ANSWER KEY

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GRADE 5 • MODULE 5

Addition and Multiplication with Volume and Area

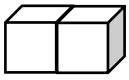
SOLUTIONS

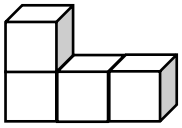
For video tutorials on many of these problems, please visit http://EMBARC.online

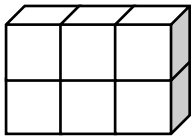
Please let me know if you find any mistakes by emailing me at dhabecker@gmail.com

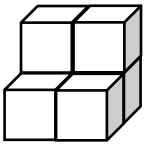
Name _____ Date _____

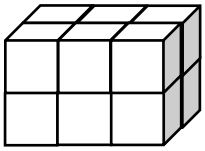
1. The following solids are made up of 1-cm cubes. Find the total volume of each figure, and write it in the chart below.

A. 

B. 

C. 

D. 

E. 

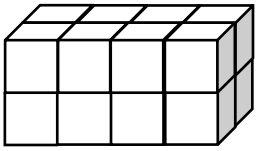
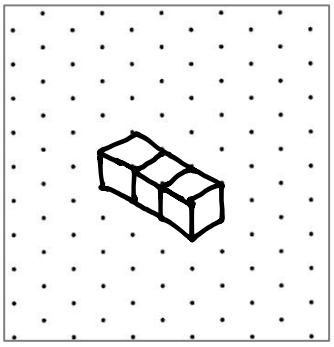
F. 

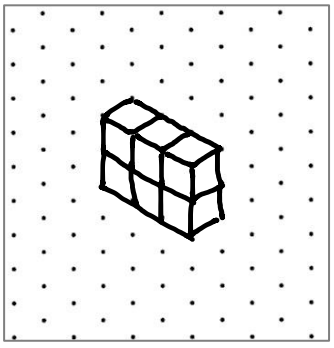
Figure	Volume	Explanation
A	2 cm^3	I counted the cubes
B	4 cm^3	I added 3 cubes (bottom) and 1 cube (top)
C	6 cm^3	I multiplied 2 layers x 3 cubes
D	6 cm^3	I added 4 cubes on bottom with 2 on top
E	12 cm^3	There are 6 cubes on each "floor" of the building
F	16 cm^3	I counted 8 cubes on the top "floor" and then multiplied by 2.

5. Draw the figures on the dot paper with the given number of unit cubes.

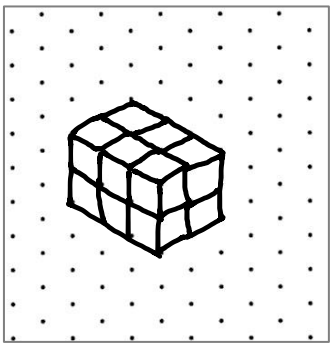
a. 3 cubic units



b. 6 cubic units

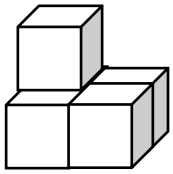


c. 12 cubic units

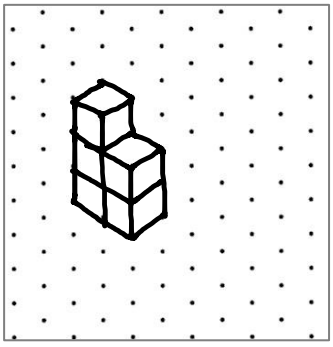


6. John built and drew a structure that has a volume of 5 cubic centimeters. His little brother tells him he made a mistake because he only drew 4 cubes. Help John explain to his brother why his drawing is accurate.

The cube on top is sitting on top of the cube that John's brother thought was missing.



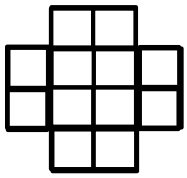
7. Draw another figure below that represents a structure with a volume of 5 cubic centimeters.



Name _____ Date _____

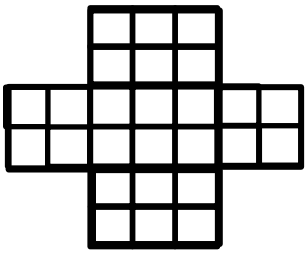
1. Make the following boxes on centimeter grid paper. Cut and fold each to make 3 open boxes, taping them so they hold their shapes. How many cubes would fill each box? Explain how you found the number.

a. Number of cubes: 4



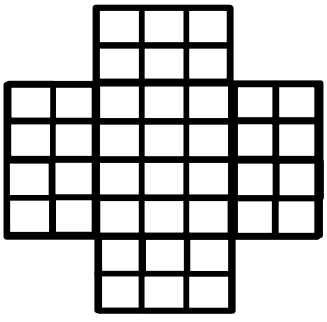
1 layer with 4 cubes.

b. Number of cubes: 12



2 layers with 6 cubes in each layer.

c. Number of cubes: 24



2 layers with 12 cubes in each layer.

2. How many centimeter cubes would fit inside each box? Explain your answer using words and diagrams on the box. (The figures are not drawn to scale; the first box is 3 centimeters across and 2 centimeters wide.)

a. 

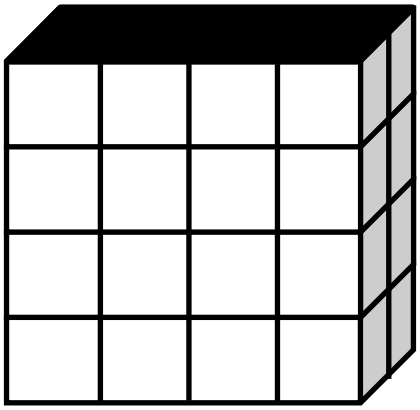
Number of cubes: 6

Explanation: There is one layer with 6 cubes in the layer.

b. 

