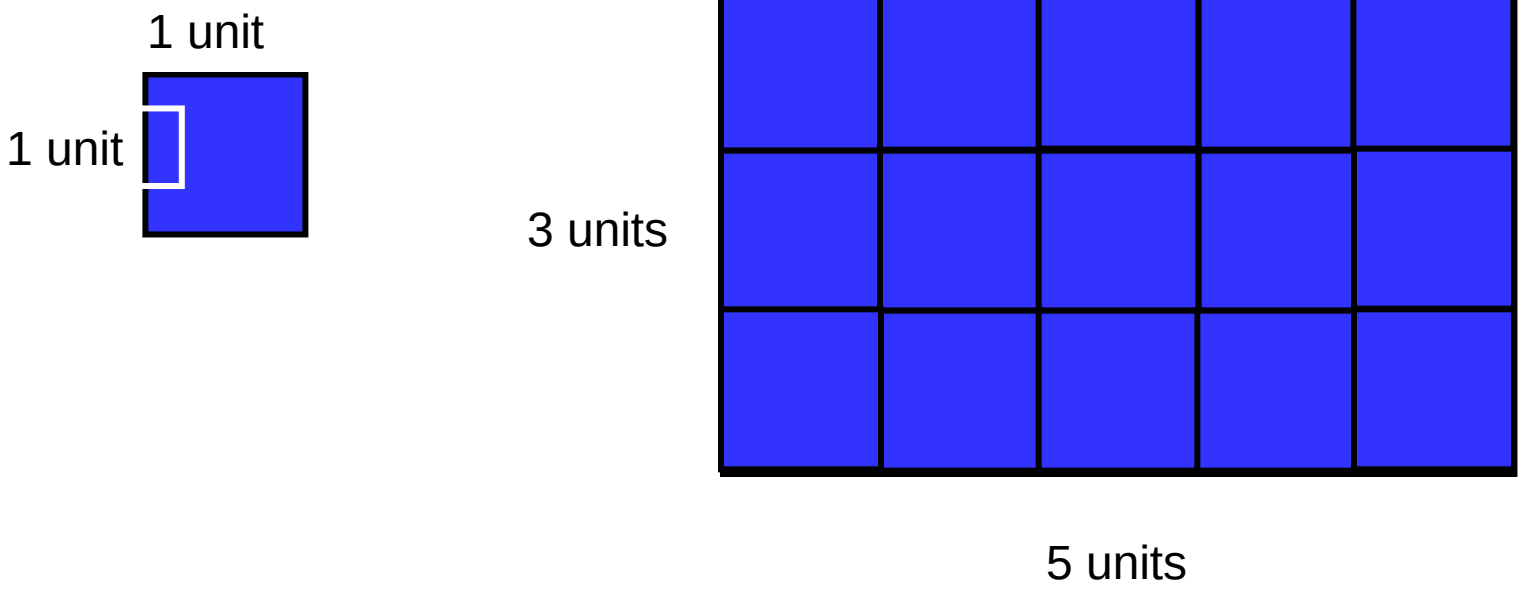
Area Measurement

Grade 2

Area Measurement



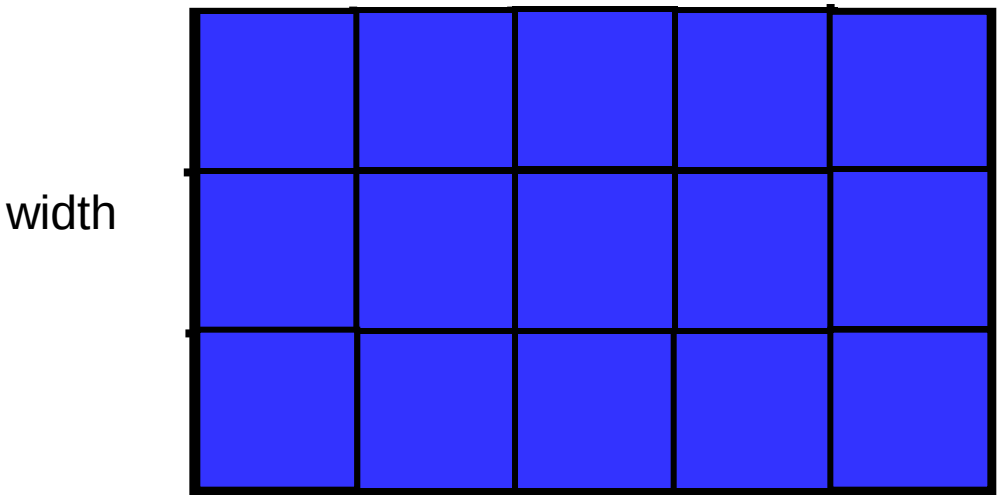




Area = 3 x 5

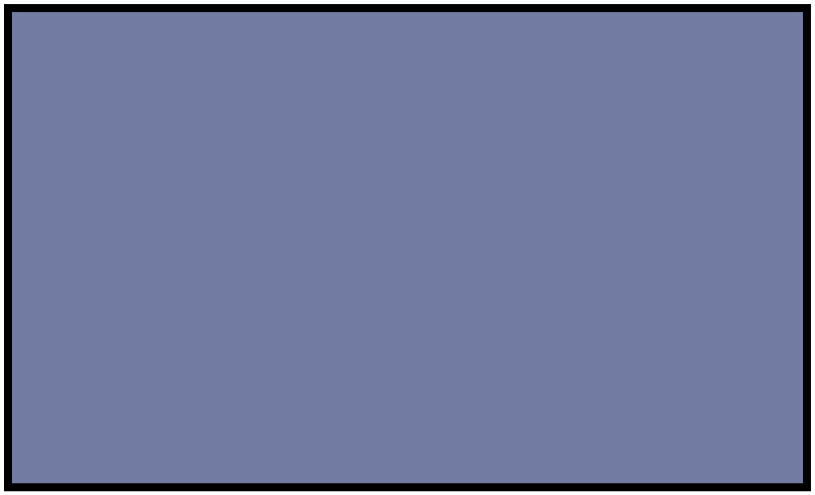
= 15 square units

Grade 3



Area of rectangle = length x width

= l x w

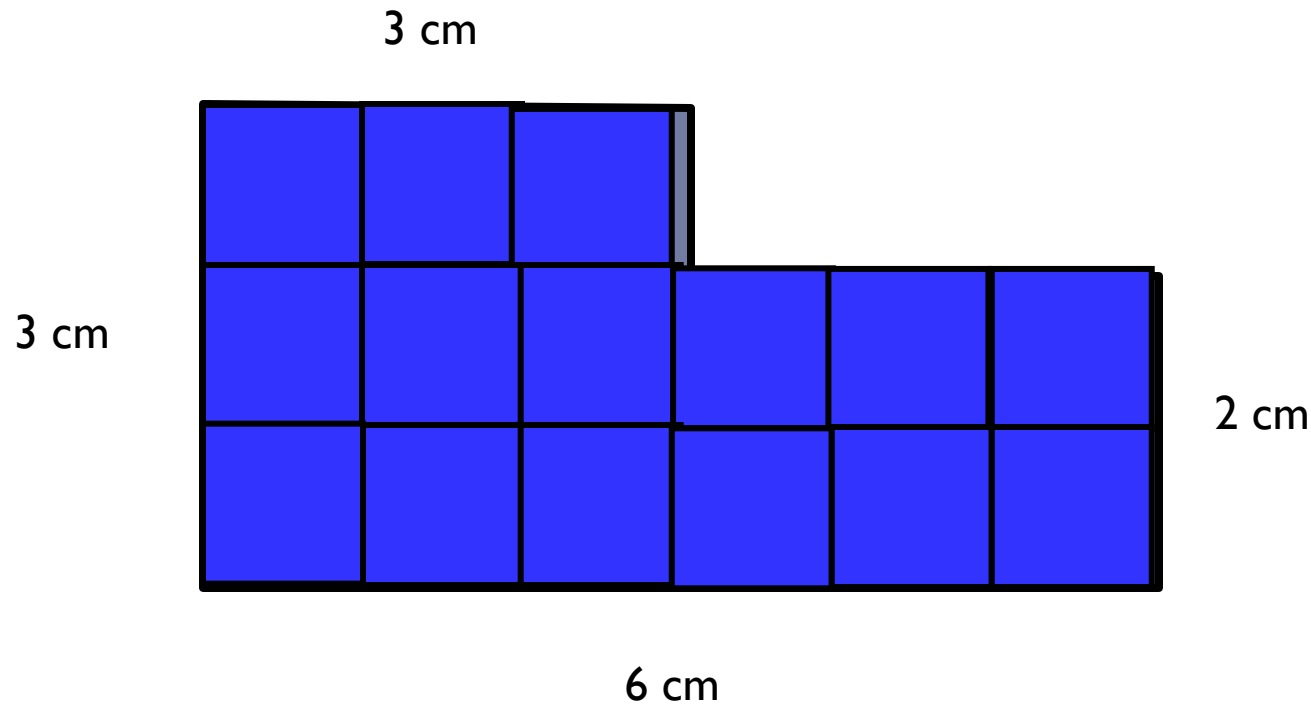


Area of rectangle = length x width

