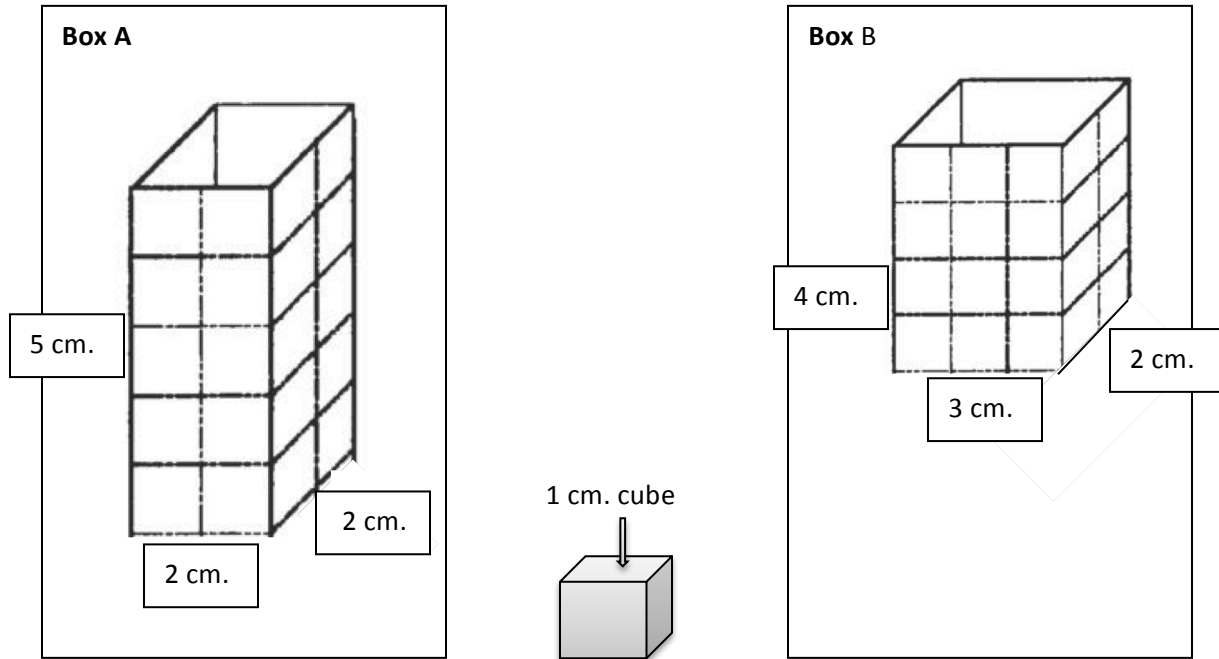


# Volume Pre-Assessment

## How Many Cubes?

This problem gives an opportunity to explain your understanding of volume.

Erick fills Box A and Box B with centimeter cubes.



1. How many cubes can Erick fit into Box A? \_\_\_\_\_

Explain in detail how you solved this problem.

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2. What is the volume of Erick's Box B? \_\_\_\_\_

Show your calculations.

3. Which of the two boxes can hold more cubes? \_\_\_\_\_

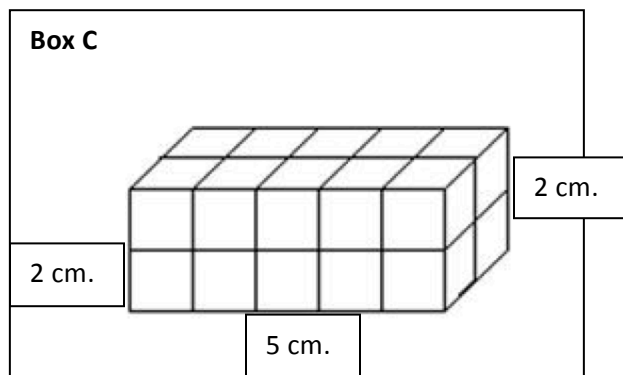
Explain your answer.

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4. Here is another box. How many centimeter cubes can this box hold?

---



List the measurements of a different box that holds the same number of cubes as Box C.

\_\_\_\_\_ cm long      \_\_\_\_\_ cm wide      \_\_\_\_\_ cm high

Name \_\_\_\_\_

## 2-D Robot Puzzle Student Worksheet PTL-B

1) On graph paper, draw a robot based on the following description:

The robot is two dimensional;

all the parts of the robot are squares or rectangles;

one leg has a total area of 15 square units;

the robot has two legs;

each arm has an area of 10 square units;

the total area of the robot is 120 square units;

draw the body and the head from the remaining square units.

2) Use different colors to show the area of each part of the robot.

3) Complete the following table:

Part of the Robot	Length	Width	Area
		Total Area	_____

## Math Talk Thought Process and Sharing Guide

<b>Problem-Solving Thought Process Guiding Questions</b>	<b>Discussion/Sharing/Sentence Frames</b>
What information is given in the problem?	The information given in the problem is _____.
How did you decide what the problem was asking you to find? What was unknown?	Since _____ is given in the problem, I determined that I need to find out what _____ is.
What was the first step you took to solve the problem?	The first step I took in solving the problem was to _____, because _____.
What did you do next?	The next step I took was to _____.
How did you know your solution was reasonable?	I decided that my solution was reasonable because _____.
Is there another strategy you can use to solve the problem?	Another strategy that I can use to solve the problem is _____.
Which strategy would work the best?	The strategy that would work the best would be _____ because it _____.
Did you try a method that did not work? Why didn't it work? Would it ever work? Why or why not?	I did try a method that didn't work. It didn't work because _____. It could work if _____.

## 2-D Robot Puzzle: PTL-B

On graph paper, draw a robot based on the following description:

- The robot is two dimensional;
- all the parts of the robot are squares or rectangles;
- it has a total area of 60 square units;
- the area of the body is 24 square units;
- the robot has two legs and two arms;
- one arm has an area of 6 square units;
- both legs have the same area;
- the head has an area ten more than one arm;

2) Use different colors to show the area of each part of the robot.