Number of cubes: 12

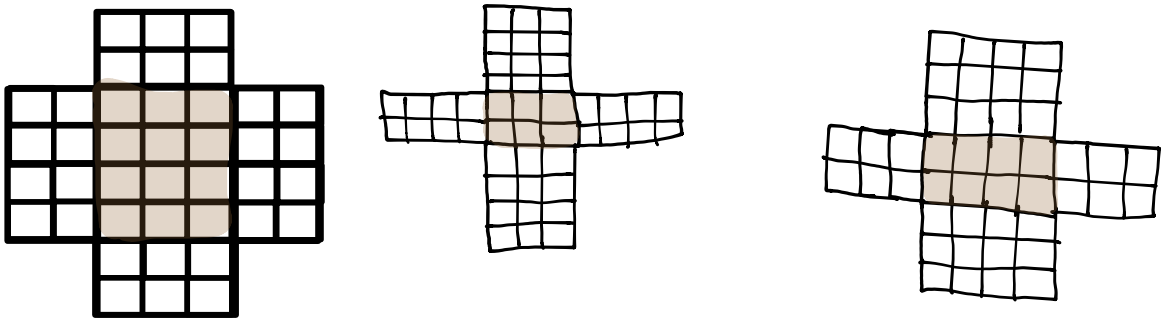
Explanation: There are 2 layers. Each layer has 6 cubes. 6x2=12

c. 

Number of cubes: 32

Explanation: There are 4 layers. Each layer has 8 cubes. 8x4=32

3. The box pattern below holds 24 1-cm cubes. Draw two different box patterns that would hold the same number of cubes.

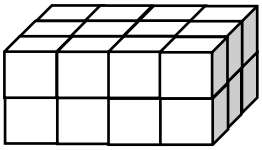


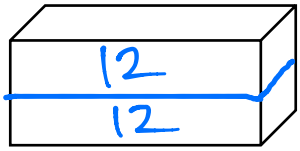
Name _____ Date _____

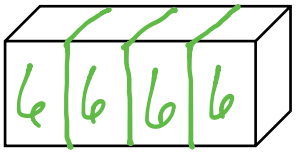
1. Use the prisms to find the volume.

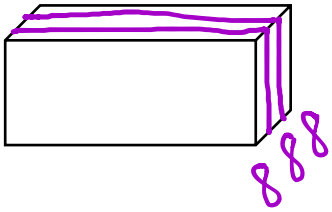
- The rectangular prisms pictured below were constructed with 1-cm cubes
- Decompose each prism into layers in three different ways, and show your thinking on the blank prisms.
- Complete each table

Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
2	12	24 cubic cm
4	6	24 cubic cm
3	8	24 cubic cm

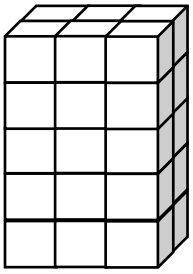


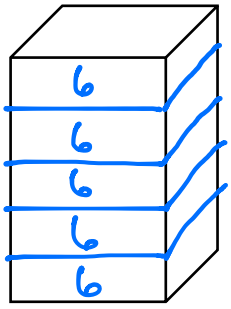


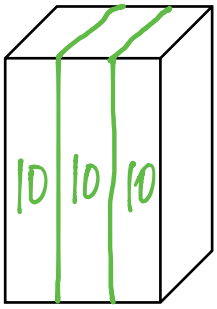


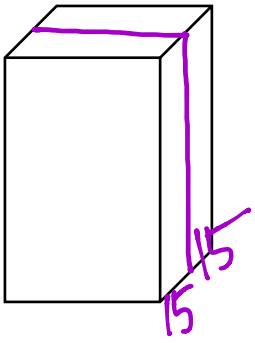


Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
5	6	30 cubic cm
3	10	30 cubic cm
2	15	30 cubic cm

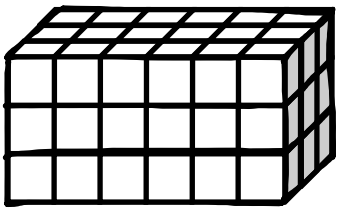








2. Stephen and Chelsea want to increase the volume of this prism by 72 cubic centimeters. Chelsea wants to add eight layers and Stephen says they only need to add four layers. Their teacher tells them they are both correct. Explain how this is possible.



Chelsea sees the 9 cubes at the end of the prism as a layer.

$9 \times 8 = 72$

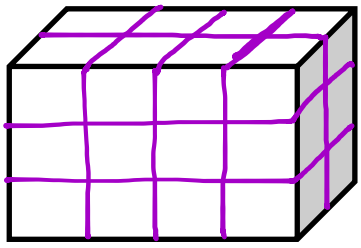
Stephen sees the 18 cubes at the top of the prism as a layer.

$18 \times 4 = 72$

3. Juliana makes a prism 4 inches across and 4 inches wide, but only 1 inch tall. She then decides to create layers equal to her first one. Fill in the chart below and explain how you know the volume of each new prism.