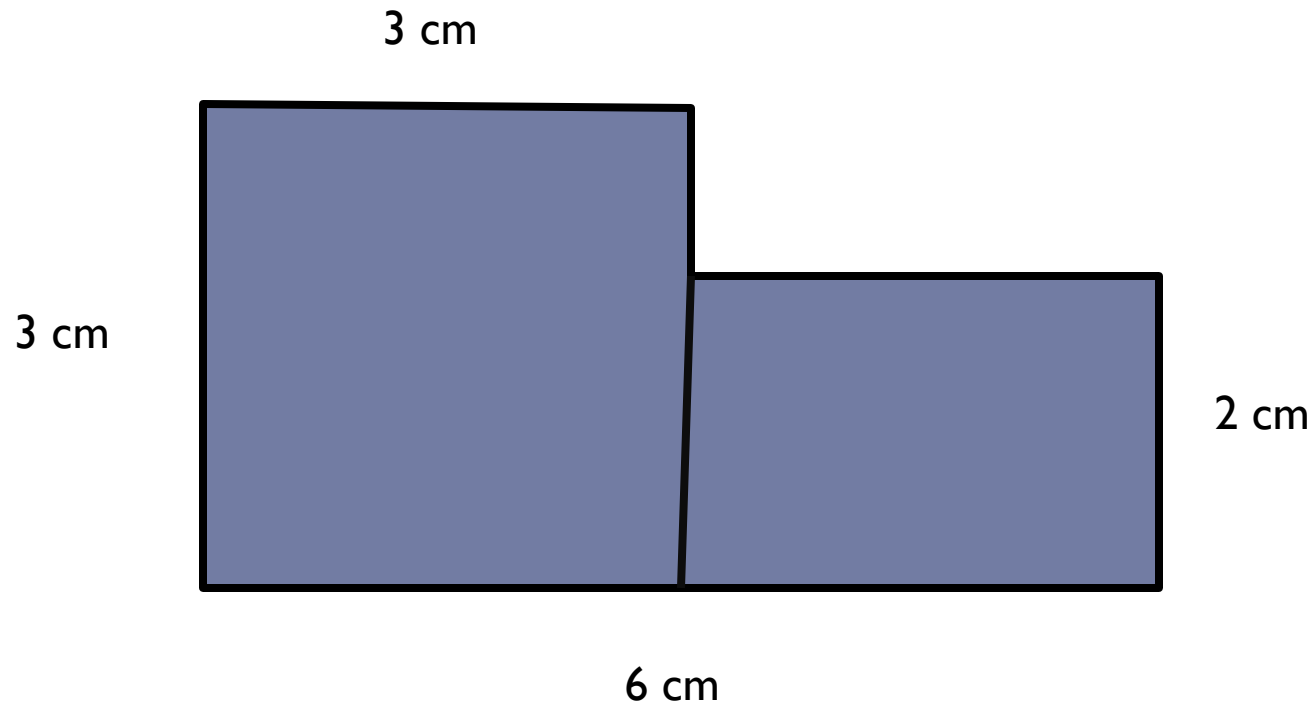
= *l* x *w*

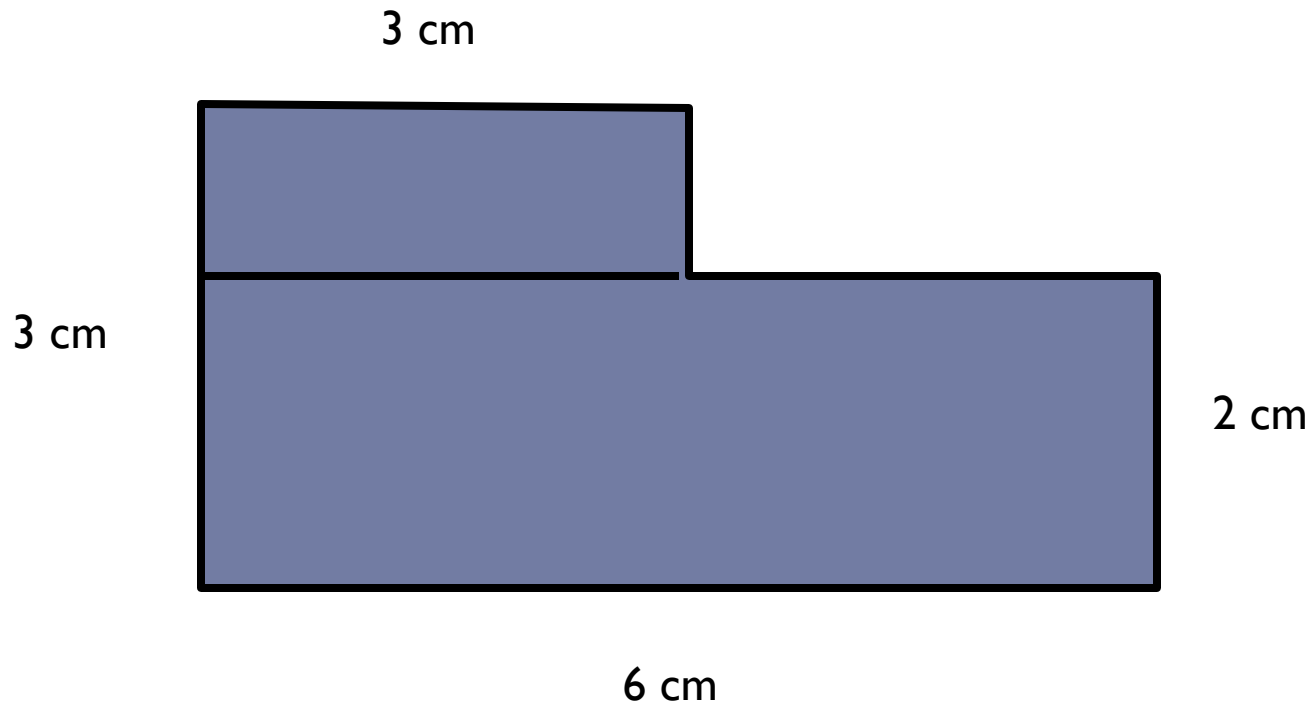
= *3 x 5*

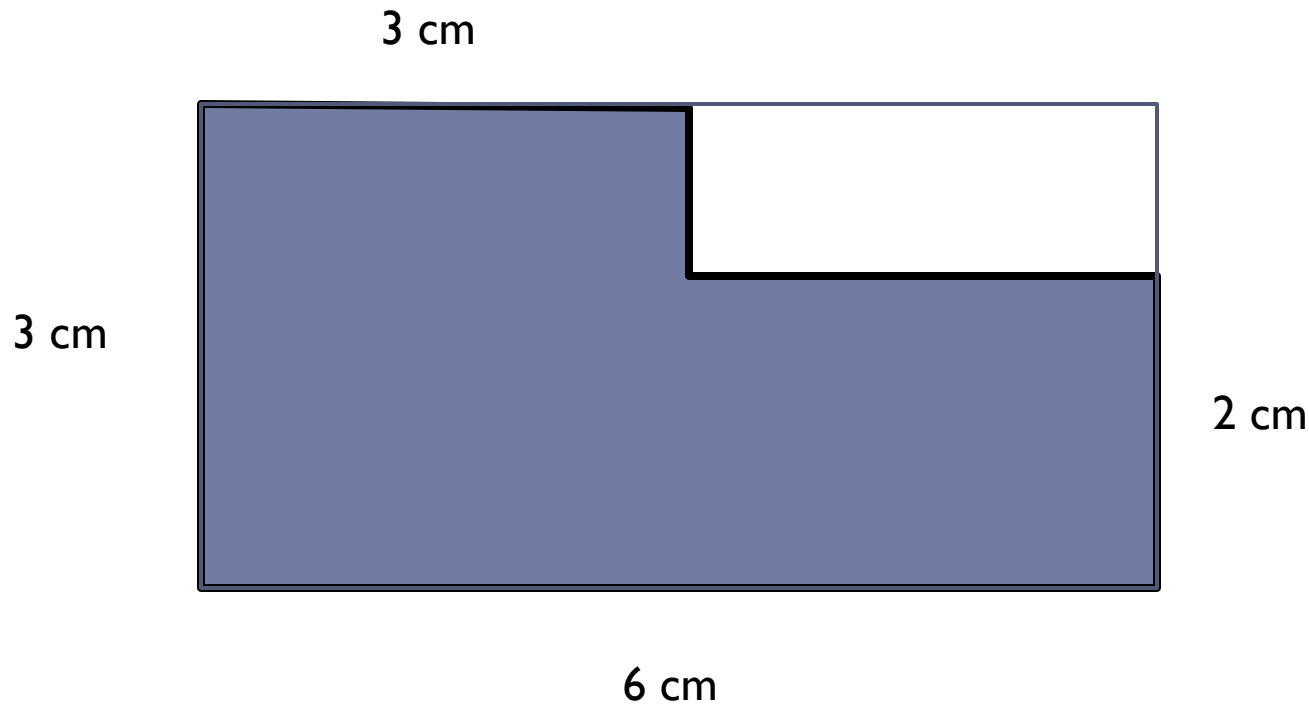
= *15 square cm*

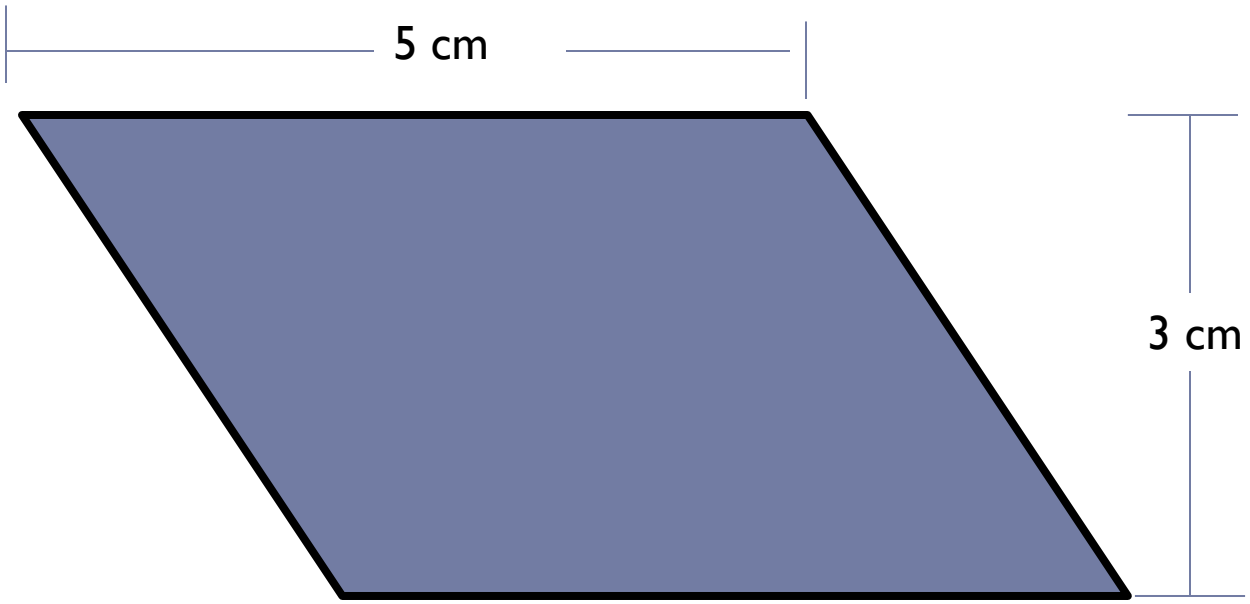


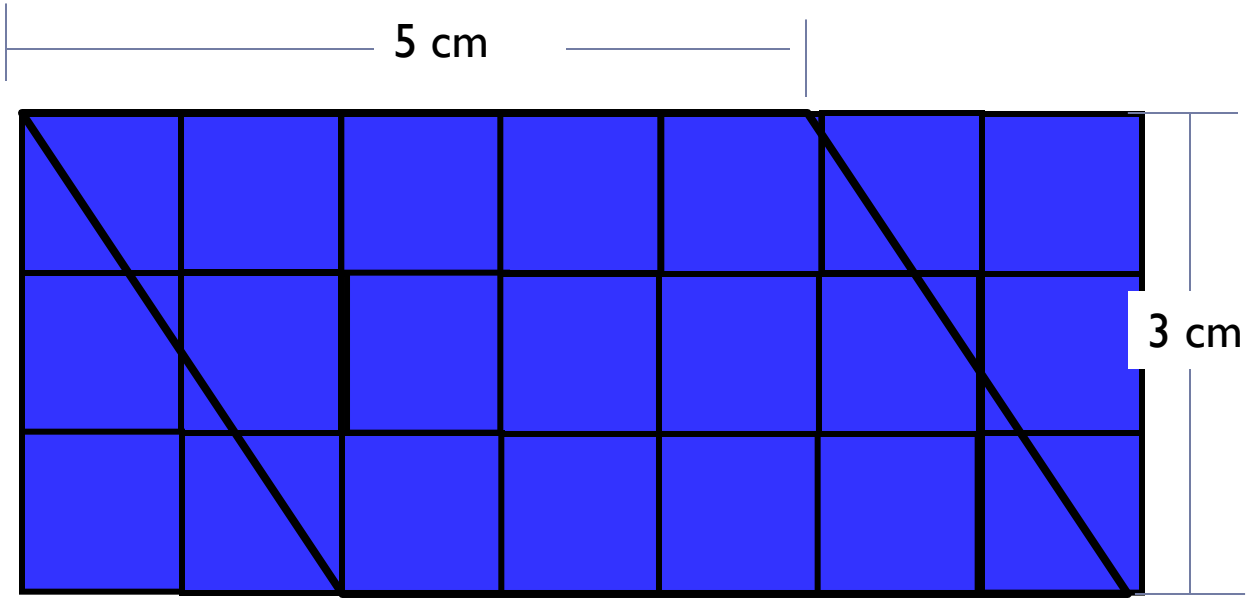
Grade 4

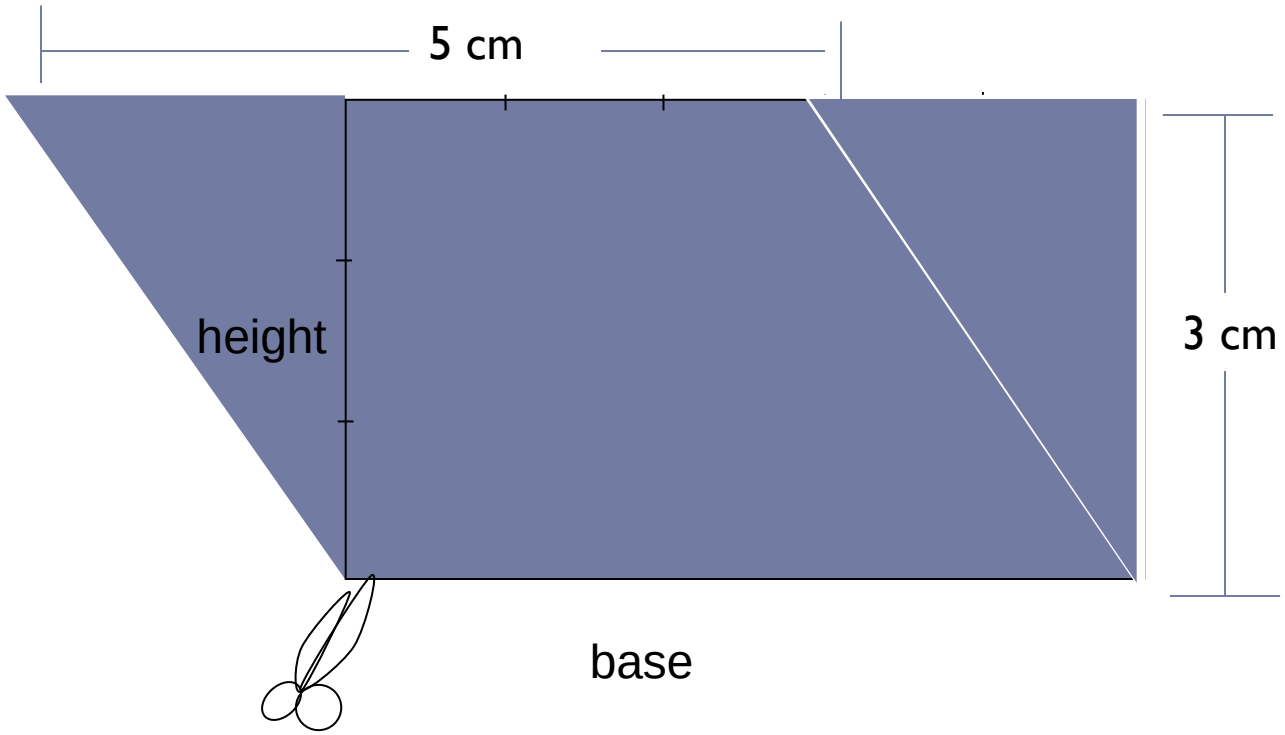

3 cm
3 cm
2 cm
6 cm