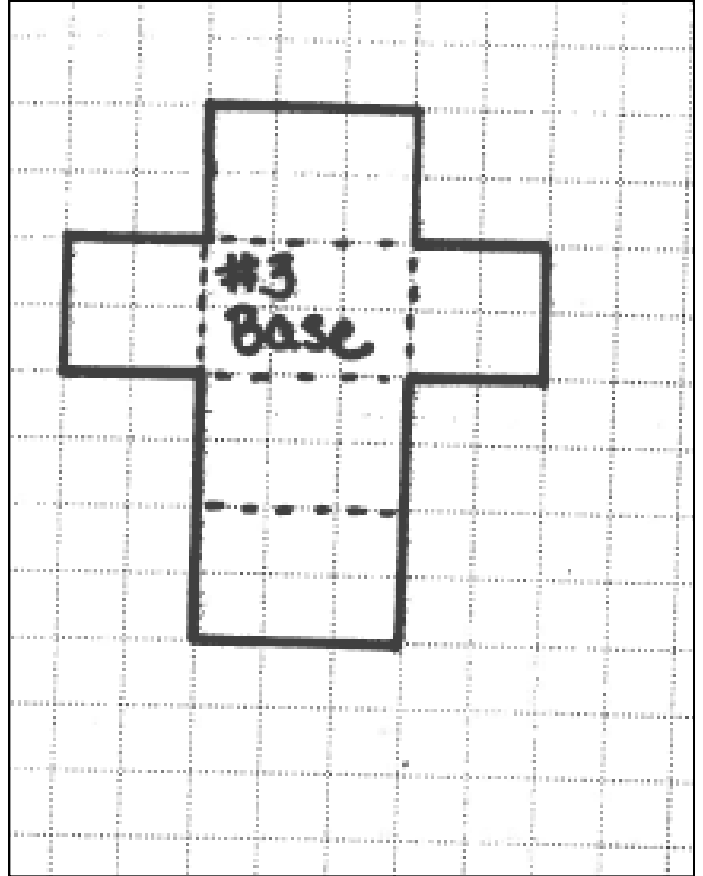
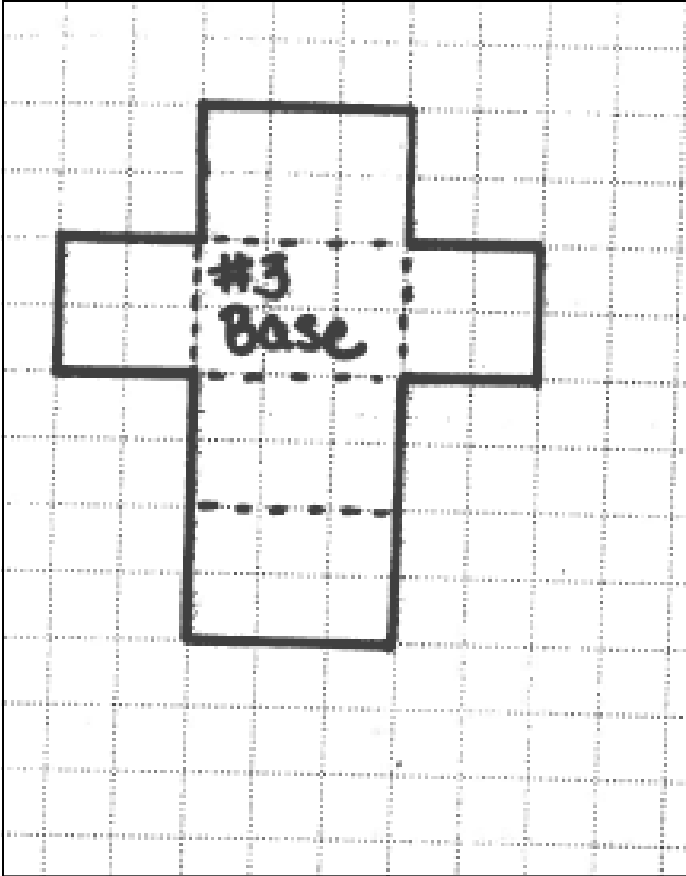
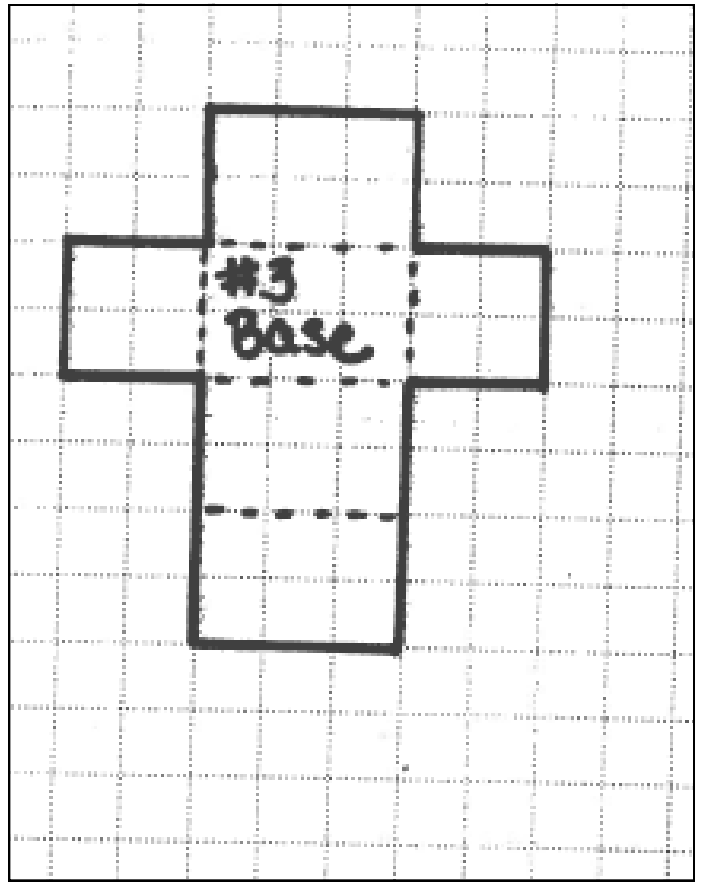
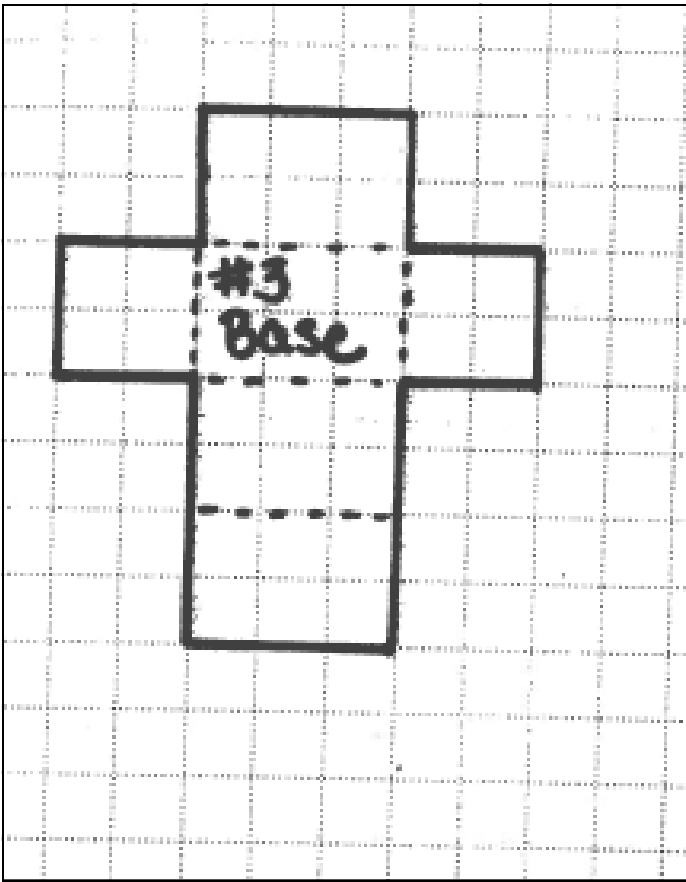
3) Complete the following table:

Part of the Robot	Length	Width	Area
		Total Area	_____

## Standing Robot – Lesson 2

- 1) Roll a die three times to find the dimensions of each of your robot's body parts.
- 2) Create the nets based on these dimensions (one net for each body part).
- 3) Create the rectangular prisms from the nets.
- 4) Calculate the volume of each rectangular prism. Show evidence of your work.
- 5) Calculate the TOTAL volume of the ENTIRE robot. Show evidence of your work.
- 6) Tape your rectangular prisms together to create a robot. **\*\*Your robot must be able to stand upright.\*\***