Number of Layers	Volume	Explanation
3	$48\ in^3$	Each layer has 16 cubes, so 3 layers is $3 \times 16 in^3$
5	$80\ in^3$	5 layers with each layer being $16 in^3$. $5 \times 16 in^3 = 80\ in^3$
7	$112\ in^3$	1 layer is $16 in^3$, so $7 \times 16 in^3 = 112 in^3$

4. Imagine the rectangular prism below is 4 meters long, 3 meters tall, and 2 meters wide. Draw horizontal lines to show how the prism could be decomposed into layers that are 1 meter in height.



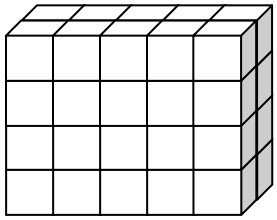
It has 4 layers from left to right.

Each layer contains 6 cubic units.

The volume of this prism is $24\ m^3$.

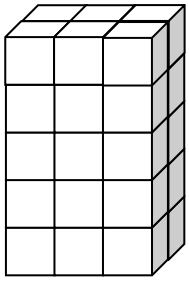
Name _____ Date _____

1. Each rectangular prism is built from centimeter cubes. State the dimensions and find the volume.

a. 

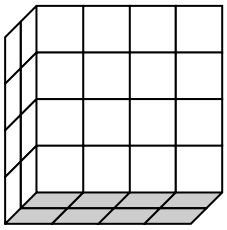
Length: 5 cm
Width: 2 cm
Height: 4 cm
Volume: 40 cm^3

5 x 2 x 4
10 x 4 = 40

b. 

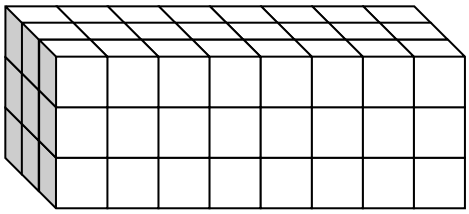
Length: 3 cm
Width: 2 cm
Height: 5 cm
Volume: 30 cm^3

3 x 2 x 5
6 x 5 = 30

c. 

Length: 4 cm
Width: 2 cm
Height: 4 cm
Volume: 32 cm^3

4 x 2 x 4
8 x 4 = 32

d. 

Length: 8 cm
Width: 3 cm
Height: 3 cm
Volume: 72 cm^3

8 x 3 x 3
24 x 3 = 72

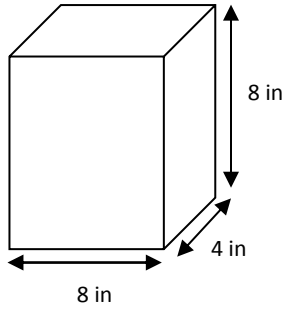
2. Write a multiplication sentence that you could use to calculate the volume for each rectangular prism in Problem 1. Include the units in your sentences.

a. $5\text{ cm} \times 2\text{ cm} \times 4\text{ cm} = 40\text{ cm}^3$ b. $3\text{ cm} \times 2\text{ cm} \times 5\text{ cm} = 30\text{ cm}^3$

c. $4\text{ cm} \times 2\text{ cm} \times 4\text{ cm} = 32\text{ cm}^3$ d. $8\text{ cm} \times 3\text{ cm} \times 3\text{ cm} = 72\text{ cm}^3$

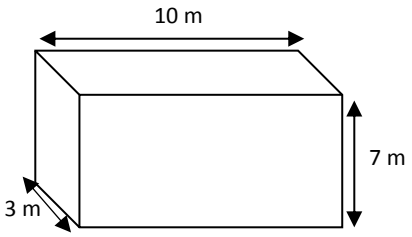
3. Calculate the volume of each rectangular prism. Include the units in your number sentences.

a.



Volume: $8\text{ in} \times 4\text{ in} \times 8\text{ in} = 256\text{ in}^3$

b.



Volume: $10\text{m} \times 7\text{m} \times 3\text{m} = 210\text{ m}^3$

4. Mrs. Johnson is constructing a box in the shape of a rectangular prism to store clothes for the summer. It has a length of 28 inches, a width of 24 inches, and a height of 30 inches. What is the volume of the box?

$V = l \times w \times h$

$= 28\text{ in} \times 24\text{ in} \times 30\text{ in}$

$= 20{,}160\text{ in}^3$

The volume of the box is 20,160 cubic inches.

5. Calculate the volume of each rectangular prism using the information that is provided.

a. Face area: 56 square meters, height: 4 meters.

$V = (\text{face area}) \times \text{height}$

$= 56\text{ m}^2 \times 4\text{ m} = 224\text{ m}^3$

b. Face area: 169 square inches, height: 14 inches.

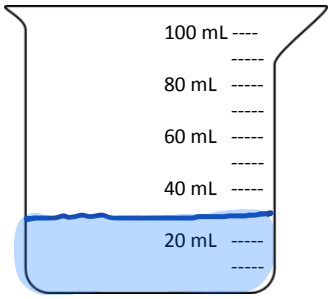
$V = (\text{face area}) \times \text{height}$

$= 169\text{ in}^2 \times 14\text{ in}$

$= 2{,}366\text{ in}^3$

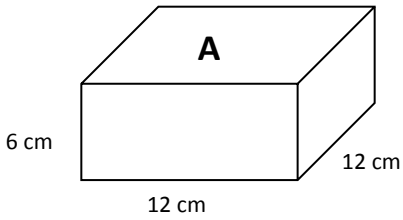
Name _____ Date _____

1. Johnny filled a container with 30 centimeter cubes. Shade the beaker to show how much water the container will hold. Explain how you know.