3 cm
3 cm
2 cm
6 cm


3 cm
3 cm
2 cm
6 cm

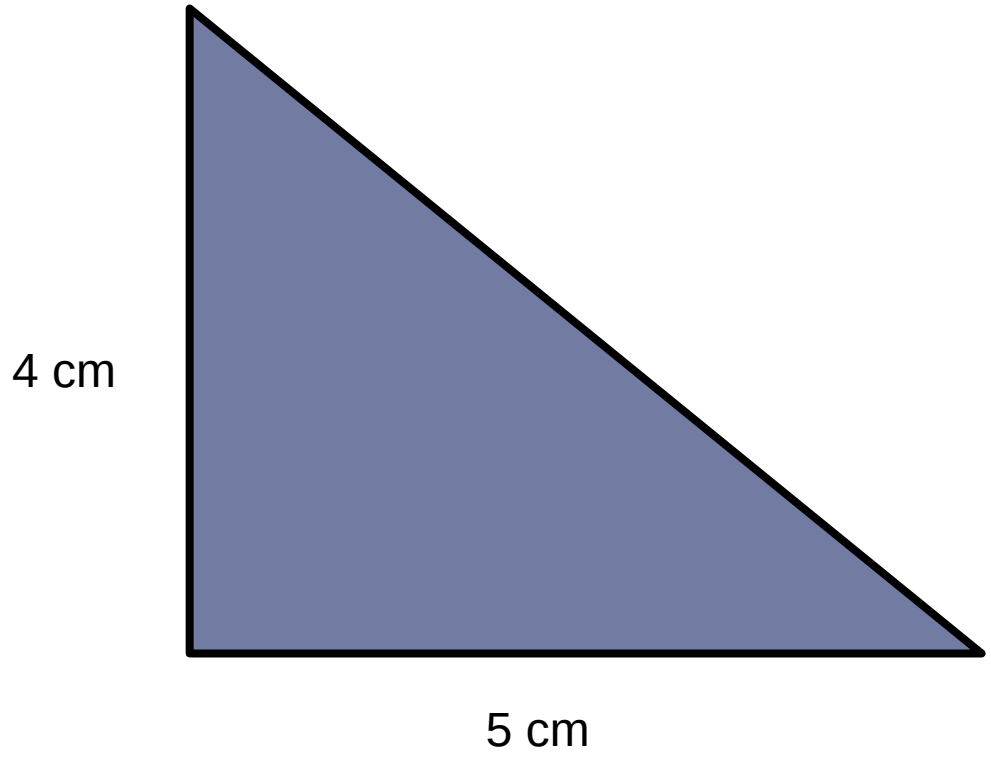

5 cm
3 cm

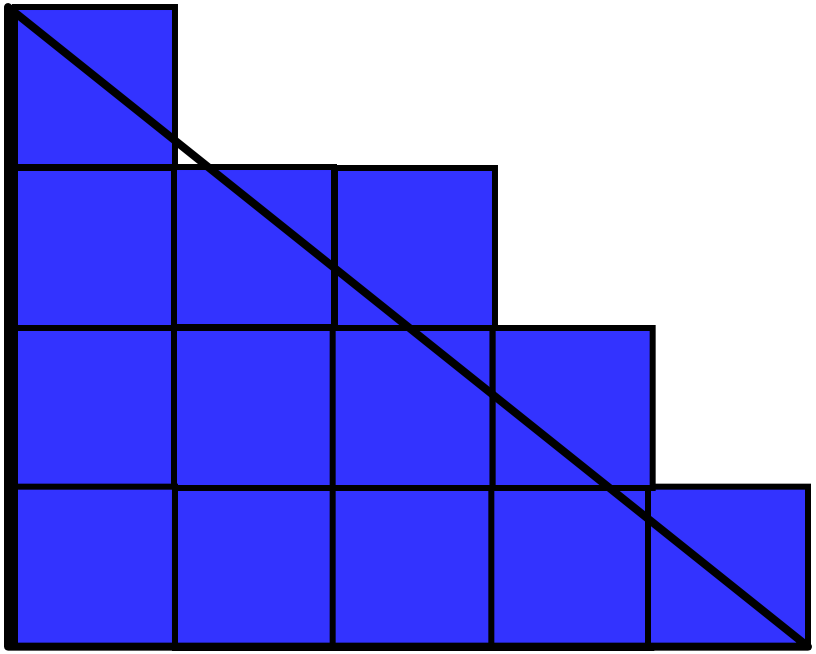

5 cm
3 cm

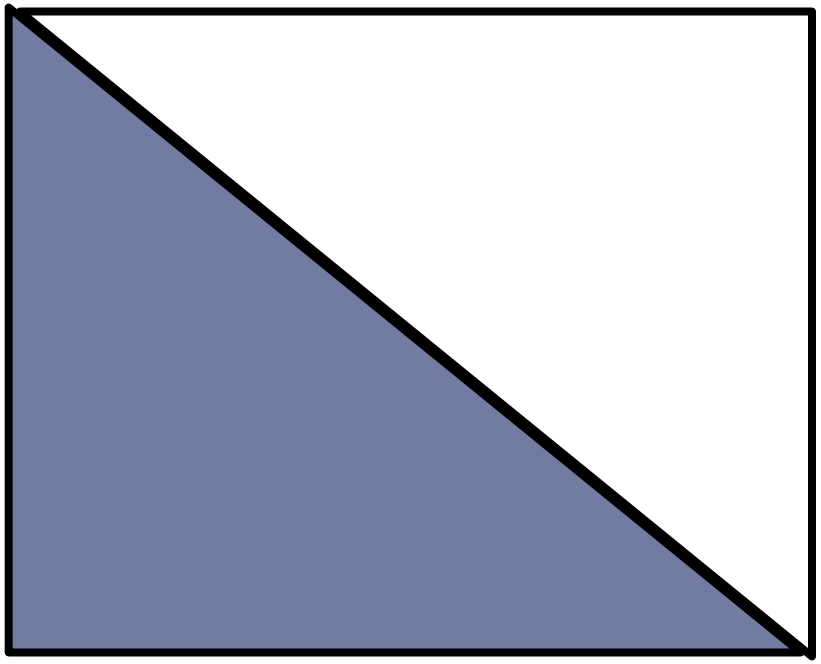


Area of parallelogram = base x height

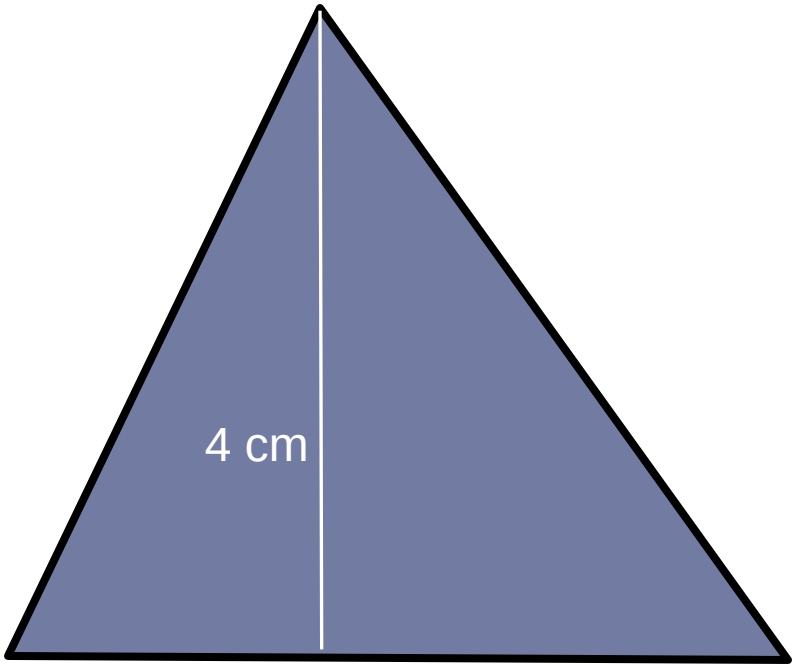
= bh


4 cm
5 cm

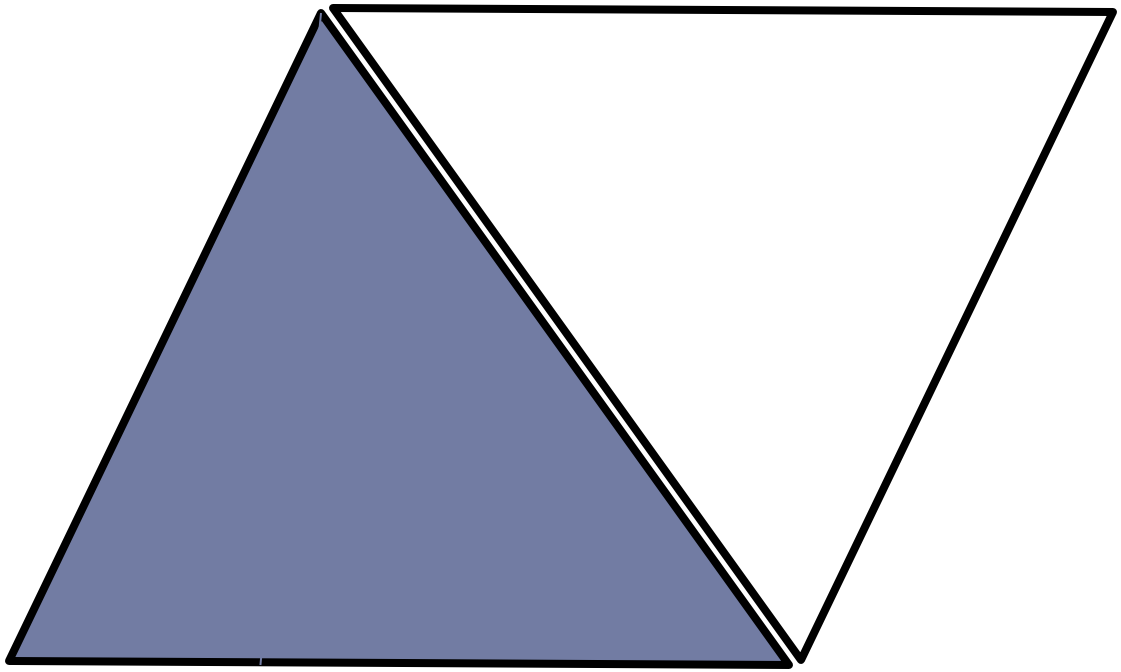