Robot Part	Dimensions of Base	Height	Volume
		Total Volume	<u>          </u>



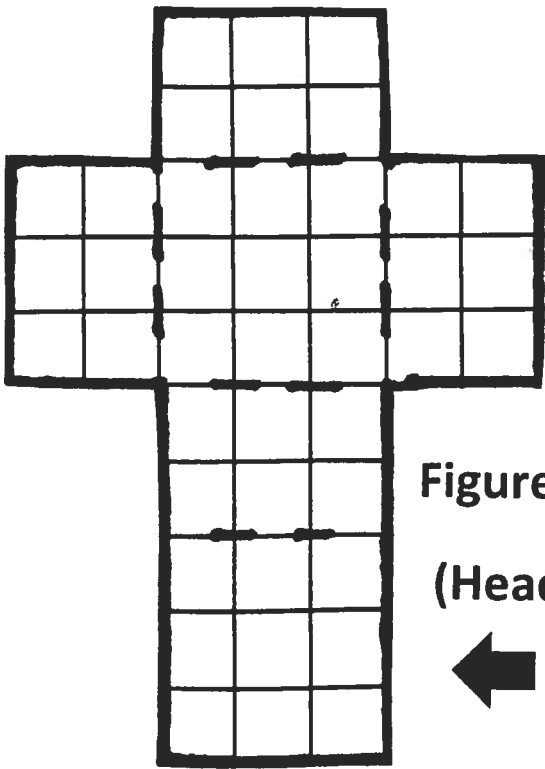


Figure A

(Head)