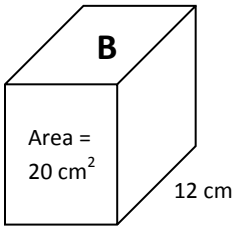


Since 1 cm^3 of water is equal to 1 mL, 30 centimeter cubes is equal to 30 mL.

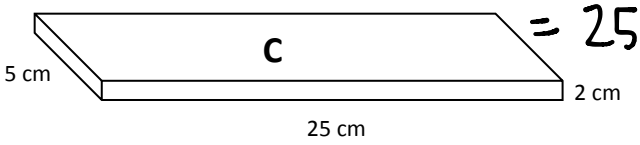
2. A beaker contains 250 mL of water. Jack wants to pour the water into a container that will hold the water. Which of the containers pictured below could he use? Explain your choices.



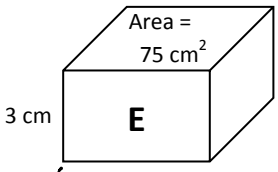
$V = 6\text{cm} \times 12\text{cm} \times 12\text{cm}$
$= 864\text{cm}^3$



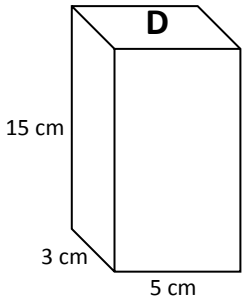
$V = 20\text{cm}^2 \times 12\text{cm}$
$= 240\text{cm}^3$



$V = 2\text{cm} \times 25\text{cm} \times 5\text{cm}$
$= 250\text{cm}^3$



$V = 75\text{cm}^2 \times 3\text{cm}$
$= 225\text{cm}^3$



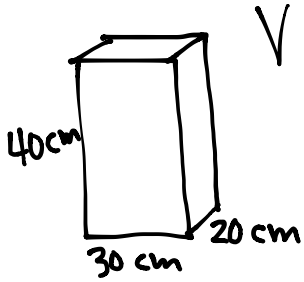
$V = 15\text{cm} \times 3\text{cm} \times 5\text{cm}$
$= 225\text{cm}^3$

Jack could use container A or C.

3. On the back of this paper, describe the details of the activities you did in class today. Include what you learned about cubic centimeters and milliliters. Give an example of a problem you solved with an illustration.

Answers will vary.

$1\text{cm}^3 = 1\text{mL}$

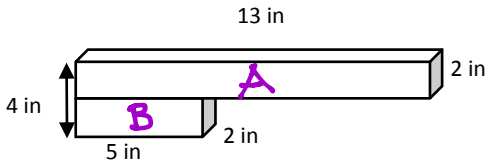


$V = 40\text{cm} \times 30\text{cm} \times 20\text{cm}$
$= 24{,}000\text{ cm}^3$
$= 24{,}000\text{ mL}$

Name _____ Date _____

1. Find the total volume of the figures and record your solution strategy.

a.



Volume: 72 in^3

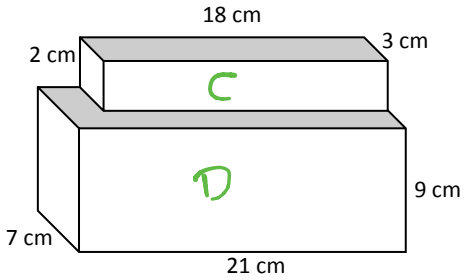
Solution Strategy:

Volume of A = 13 in × 2 in × 2 in = 52 in^3

Volume of B = 2 in × 5 in × 2 in = 20 in^3

Total = 52 in^3 + 20 in^3 = 72 in^3

b.



Volume: _____

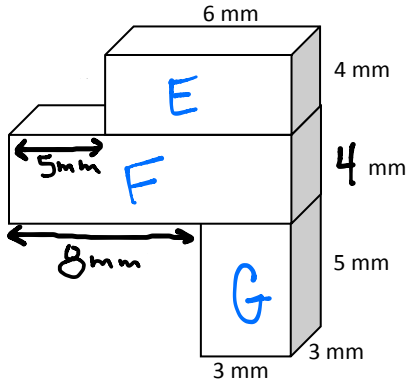
Solution Strategy:

Volume of C = 2 cm × 18 cm × 3 cm = 108 cm^3

Volume of D = 7 cm × 21 cm × 9 cm = 1,323 cm^3

Total = 108 cm^3 + 1,323 cm^3 = 1,431 cm^3

c.



Volume: 72 mm^3 + 132 mm^3 + 45 mm^3 = 249 mm^3

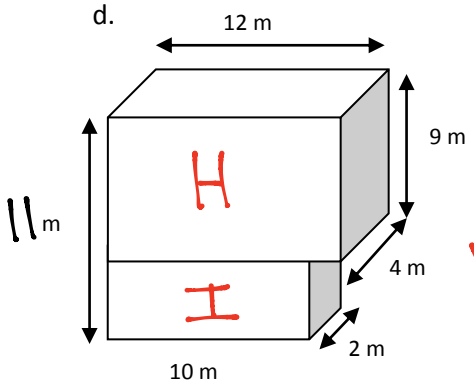
Solution Strategy:

V_E = 3 mm × 4 mm × 6 mm = 72 mm^3

V_F = 11 mm × 3 mm × 4 mm = 132 mm^3

V_G = 3 mm × 3 mm × 5 mm = 45 mm^3

d.