4 cm
5 cm



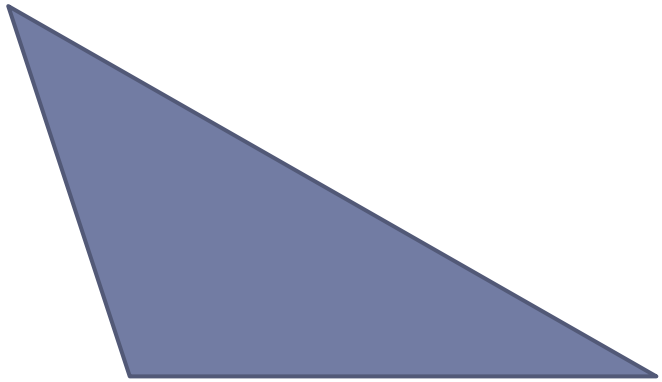
Area = $\frac{bh}{2}$

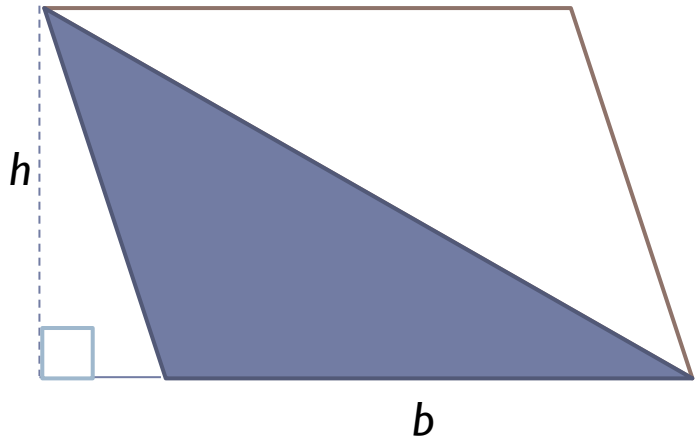


5 cm

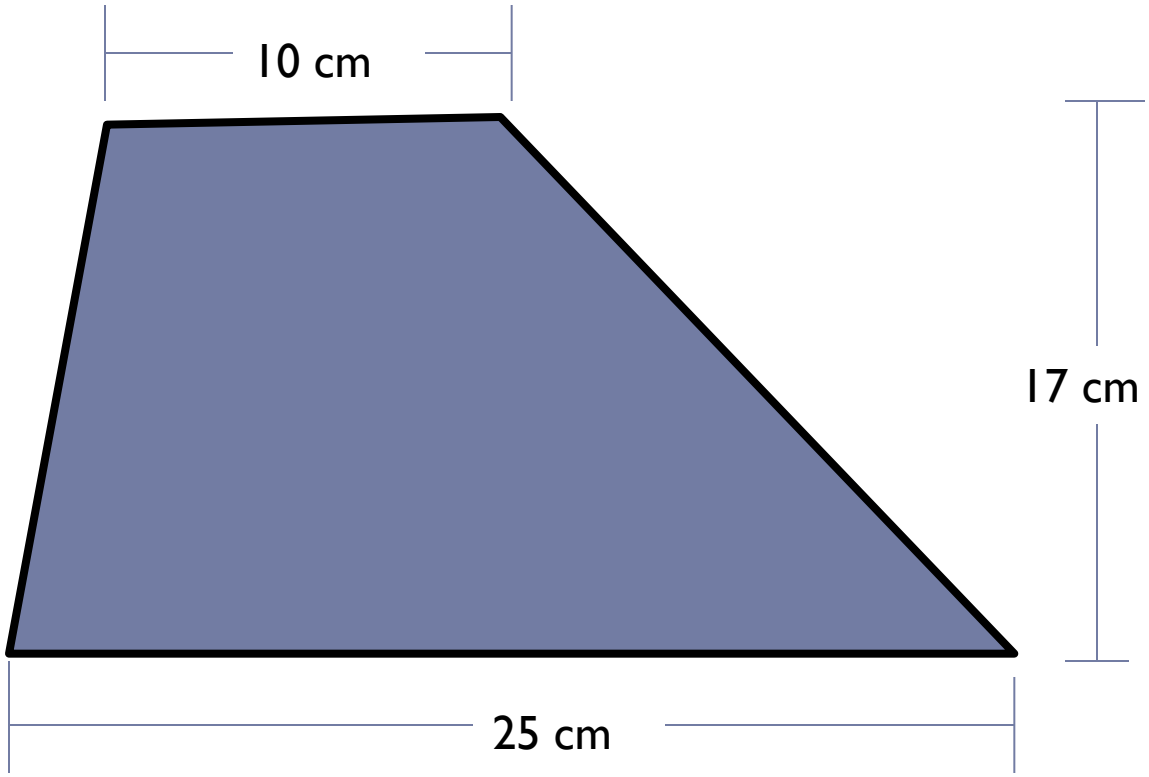


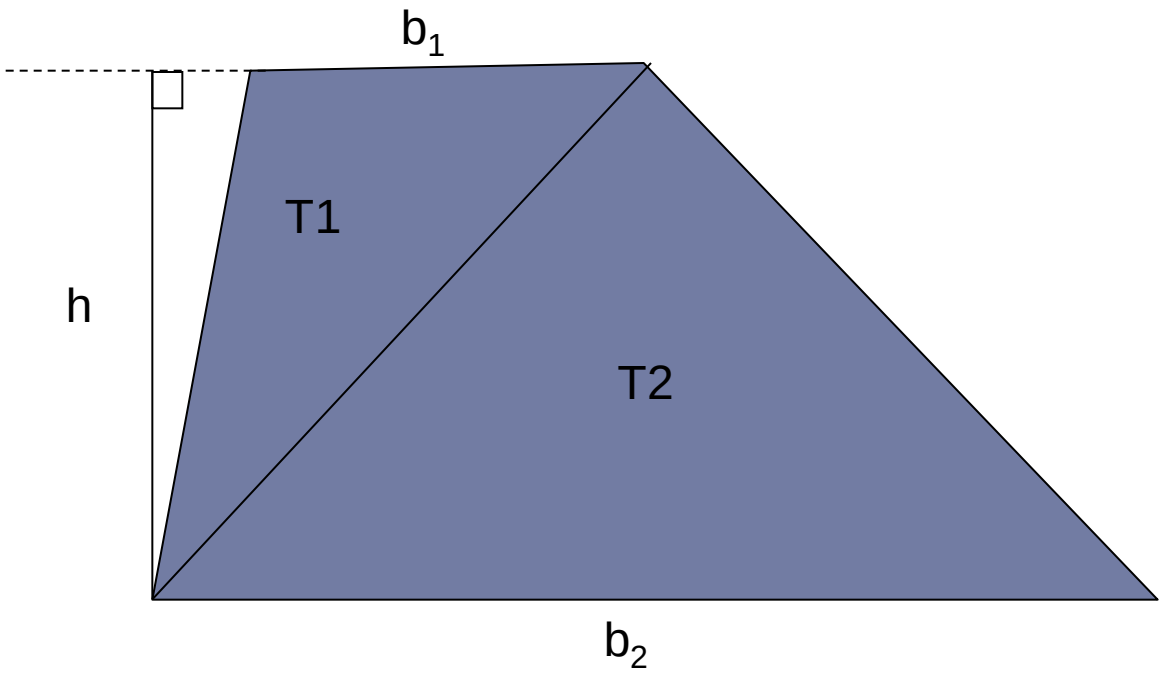
Area = $\frac{bh}{2}$





$$\text{Area} = \frac{bh}{2}$$


10 cm
17 cm
25 cm

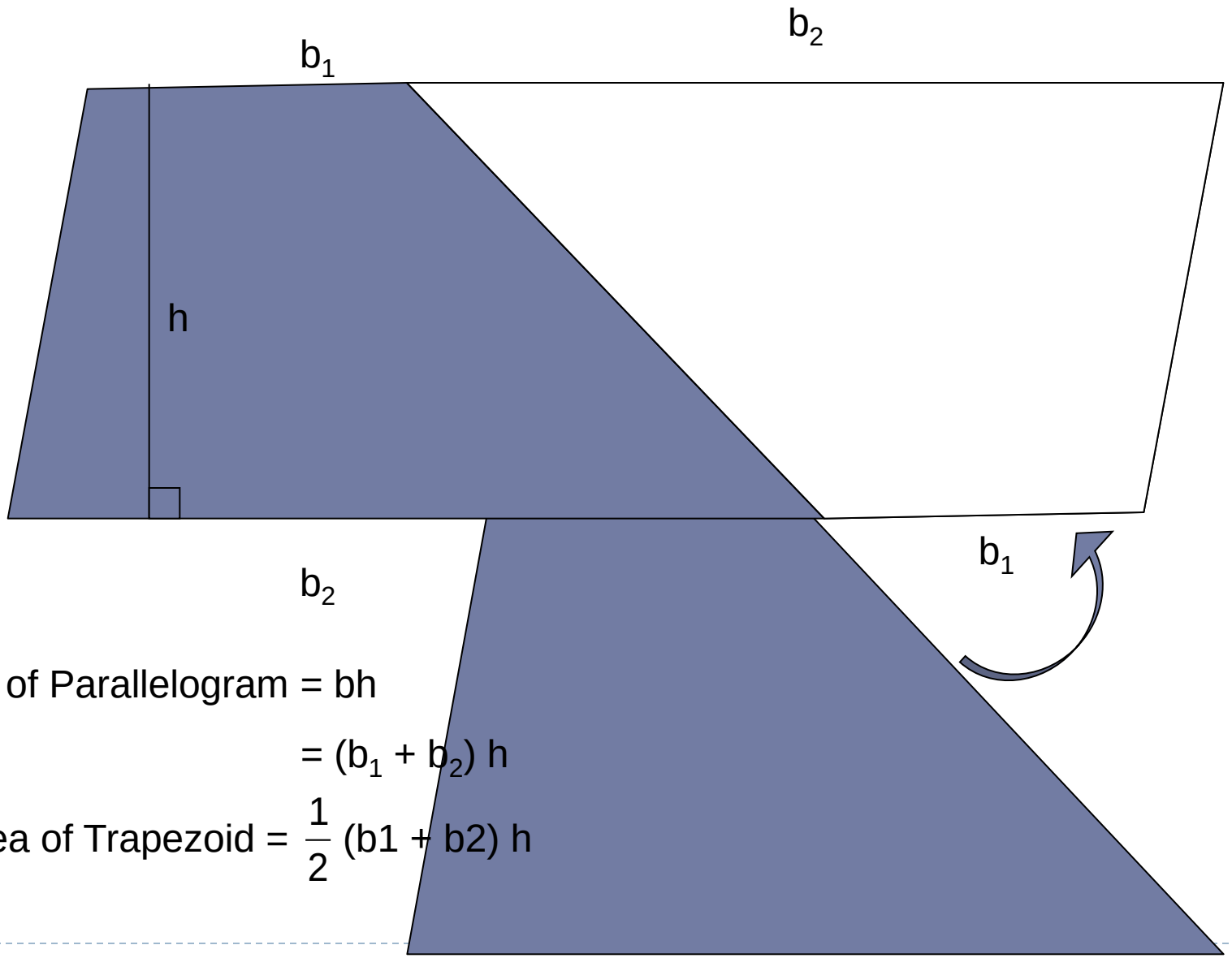