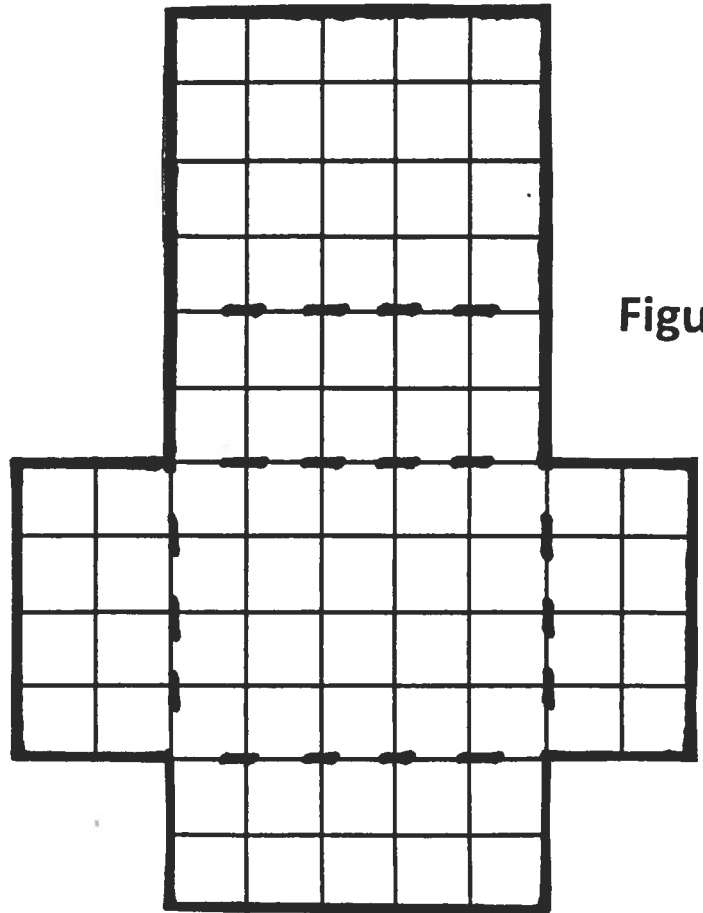


Figure D

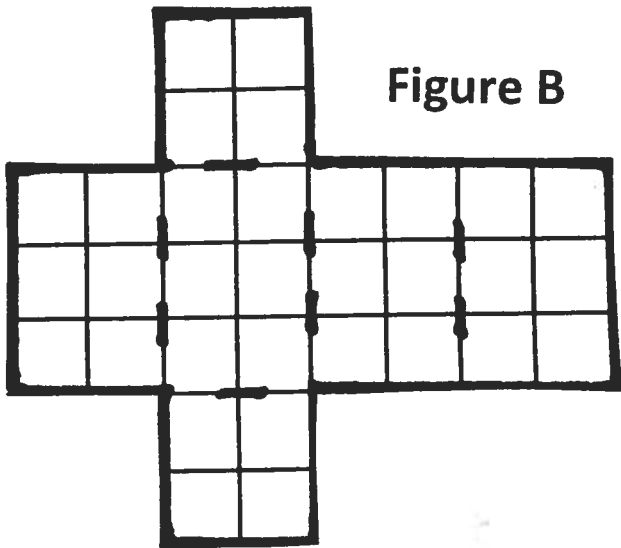


Figure B

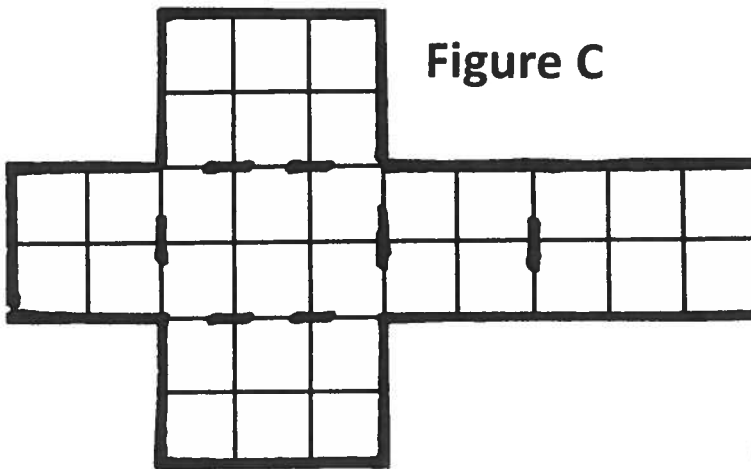


Figure C

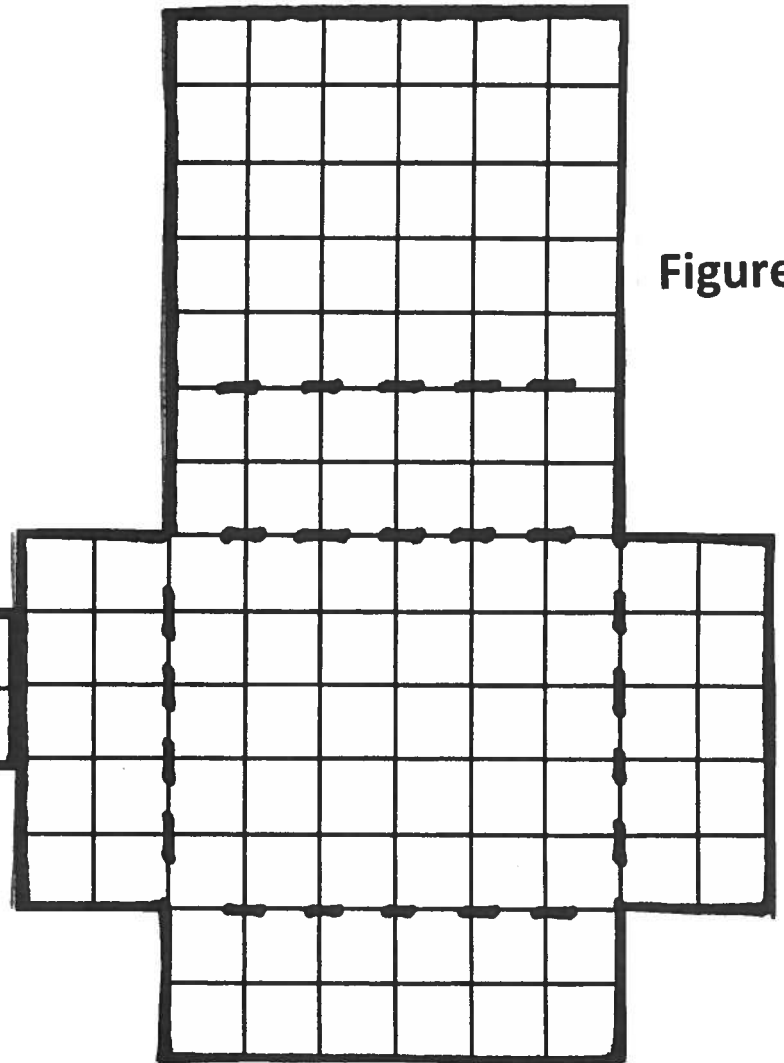


Figure E



Name \_\_\_\_\_

## Robot Recording Sheet

Complete the following table:

Part of the Robot	Dimensions of the Base length x width	Height	Volume (number of cubic units)

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Total Volume

# VOLUME HOMEWORK

Practice making prisms using these nets.

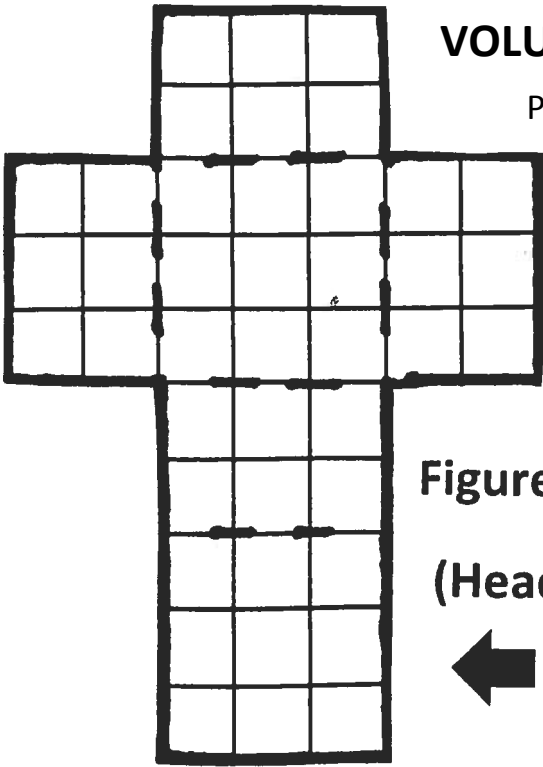


Figure A

(Head)