V_H = 12 m × 9 m × 4 m = 432 m^3

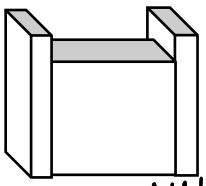
V_I = 10 m × 2 m × 2 m = 40 m^3

Volume: 432 m^3 + 40 m^3 = 472 m^3

Solution Strategy:

15 m − 9 m gives the height of I.

2. A planting box (pictured below) is made of two sizes of rectangular prisms. One type of prism measures 3 inches by 6 inches by 14 inches. The other type measures 15 inches by 5 inches by 10 inches. What is total volume of three such boxes?



Left and Right sides: $(3\text{in} \times 6\text{in} \times 14\text{in}) + (3\text{in} \times 6\text{in} \times 14\text{in})$

$= 252\ \text{in}^3 + 252\ \text{in}^3$

$= 504\ \text{in}^3$

Middle: $15\text{in} \times 5\text{in} \times 10\text{in}$

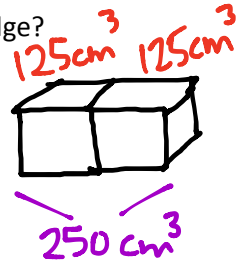
$= 750\ \text{in}^3$

$750\ \text{in}^3 + 504\ \text{in}^3 = 1254\ \text{in}^3$ is volume of one box

$1254 \times 3 = 3762$

Total volume = 3,762 in^3

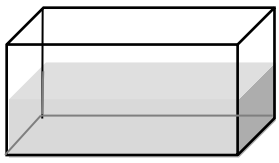
3. The combined volume of two identical cubes is 250 cubic centimeters. What is the measure of one cube's edge?



$5\text{cm} \times 5\text{cm} \times 5\text{cm} = 125\text{cm}$

The edge of one cube is 5 cm long.

4. A fish tank has a base area of 45 cm^2 and is filled with water to a depth of 12 cm. If the height of the tank is 25 cm, how much more water will be needed to fill the tank to the brim?



$V_{water} = 45\text{cm}^2 \times 12\text{cm}$

$= 540\ \text{cm}^3$

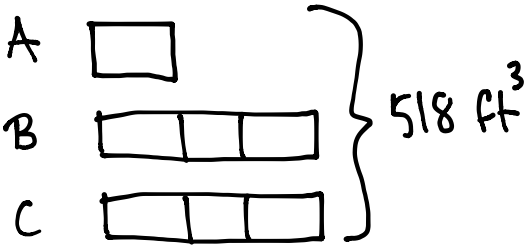
$V_{tank} = 45\ \text{cm}^2 \times 25\ \text{cm}$

$= 1{,}125\ \text{cm}^3$

$1125\ \text{cm}^3 - 540 = 585\ \text{cm}^3$

585 cm^3 more water is needed.

5. Three rectangular prisms have a combined volume of 518 cubic feet. Prism A has one-third the volume of Prism B, and Prisms B and C have equal volume. What is the volume of each prism?



7 units = 518 ft^3

÷7 ÷7

1 unit = 518 ÷ 7

= 74 ft^3

A = 74 ft^3

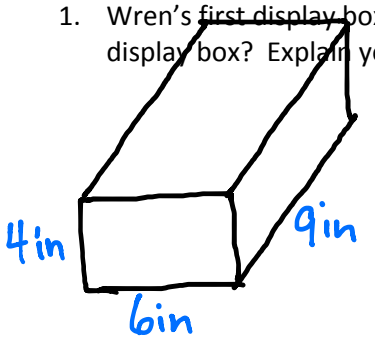
B = 74 × 3 = 222 ft^3

C = 222 ft^3

Name _____ Date _____

Wren makes some rectangular display boxes.

1. Wren's ~~first display~~ box is 6 inches long, 9 inches wide, and 4 inches high. What is the volume of the display box? Explain your work using a diagram.

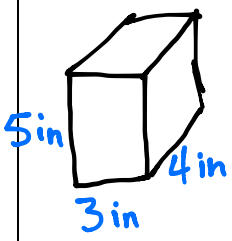


$V = l \times w \times h$
$= 6\text{in} \times 9\text{in} \times 4\text{in}$
$= 216\ \text{in}^3$

The box has a volume of $216\ \text{in}^3$.

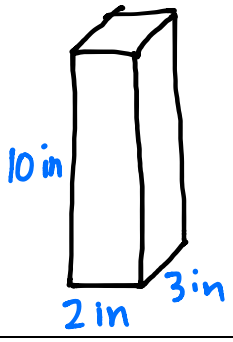
2. Wren wants to put some artwork into three large display boxes. She knows they all need a volume of 60 cubic inches, but she wants them all to be different. Show three different ways Wren can make these boxes by drawing diagrams and labeling the measurements.

Shadow Box A



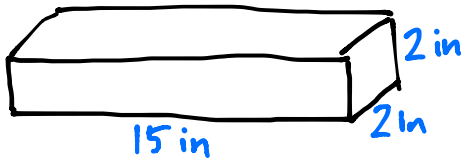
$V = l \times w \times h$
$= 3\text{in} \times 4\text{in} \times 5\text{in}$
$= 60\ \text{in}^3$

Shadow Box B



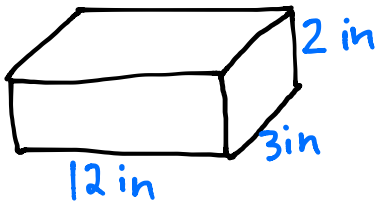
$V = l \times w \times h$
$= 2\text{in} \times 3\text{in} \times 10\text{in}$
$= 60\ \text{in}^3$

Shadow Box C



$V = l \times w \times h$
$= 15\text{in} \times 2\text{in} \times 2\text{in}$
$= 60\ \text{in}^3$

3. Wren wants to build a box to organize her scrapbook supplies. She has a stencil set that is 12 inches wide that needs to lay flat in the bottom of the box. The supply box must also be no taller than 2 feet. Name one way she could build a toy box with a volume of 72 cubic inches.