Area of Trapezoid = Area of T1 + Area of T2

$$= \frac{b_1 h}{2} + \frac{b_2 h}{2}$$

$$= \frac{h(b_1 + b_2)}{2}$$

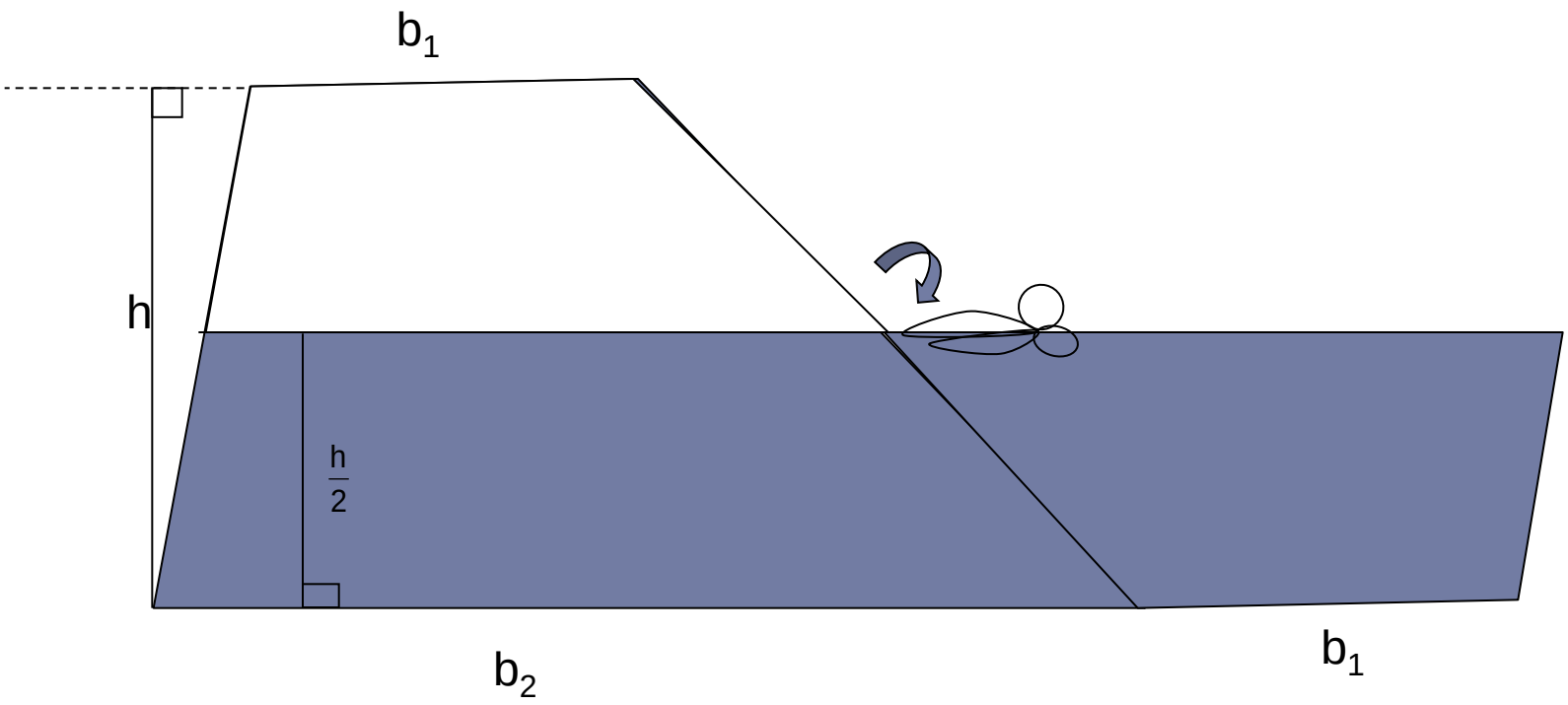
$$= \frac{1}{2}(b_1 + b_2)h$$



Area of Parallelogram = bh

$= (b_1 + b_2)\, h$

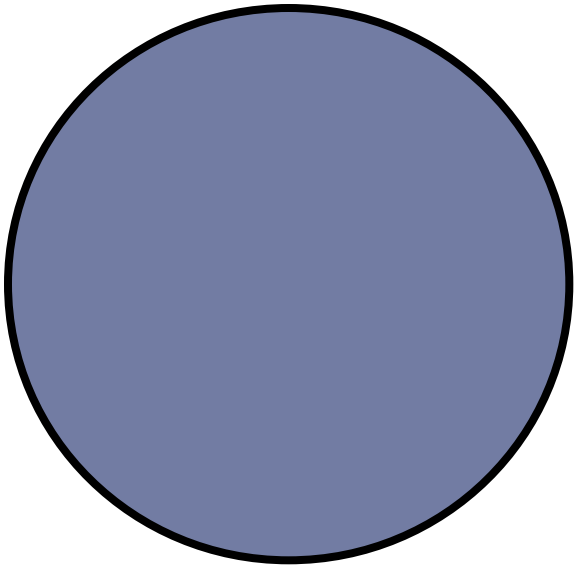
Area of Trapezoid = $\frac{1}{2}$ (b1 + b2) h