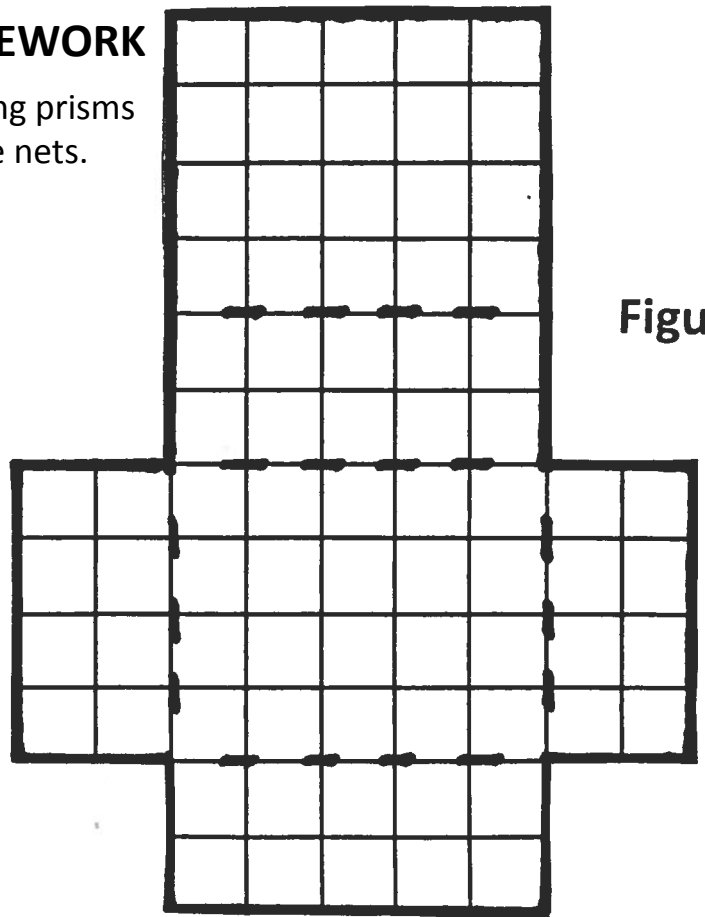


Figure D

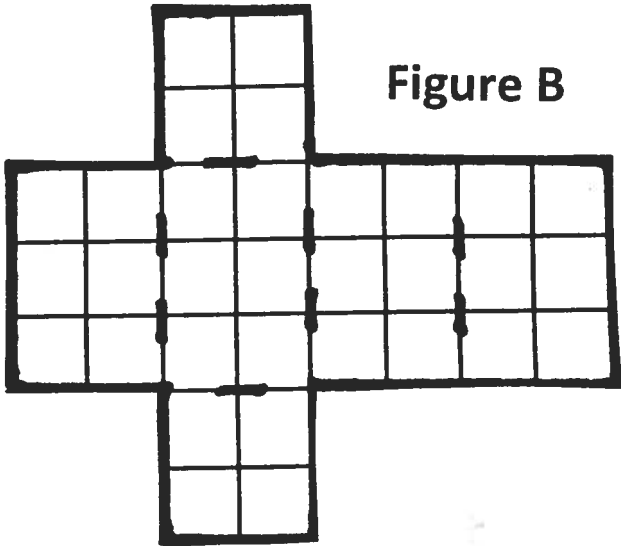


Figure B

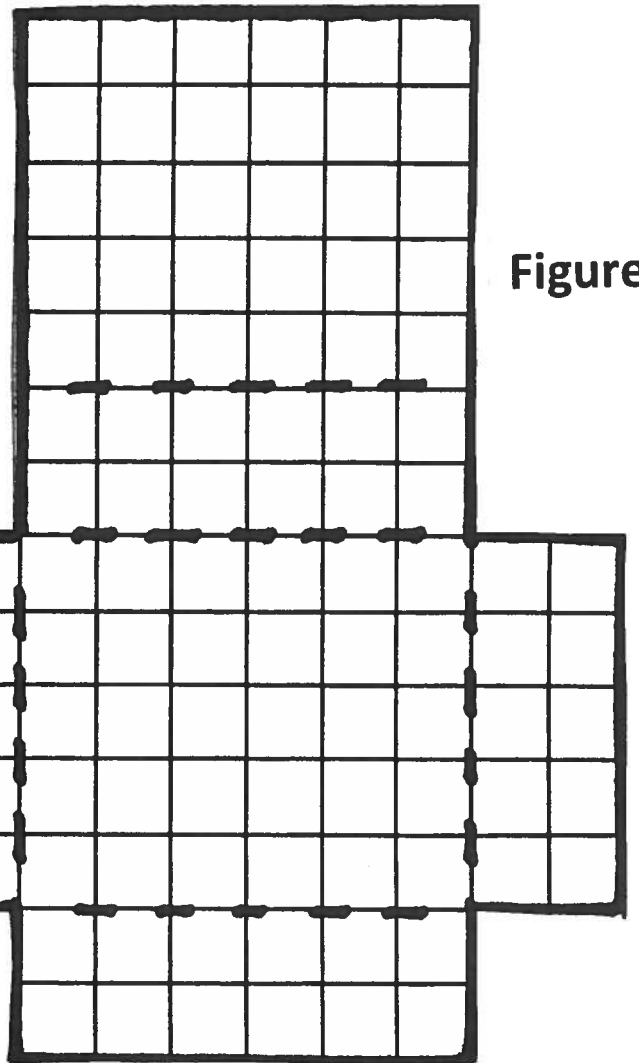


Figure E

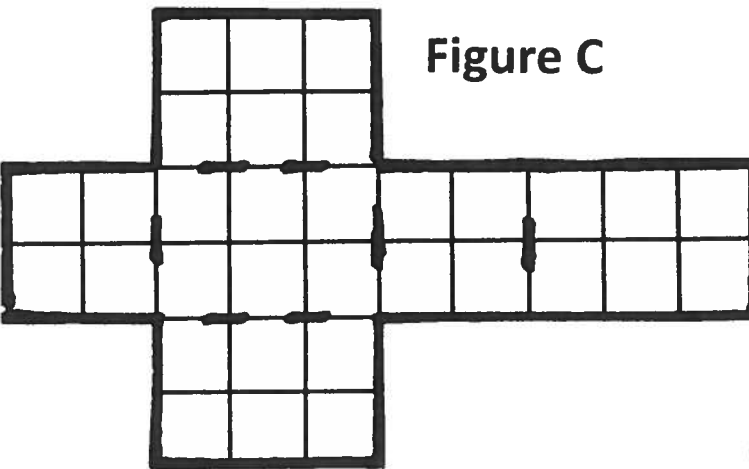


Figure C

Name \_\_\_\_\_

## Standing Robot – Lesson 2

- 1) Roll a die three times to find the dimensions of each of your robot's body parts.
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- 3) Create the rectangular prisms from the nets.
- 4) Calculate the volume of each rectangular prism. Show evidence of your work.
- 5) Calculate the TOTAL volume of the ENTIRE robot. Show evidence of your work.
- 6) Tape your rectangular prisms together to create a robot. **\*\*Your robot must be able to stand upright.\*\***

Robot Part	Dimensions of Base	Height	Volume
		Total Volume	<u>          </u>

Looking at the numbers in the chart and thinking about your method to find volume for the last prism, make a conjecture about how to find the volume of a rectangular prism without using cm cubes.

**How can you find the volume of a rectangular prism without using cm cubes?**

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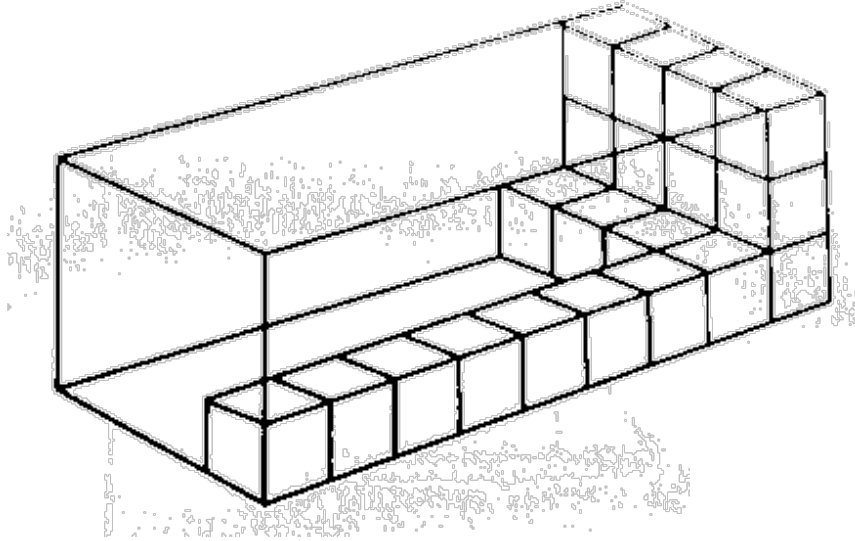
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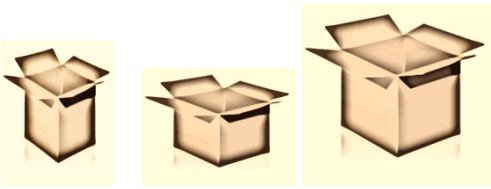
## VOLUME – LESSON 2



Find the volume of this rectangular prism. Please show evidence of your work.

**Explain your reasoning.**

# “Pack Your Boxes!”



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Our family is going on vacation to Joshua Tree. Mom told us we will be gone for an entire week. She is giving us boxes to pack our things in. My sister got the largest box because she has more stuff. It is 3ft. long, 3ft. wide and 2ft. high. My brother’s box is 2ft. long, 3ft. wide and 2ft. high. My box is 2ft. long, 2ft. wide and 3ft high. I’m not sure why I got the smallest box. My mom told me that the boxes have the same amount of space. I want to figure out if Mom is right. Then Mom told me to check that our boxes will fit in the bed of Dad’s truck. The dimensions for the truck bed are 6ft. long, 5 ft. wide and 3 ft. high. Help me figure this out. Make the boxes using graph paper. Each centimeter will represent 1 foot to recreate the boxes and the bed of the truck.

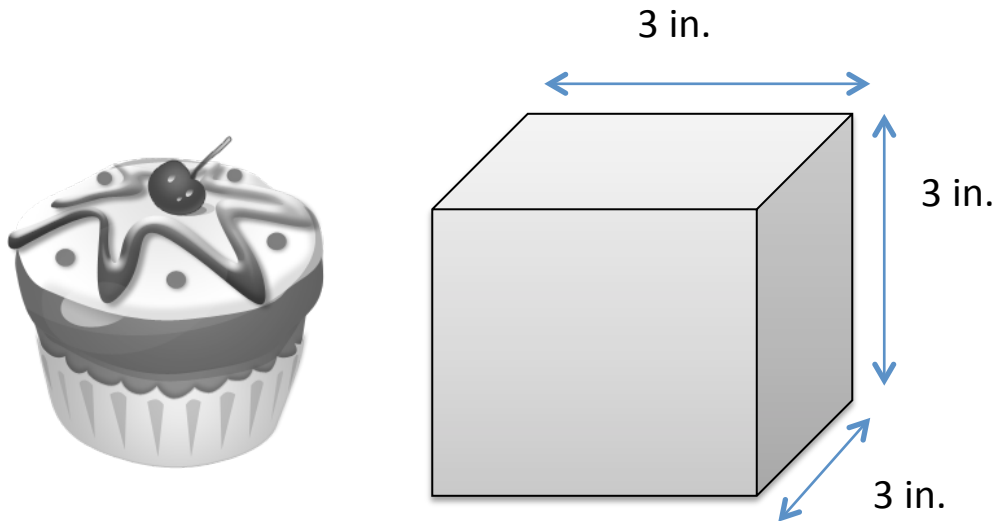
## Boxes’ Volume

Box	Diagram	Length	Width	Height	Volume
Sister’s					
Brother’s					
Mine					
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	

Box	Diagram	Length	Width	Height	Volume
<b>Truck bed</b>					

## Lesson 3 Homework

Maria works at a bakery. When she sells individual cupcakes, she packages each cupcake in a cube-shaped box. Each box measures 3 inches in length, width, and height.