$V = l \times w \times h$
$= 12 \text{ in} \times 3 \text{ in} \times 2 \text{ in}$
$= 72 \text{ in}^3$

The box is 12 inches long, 3 inches wide, and 2 inches high.

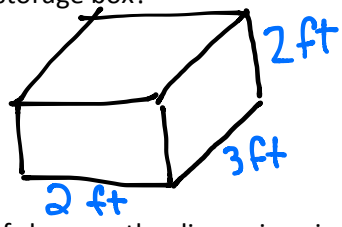
4. After all of this organizing, Wren decides she also needs more storage for her soccer equipment. Her current storage box measures 1 foot long by 2 feet wide by 2 feet high. She realizes she needs to replace it with a box with 12 cubic feet of storage, so she doubles the width.

a. Will she achieve her goal if she does this? Why or why not?

$1 \text{ ft} \times \cancel{2}\ 4 \text{ ft} \times 2 \text{ ft} = 8 \text{ ft}^3$

Wren does not reach her goal.

b. If she wants to keep the height the same, what could the other dimensions be for a 12-cubic-foot storage box?



$V = l \times w \times h$
$= 2 \text{ ft} \times 3 \text{ ft} \times 2 \text{ ft}$
$= 12 \text{ ft}^3$

length = 2 feet
width = 3 feet
height = 2 feet

c. If she uses the dimensions in Part (b), what is the area of the new storage box's floor?

The area of the box's floor is 6 ft^2 ($2 \text{ ft} \times 3 \text{ ft}$).

d. How has the area of the bottom in her new storage box changed? Explain how you know.

The original area of the box floor in Part (a) was 2 ft^2 ($1 \text{ ft} \times 2 \text{ ft}$)
In Part (c) the area of the box floor is 6 ft^2 ($2 \text{ ft} \times 3 \text{ ft}$).

Name _____ Date _____

1. I have a prism with the dimensions of 6 cm by 12 cm by 15 cm. Calculate the volume of the prism, then give the dimensions of three different prisms that have $\frac{1}{3}$ of the volume.

	Length	Width	Height	Volume
Original Prism	6 cm	12 cm	15 cm	1080 cm^3
Prism 1	10 cm	4 cm	9 cm	360 cm^3
Prism 2	10 cm	6 cm	6 cm	360 cm^3
Prism 3	10 cm	2 cm	18 cm	360 cm^3

2. Sunni's bedroom has the dimensions of 11 ft by 10 ft by 10 ft. Her den has the same height, but double the volume. Give two sets of the possible dimensions of the den and the volume of the den.

Bedroom: 11 ft x 10 ft x 10 ft = 1100 ft^3

Den: 11 ft x ~~10~~ 20 ft x 10 ft = 2200 ft^3

Den: ~~11~~ 22 ft x 10 ft x 10 ft = 2200 ft^3

Name _____ Date _____

1. Find three rectangular prisms around your house. Describe the item you are measuring (cereal box, tissue box, etc.), then measure each dimension to the nearest whole inch and calculate the volume.

   a. Rectangular Prism A

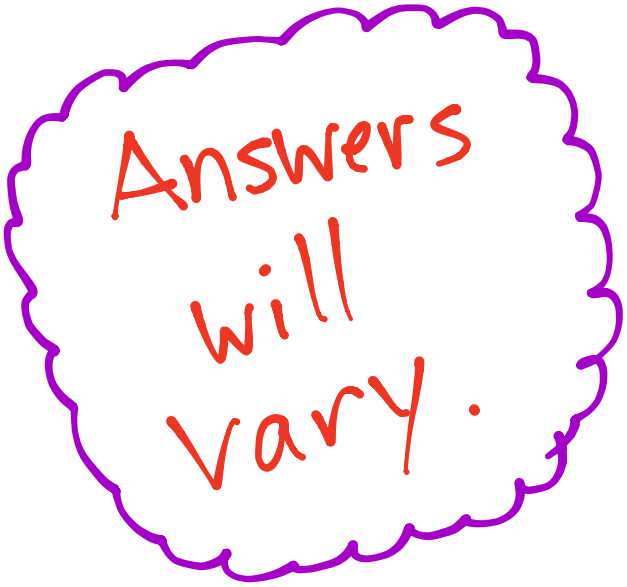
   Item:

   Height: _____ inches

   Length: _____ inches

   Width: _____ inches

   Volume: _____ cubic inches



   b. Rectangular Prism B

   Item:

   Height: _____ inches

   Length: _____ inches

   Width: _____ inches

   Volume: _____ cubic inches

   c. Rectangular Prism C

   Item:

   Height: _____ inches

   Length: _____ inches

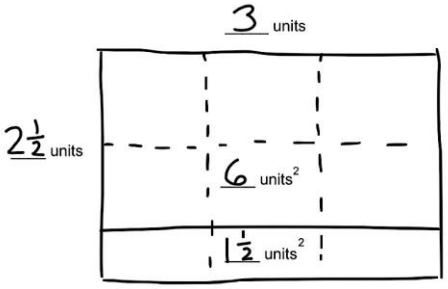
   Width: _____ inches

   Volume: _____ cubic inches

Name _____ Date _____

1. John tiled some rectangles using square unit. Sketch the rectangles if necessary, fill in the missing information, and then confirm the area by multiplying.

a. **Rectangle A:**



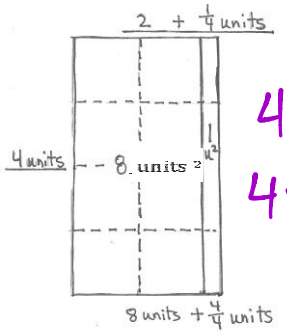
$6u^2 + 1\frac{1}{2}u^2 = 7\frac{1}{2}u^2$

Rectangle A is

3 units long $2\frac{1}{2}$ units wide

Area = $7\frac{1}{2}$ units²

b. **Rectangle B:**



$4 \times 2 = 8$

$4 \times \frac{1}{4} = \frac{4}{4} = 1$

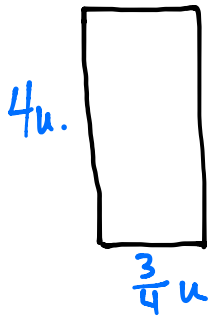
$8 + 1 = 9$

Rectangle B is

$2\frac{1}{4}$ units long 4 units wide

Area = 9 units²

c. **Rectangle C:**



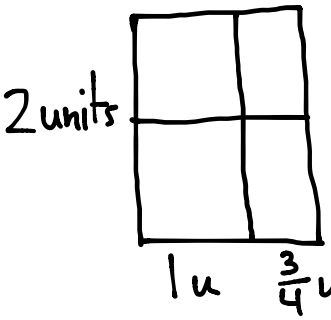
$4 \times \frac{3}{4} = \frac{12}{4} = 3$

Rectangle C is

$\frac{3}{4}$ units long 4 units wide

Area = 3 units²

d. **Rectangle D:** $2 \times 1\frac{3}{4}$



$2 \times 1 = 2$

$2 \times \frac{3}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

$2 + 1\frac{1}{2} = 3\frac{1}{2}$

Rectangle D is

2 units long $1\frac{3}{4}$ units wide

Area = $3\frac{1}{2}$ units^2

2. Rachel made a mosaic from different color rectangular tiles. Three tiles measured $3\frac{1}{2}$ inches × 3 inches. Six tiles measured 4 inches × $3\frac{1}{4}$ inches. What is the area of the whole mosaic in square inches?

$3\frac{1}{2}$ in $\times$ 3 in $= (3 \times 3) + (\frac{1}{2} \times 3)$

$= 9 + \frac{3}{2}$

$= 9 + 1\frac{1}{2}$

$= 10\frac{1}{2}$ in^2

4 in $\times$ $3\frac{1}{4}$ in $= (4 \times 3) + (4 \times \frac{1}{4})$

$= 12 + \frac{4}{4}$

$= 12 + 1$

$= 13$ in^2

$(3 \times 10\frac{1}{2}$ in$^2) + (6 \times 13$ in$^2)$

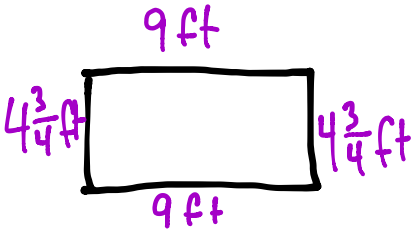
$= 30 + \frac{3}{2} + 78$

$= 108 + 1\frac{1}{2}$

$= 109\frac{1}{2}$ in^2

The area of the whole mosaic is $109\frac{1}{2}$ in^2.

3. A garden box has a perimeter of $27\frac{1}{2}$ feet. If the length is 9 feet, what is the area of the garden box?



$27\frac{1}{2} - 18 = 9\frac{1}{2}$

9 ft $\times$ $4\frac{3}{4}$ ft

$= (9 \times 4) + (9 \times \frac{3}{4})$

$= 36 + \frac{27}{4}$

$= 36 + 6\frac{3}{4}$

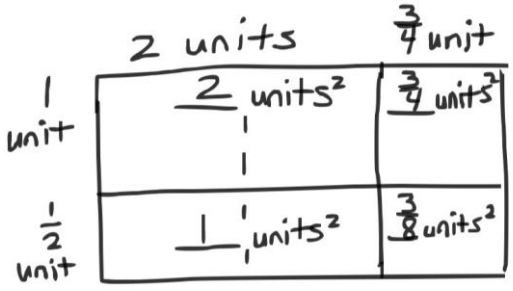
$= 42\frac{3}{4}$ ft^2

The area of the box is $42\frac{3}{4}$ ft^2.