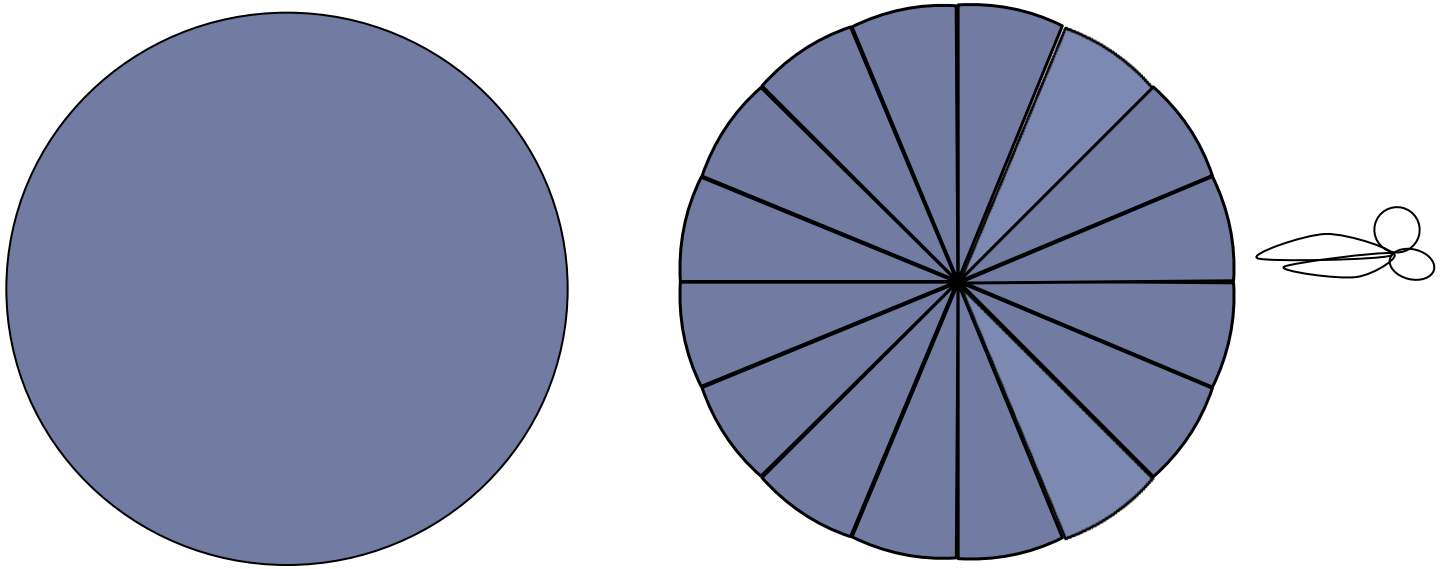
Area of Parallelogram = bh

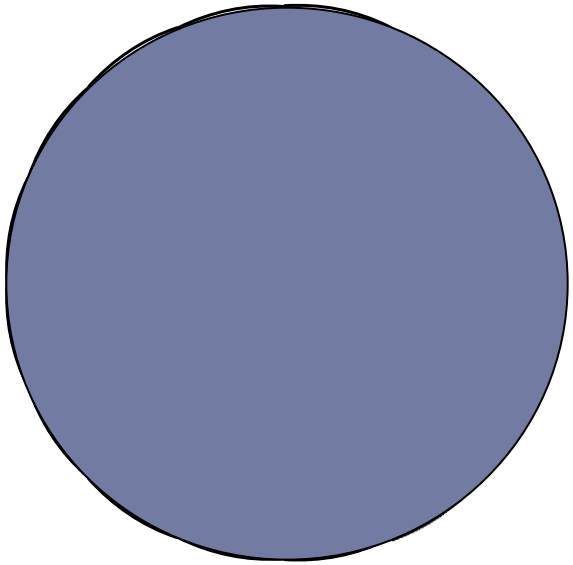
$$= (b_1 + b_2)\frac{h}{2}$$

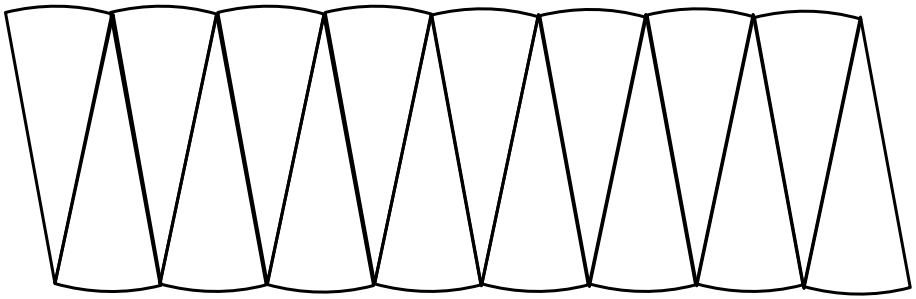
Area of Trapezoid = $\frac{1}{2}(b_1 + b_2)h$