**Individual Cupcake Box**

1. Maria wants to design a new box that holds 6 cupcakes. The new 6-pack cupcake box must
  - be a rectangular prism;
  - provide each cupcake with the same dimensions of space as an individual cupcake box provides; and
  - measure 3 inches in height

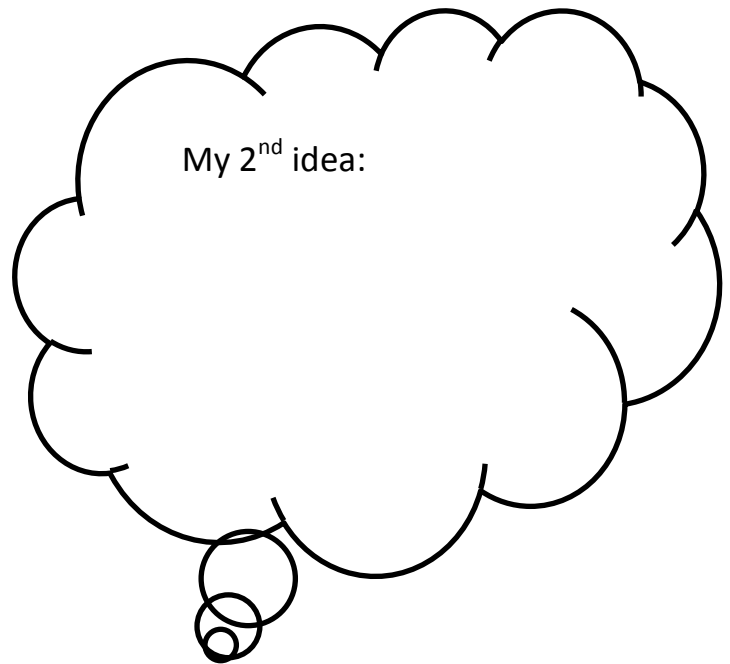
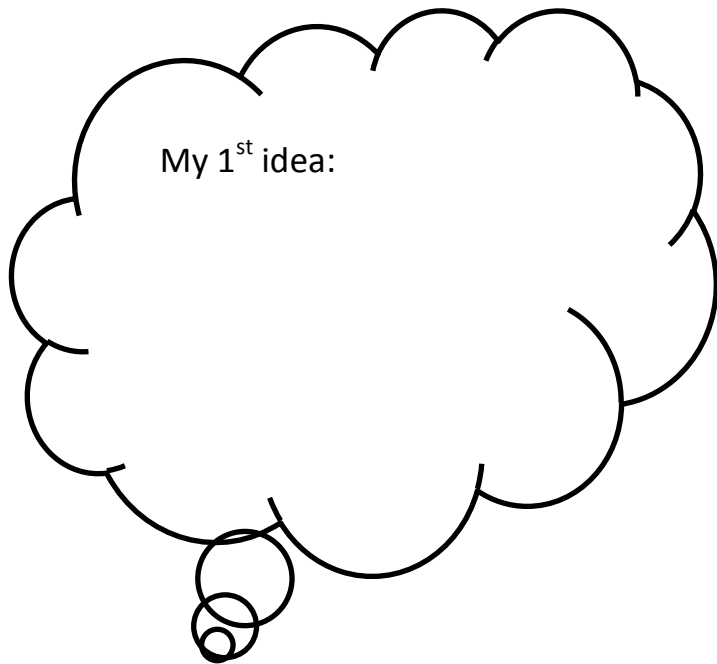
Describe, in words, all the 6-pack box designs that will fit these conditions.

2. Create a model of your cupcake box. Draw the net onto the graph paper and cut it out to turn in with your homework.

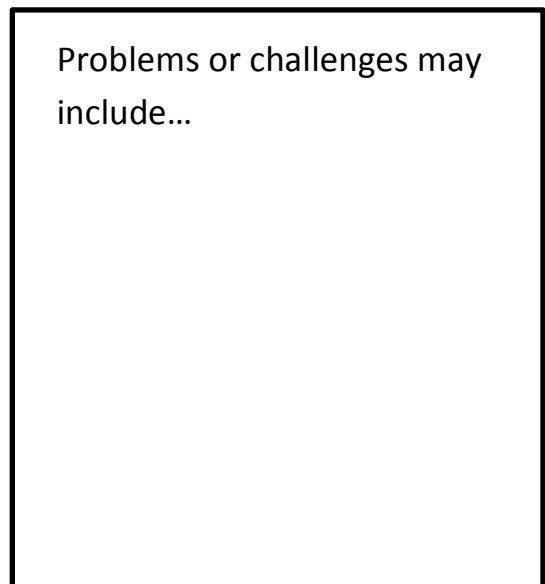
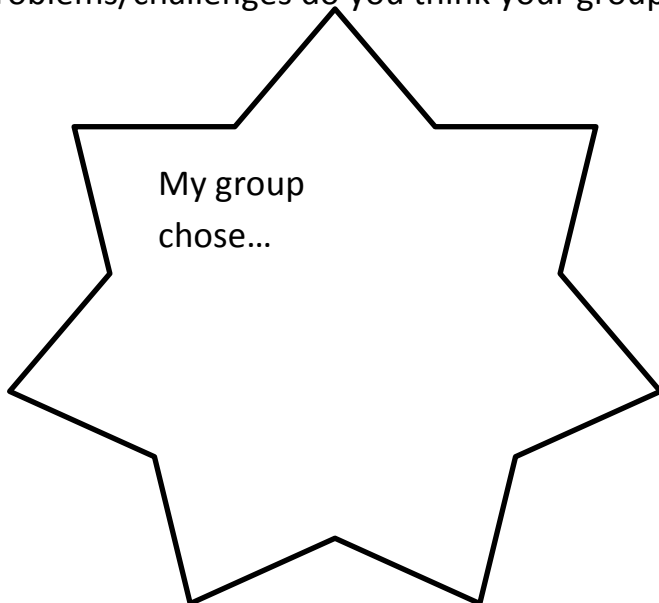
Name: \_\_\_\_\_

### **Brainstorming Worksheet– Lesson 4**

You need to determine how many linking Cubes will fill our classroom. Think about at least two different ways that you could measure the classroom and figure out how many cubes would be needed. If you have more than two ideas, you may write them on the back of this paper.



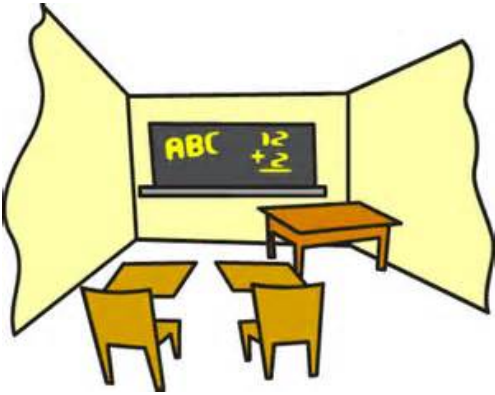
Now that you have met with your group, which strategy or combined strategies did your group decide to use to determine how many linking cubes would fit into our classroom? What problems/challenges do you think your group may have?