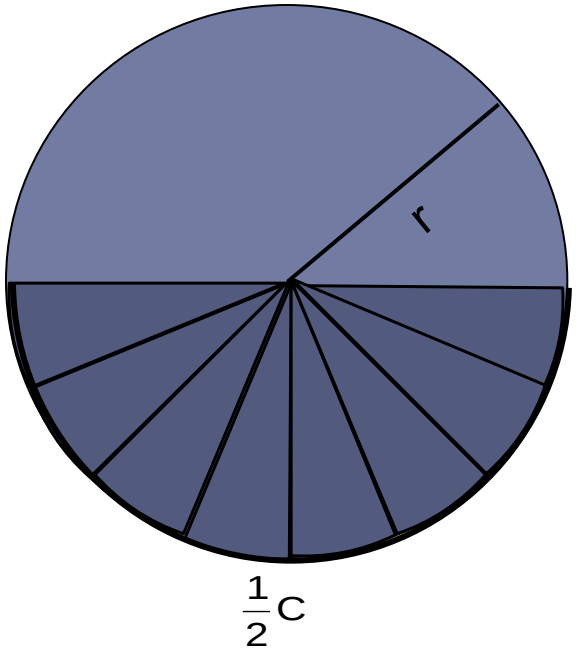
Grade 5







Area of the Circle = Area of the Parallelogram



Area of the Circle = Area of the Parallelogram

Area of Parallelogram = bh

Area of Circle $= \frac{1}{2}$ Cr

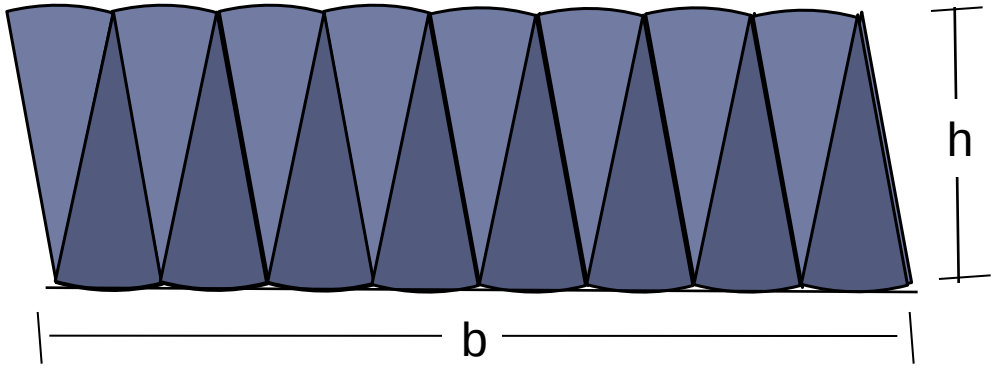
$= \frac{1}{2}$ $(2\pi r)$ r

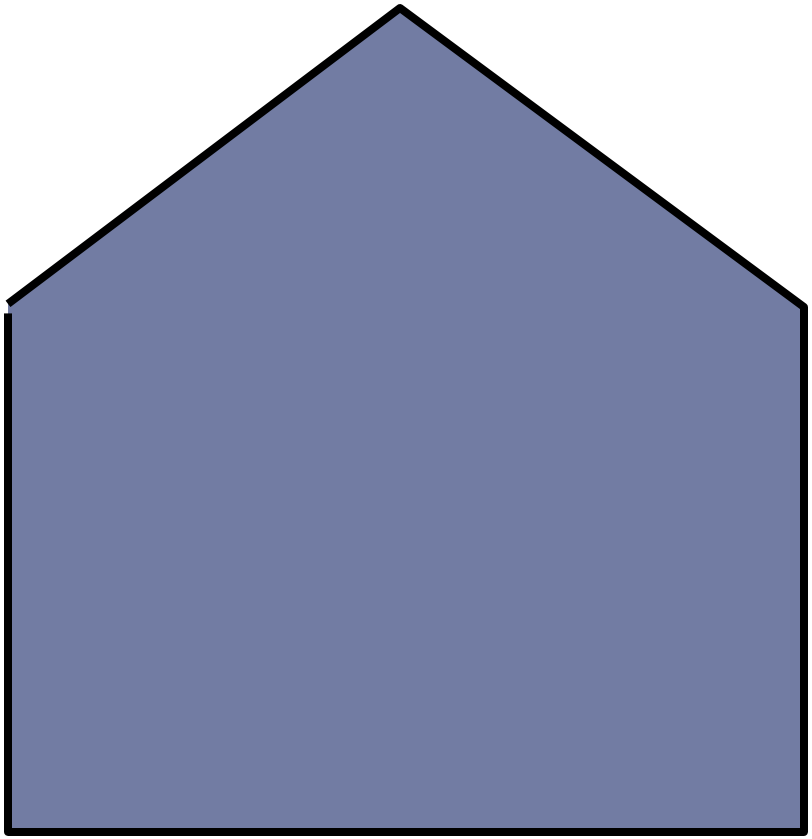
$= \pi r^2$

$b = \frac{1}{2}C$

$h = r$

$C = 2\pi r$





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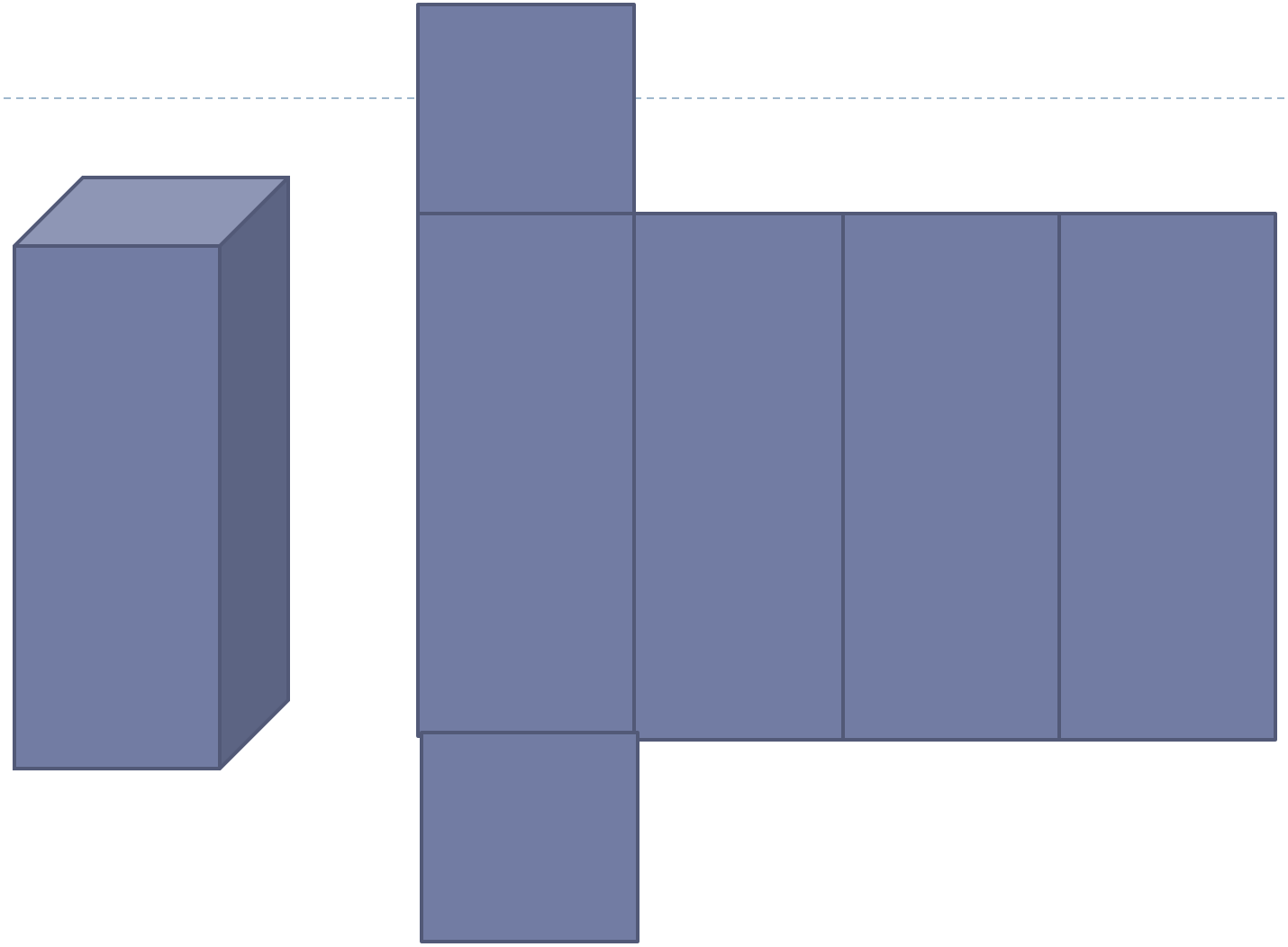


Patterns and Algebra in the K + 12 Curriculum

- Draw the next two figures:

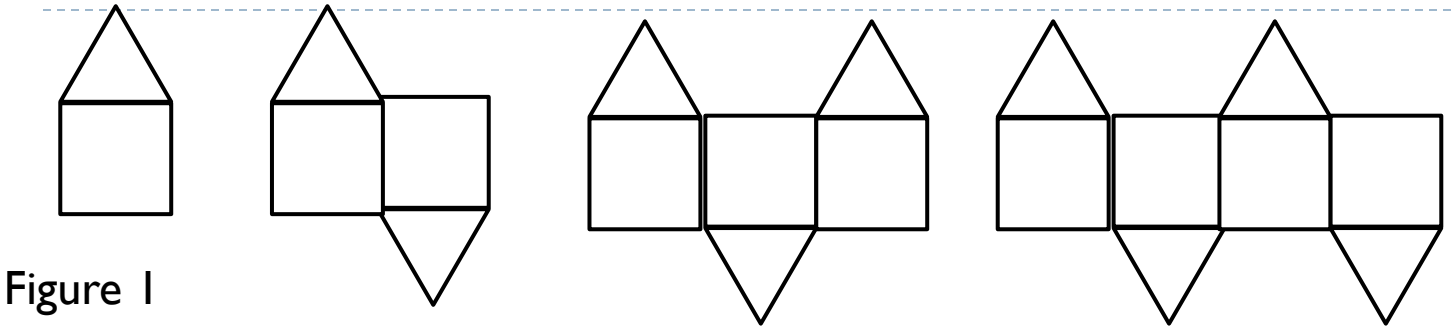


Figure 1

Figure 2

Figure 3

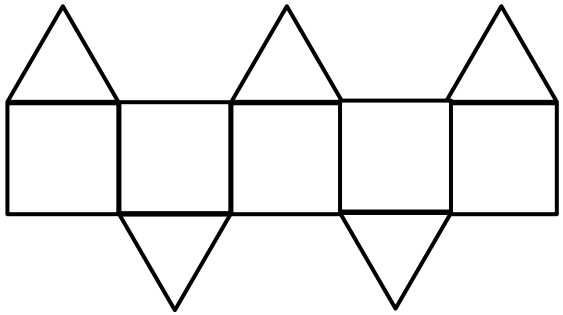
Figure 4

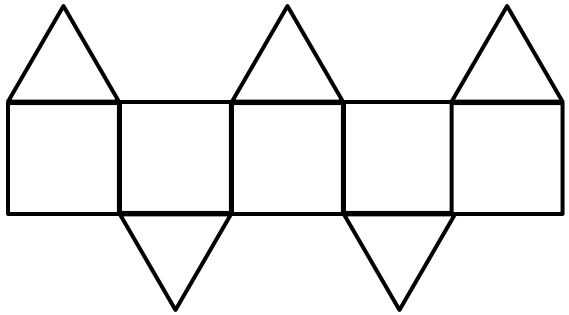
•How many sticks are used in each of Figure 1 to Figure 6?

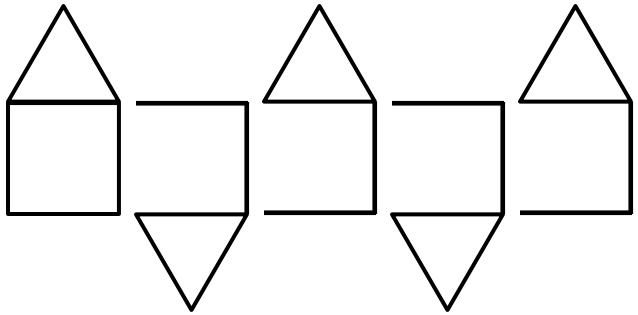
•How many sticks will there be for Figure 10?

Problem

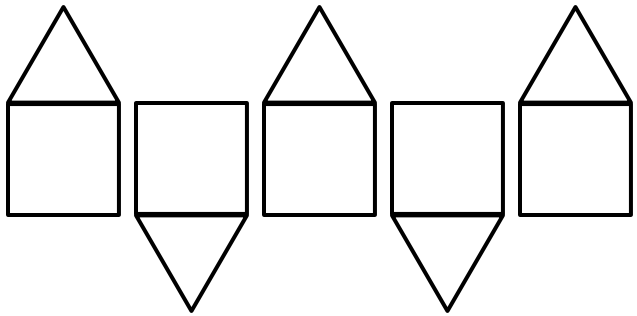
How many sticks were used in the figure below? Count systematically.

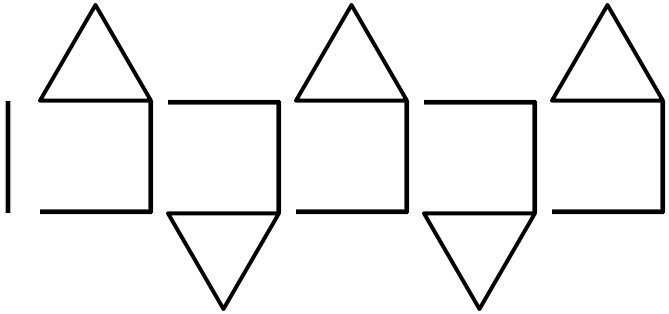






6 + (5 – 1) x5

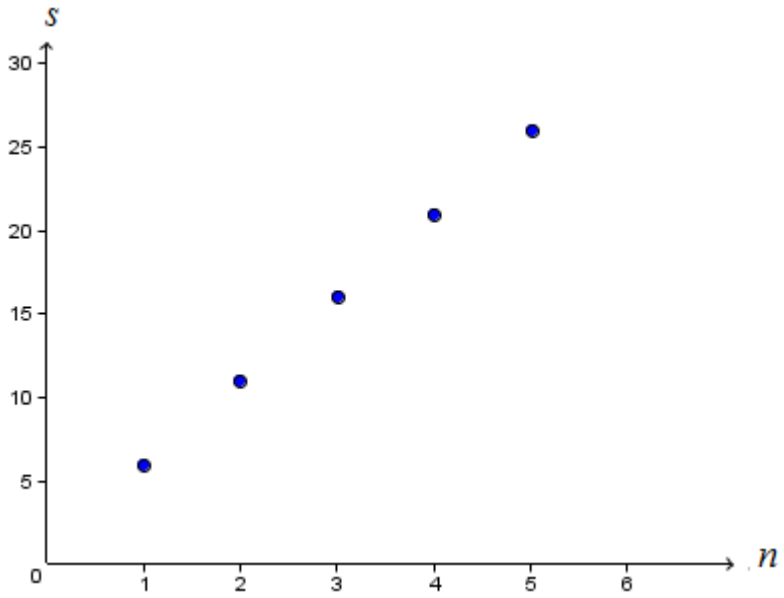




(5 x 6) – (5 – 1)

1 + (5 x 5)