# ***Volume of a Classroom* RUBRIC**

<b>Volume of a Classroom</b> <i>Based on these, credit for specific aspects of performance could be assigned as follows</i>	
<b>1. Materials</b>	<b>2 points</b>
<b>2. Steps to Solve the Problem</b>	<b>2 points</b>
<b>3. Scale Model</b>	<b>2 points</b>
<b>4. Evidence of Math Work</b>	<b>2 points</b>
<b>5. Explanation of Reasoning</b>	<b>2 points</b>
<b>TOTAL Points</b>	<b>10 points</b>



Volume of a Classroom Response Sheet – Lesson 4

Name: \_\_\_\_\_

QUESTION: How many linking cubes will it take to fill your classroom?

What materials are you using?

Five horizontal lines for writing the answer to "What materials are you using?"

Record the steps that you take as you complete the problem:

Eight horizontal lines for recording steps to solve the problem.



Make a scale model:

Show your math:

Explain your reasoning:

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**FIND THE FICTION**

***VOLUME REVIEW***

***Lesson 4***

**Write three statements about volume:**

- **2 true statements**
- **1 false statement (fiction)**

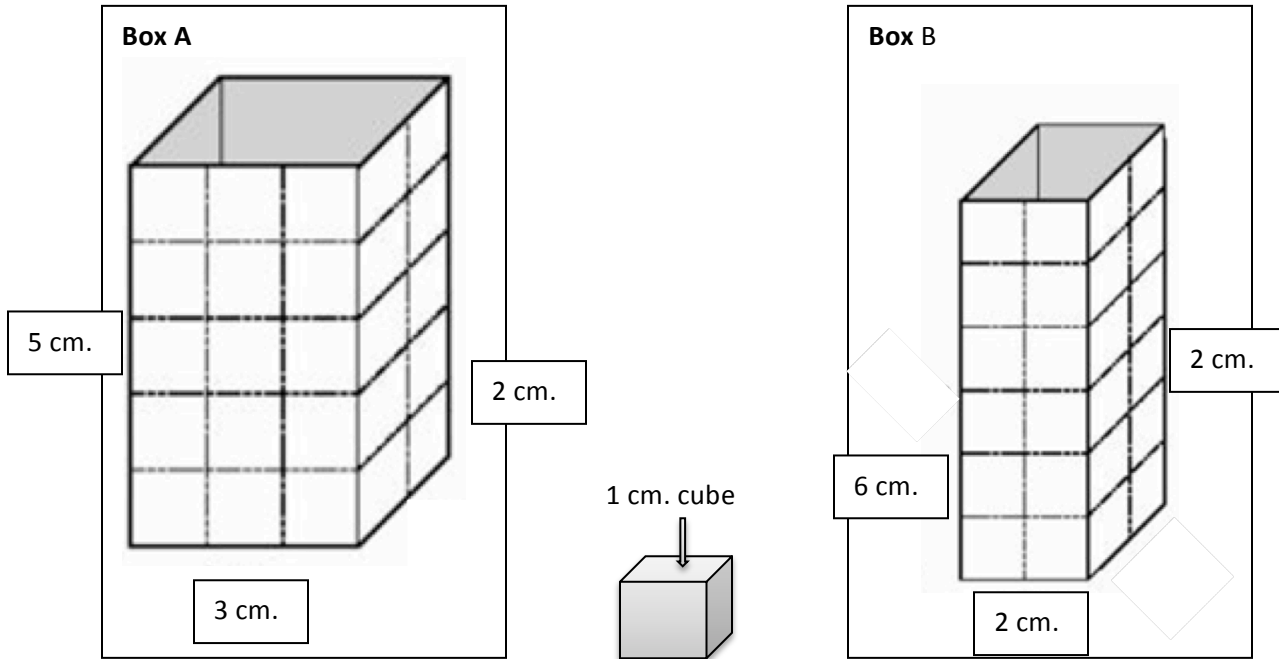
**Tomorrow, you will challenge your classmates to “Find the Fiction”.**

# Volume Summative Assessment

## How Many Cubes?

This problem gives an opportunity to explain your understanding of volume.

Steve fills Box A and Box B with centimeter cubes.



1. How many cubes can Steve fit into Box A? \_\_\_\_\_

Explain in detail how you solved this problem.

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2. What is the volume of Steve's Box B? \_\_\_\_\_

Show your calculations.

3. Which of the two boxes can hold more cubes? \_\_\_\_\_

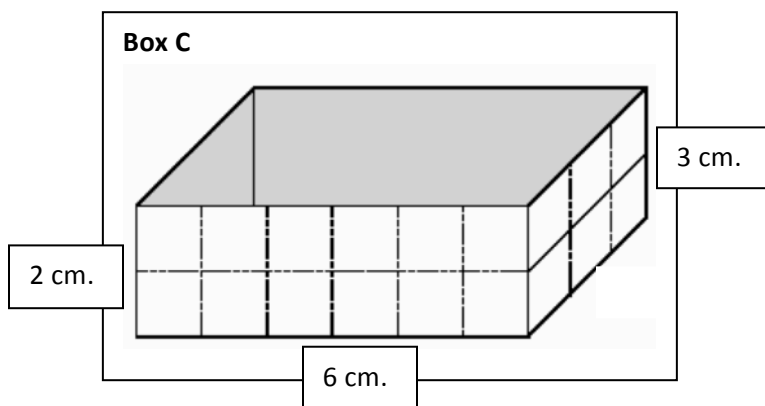
Explain your answer.

---

---

4. Here is another box. How many centimeter cubes can this box hold?

---



List the measurements of a different box that holds the same number of cubes as Box C.

\_\_\_\_\_ cm long      \_\_\_\_\_ cm wide      \_\_\_\_\_ cm high

## Cool Jobs: Math as entertainment

### Magic, movies and metal: How mathematics adds dazzle to the visual world

*This is one in a series on careers in science, technology, engineering and mathematics made possible by support from the Northrop Grumman Foundation.*



Credit: “Madagascar 3” © 2012 DreamWorks Animation LLC, used with permission of DreamWorks Animation LLC

When a band of zoo buddies tears through a Monte Carlo casino, the marble columns don’t have a chance. Nafees Bin Zafar used mathematics to power the visual effects behind this madcap scene in *Madagascar 3*.

“I seem to specialize in the area of mayhem,” says Nafees Bin Zafar with a smile. This visual effects expert helps bring some of the most memorable smashes, crashes and dashes to the movie screen. The one in *Madagascar 3* where the fearless heroes flee a casino, leaving all sorts of rubble in their wake? Check. The scene in *2012* where Los Angeles slides into the Pacific Ocean? Check. The light cycle chase scenes in *Tron: Legacy*? Check.

At DreamWorks Animation (and previously at another company called Digital Domain) Bin Zafar creates software used to make the special effects in motion pictures — and sometimes cartoons — look as realistic as possible. Often he works with the skimpiest of instructions. “For *2012*,” he recalls, “all we really had was one line in the script: ‘And then California sinks into the ocean.’” Bin Zafar and a team of nine other programmers and animators took that one line and turned it into a five-minute montage of falling buildings, collapsing freeways and enormous cracks splitting Earth. To make all this fakery look real, it has to *act* real. “Do we know the math of how this stuff bends and flexes and shakes around?” Bin Zafar asks. “It turned out that we didn’t.”