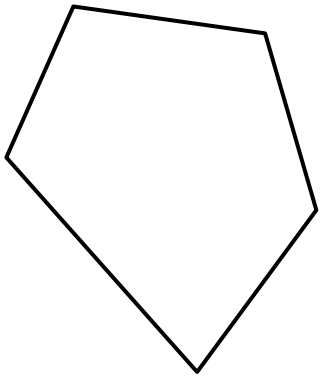
n	1	2	3	4	5
s	6	11	16	21	26



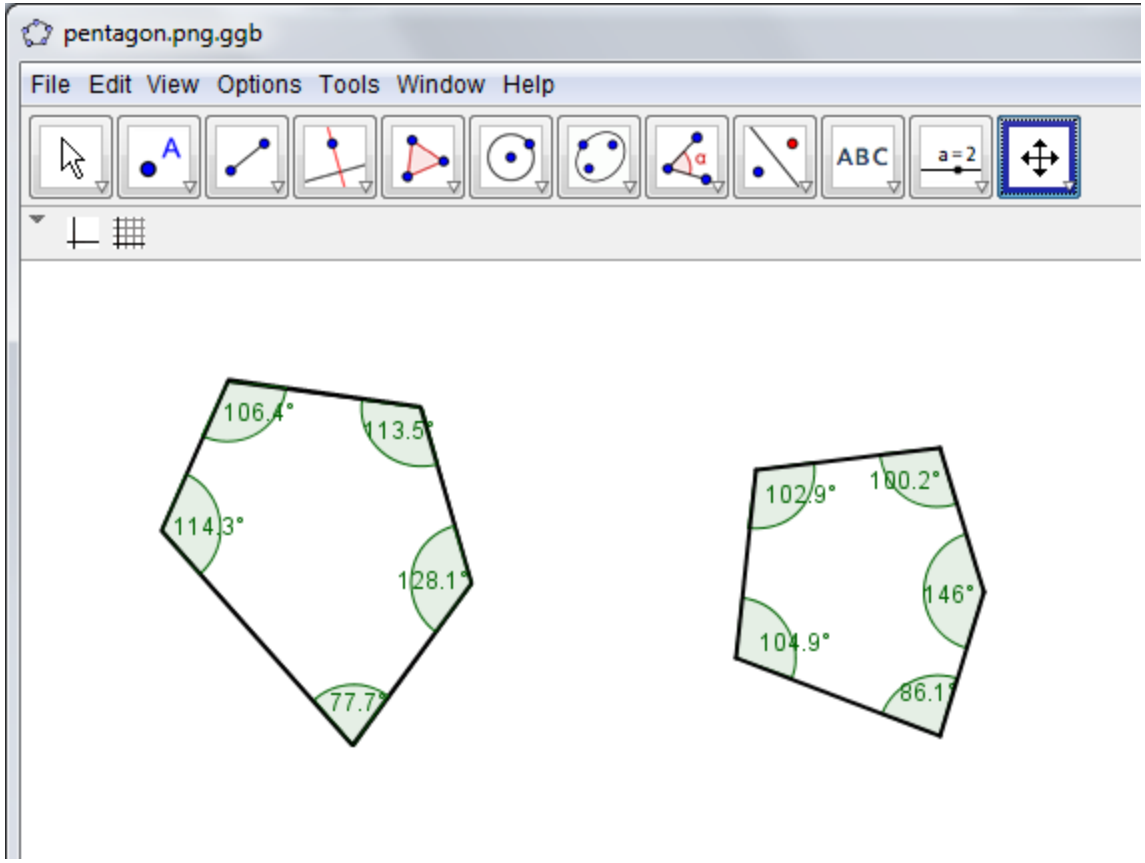
$s = 1 + 5n$

Problem

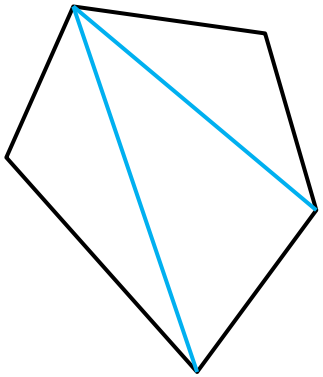
What is the sum of the measures of the interior angles of the pentagon shown?



Solution 1: Using GeoGebra

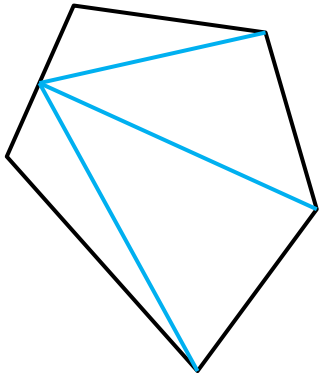


Solution 2



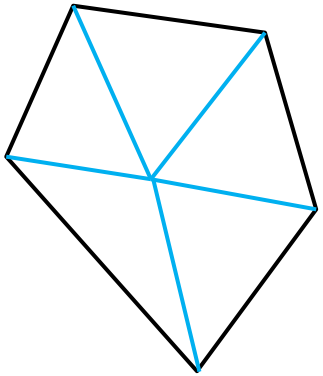
a = 180(5-2)

Solution 3



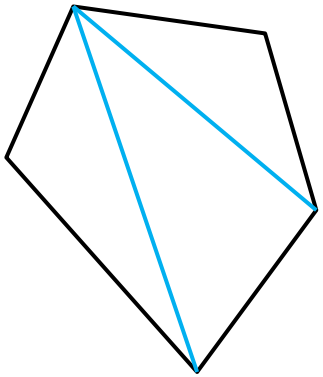
a = 180(5 – 1) - 180

Solution 4



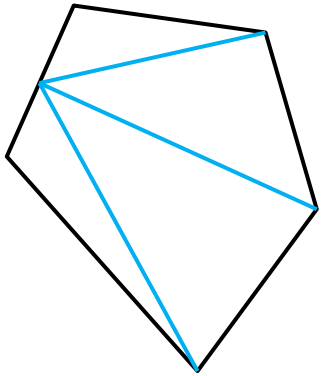
a = 180(5) - 360

Solution 2



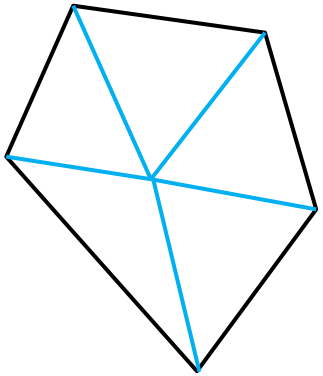
$a = 180(n-2)$

Solution 3



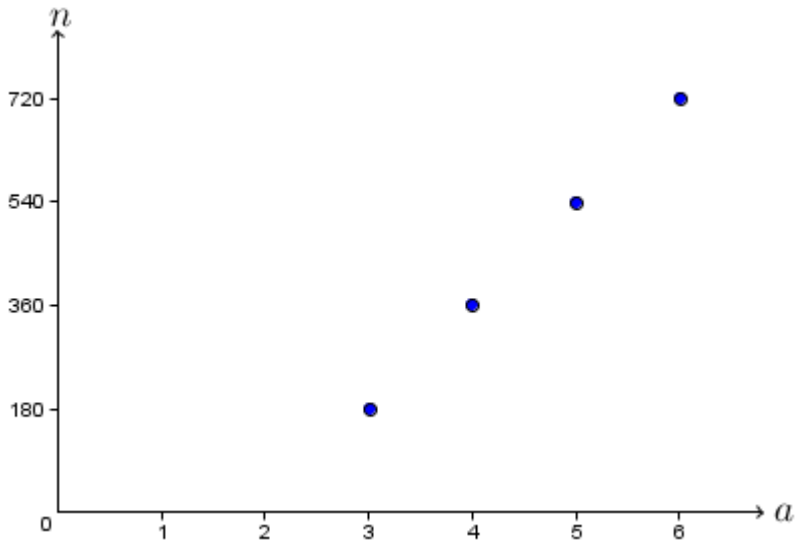
$a = 180(n - 1) - 180$

Solution 4



$a = 180n - 360$

n	3	4	5	6
a	180°	360°	540°	720°

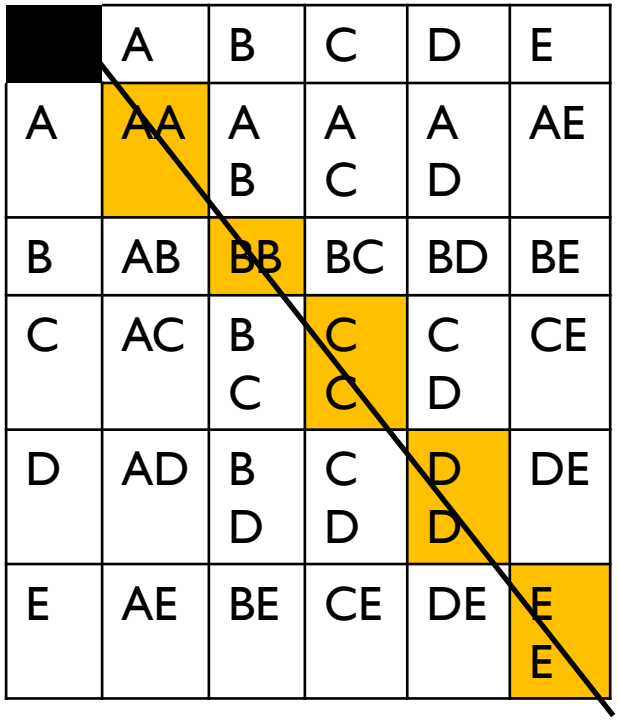


$a = 180°(n\text{-}2)$

Problem

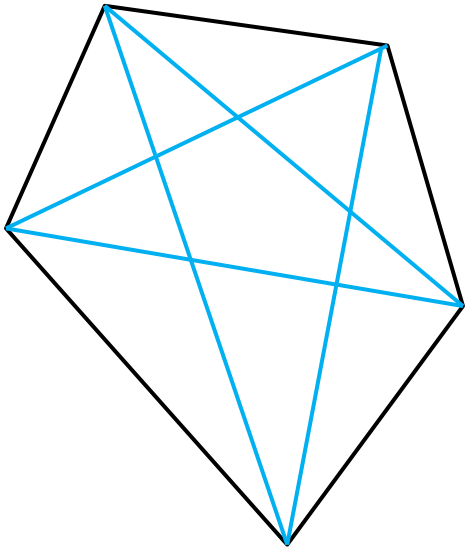
In a small gathering, there are 5 guests. If each guest shakes hands with the other guests only once, how many handshakes are there in all?

Solution 1

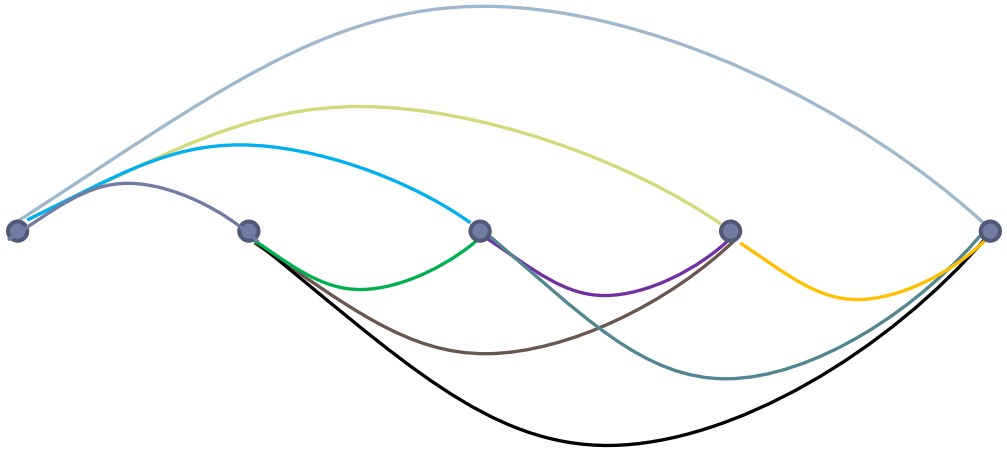


	A	B	C	D	E
A	AA	AB	AC	AD	AE
B	AB	BB	BC	BD	BE
C	AC	BC	CC	CD	CE
D	AD	BD	CD	DD	DE
E	AE	BE	CE	DE	EE

$(\frac{1}{2})[(5 \times 5) - 5]$



(½)(5 x 4)



4 + 3 + 2 + 1

Thank you!