Bin Zafar eventually solved that math problem along the way to helping create some cutting-edge visual effects. He’s just one of three experts profiled in this article who rely on math to entertain — and amaze.

#### How to realistically destroy a fake building

To compute how a virtual building should collapse on-screen in a convincingly real way, Bin Zafar uses engineering, computer skills and a toy familiar to most kids. Yes, he starts by pretending the building is made of Lego bricks connected by springs. (He actually keeps a box of Legos — the regular kind without springs — in his office for inspiration.) The virtual Legos form the large chunks into which the building crumbles, while the virtual springs simulate the forces that would act on the building. Once the building starts to collapse, Bin Zafar then ensures that the thousands of computer-drawn pieces fall in a realistic way, without their passing through each other — something that would immediately spoil the illusion of reality.

Although Bin Zafar instructs his computer program to apply the laws of physics in most instances, he also knows when to bend them. This was especially true in *Madagascar 3*. “We do things like change gravity’s direction all the time,” Bin Zafar says. “In a cartoon,” he explains, “it’s quite reasonable for a character to start walking up a wall — and yet have everything look natural.”

As a kid, Bin Zafar was a big fan of cartoons and movies. “*Looney Tunes* were my favorites,” he recalls. He also loved the original *Tron*, a movie that came out in 1982. Imagine his thrill at being asked to work on the film’s sequel, 28 years later. Bin Zafar points to two important skills he has needed to work in a digital movie studio: communicating effectively and solving word puzzles.

Communication is critical because creating visual effects is a team job. When Bin Zafar writes a computer program, he also has to explain the program to the animators who use it. “My work makes things look believable, but it really takes an artist to make things look spectacular,” he says.

Solving word problems is almost as important, Bin Zafar notes, because requests are never described in numerical terms. Instead he gets: “And then Los Angeles sinks into the ocean.” It’s his job to translate that request into the language of mathematics, so that a computer can render it into believable images.

In the exciting environment in which Bin Zafar works, the distinctions between artist and mathematician often blur: Artists need to understand math and the mathematicians need to understand art. Says Bin Zafar: “We’re all exploring our imaginations together.”

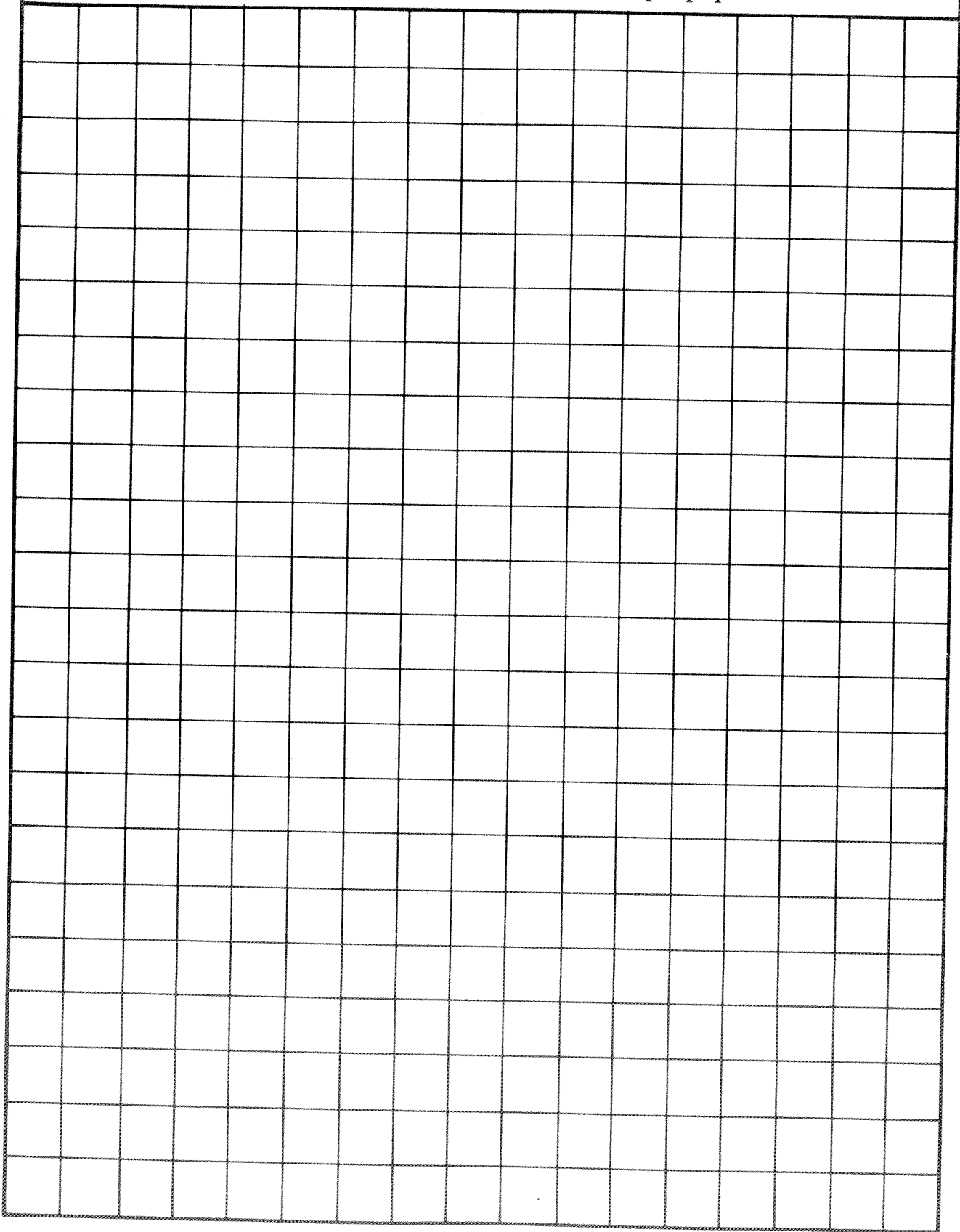
*Adapted from “Cool Jobs: Math as Entertainment – Magic, movies and metal: How mathematics adds dazzle to the visual world”*

By Dana Mackenzie/December 19, 2012

<http://www.sciencenewsforkids.org/2012/12/cool-jobs-math-as-entertainment/>



# 1 CENTIMETER Graph paper





## Step 1

Uncover Thinking

What have you tried?  
What happened then?  
Why did you \_\_?



## Step 2

Examine Animation

What is happening in the animation?  
What did you notice? What else?  
When you clicked \_\_\_\_, what happened?



## Step 3

Apply Hypothesis

What do you think will happen?  
How will this work on this problem?  
What steps will you take?  
How did you decide that was correct?



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What happened then?  
Why did you \_\_?



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Apply Hypothesis

What do you think will happen?  
How will this work on this problem?  
What steps will you take?  
How did you decide that was correct?

## Facilitating Questions

- What does JiJi need to do?
- How might you begin?
- What do you need to do next?
- Why did that happen?
- How can you help JiJi?
- How did the earlier problems/levels work?
- Is this like \_\_\_\_\_ that you did earlier?  
How is it the same? How is it different?
- What did you see that showed you the answer was wrong?
- Why do you think that was not the right answer?
- What will happen if you click on \_\_\_\_\_?
- What have you tried? What happened?
- What do you notice? What else do you notice?
- What did you try that did not work?  
Why did it not work?
- Please explain it in a different way.
- Show me how this will work on the next problem.
- What do you already know about?
- Why did you \_\_\_\_?

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