Name _____ Date _____

1. Kristen tiled the following rectangles using square units. Sketch the rectangles, and find the areas. Then confirm the area by multiplying. Rectangle A has been sketched for you.

a. Rectangle A:



Rectangle A is

$2\frac{3}{4}$ units long × $1\frac{1}{2}$ units wide

Area = $4\frac{1}{8}$ units²

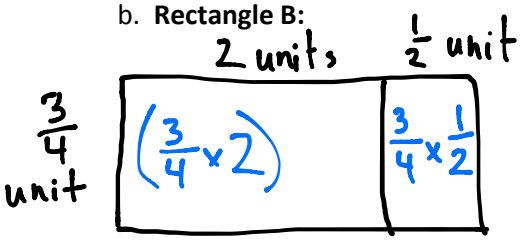
$2\frac{3}{4} \times 1\frac{1}{2} = (1\times2) + (1\times\frac{3}{4}) + (\frac{1}{2}\times2) + (\frac{1}{2}\times\frac{3}{4})$

$= 2 + \frac{3}{4} + \frac{2}{2} + \frac{3}{8}$

$= 3 + \frac{3}{4}\times\frac{2}{2} + \frac{3}{8}$

$= 3 + \frac{6}{8} + \frac{3}{8} = 3\frac{9}{8} = 4\frac{1}{8}$

b. **Rectangle B:**



Rectangle B is

$2\frac{1}{2}$ units long × $\frac{3}{4}$ unit wide

Area = $1\frac{7}{8}$ units²

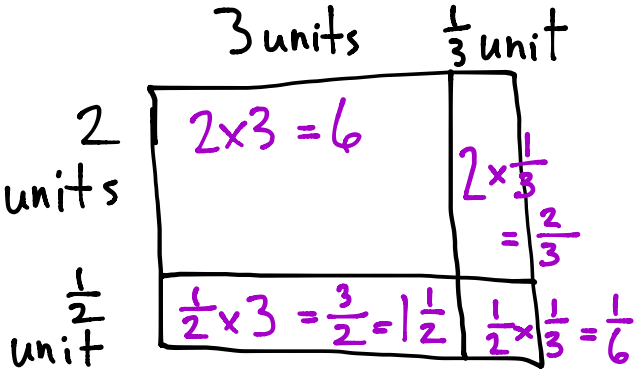
$2\frac{1}{2} \times \frac{3}{4}$

$= (2\times\frac{3}{4}) + (\frac{1}{2}\times\frac{3}{4})$

$= \frac{6}{4}\times\frac{2}{2} + \frac{3}{8}$

$= \frac{12}{8} + \frac{3}{8} = \frac{15}{8} = 1\frac{7}{8}$

c. **Rectangle C:**



Rectangle C is

$3\frac{1}{3}$ units long × $2\frac{1}{2}$ units wide

Area = $8\frac{1}{3}$ units²

$3\frac{1}{3} \times 2\frac{1}{2}$

$= (2\times3) + (2\times\frac{1}{3}) + (\frac{1}{2}\times3) + (\frac{1}{2}\times\frac{1}{3})$

$= 6 + \frac{2}{3}\times\frac{2}{2} + \frac{3}{2}\times\frac{3}{3} + \frac{1}{6}$

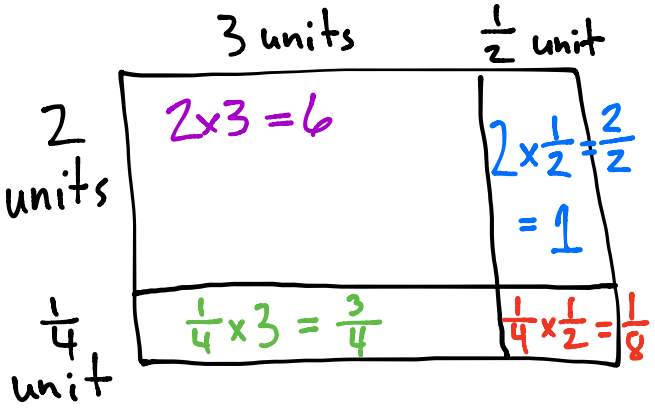
$= 6 + \frac{4}{6} + \frac{9}{6} + \frac{1}{6}$

$= 6\frac{14}{6} = 6 + 2\frac{2}{6} = 8\frac{2}{6} = 8\frac{1}{3}$

$\frac{14}{6}$

$\frac{12}{6}$ $\frac{2}{6}$

d. **Rectangle D:**



Rectangle D is

$3\frac{1}{2}$ units long × $2\frac{1}{4}$ units wide

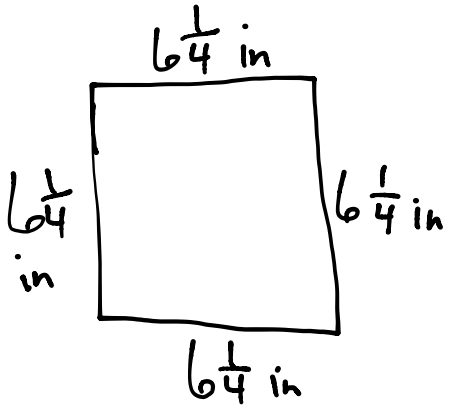
Area = $7\frac{7}{8}$ units^2

$3\frac{1}{2} \times 2\frac{1}{4}$

$= 6 + 1 + \frac{3}{4} \times \frac{2}{2} + \frac{1}{8}$

$= 6 + 1 + \frac{6}{8} + \frac{1}{8} = 7\frac{7}{8}$

2. A square has a perimeter of 25 inches. What is the area of the square?



$6\frac{1}{4}$
4 | 25
-24
1

The square has an area of $39\frac{1}{16}$ in^2.

Area = l x w

$= 6\frac{1}{4} \times 6\frac{1}{4}$

$= (6 \times 6) + (6 \times \frac{1}{4}) + (\frac{1}{4} \times 6) + (\frac{1}{4} \times \frac{1}{4})$

$= 36 + \frac{6}{4} + \frac{6}{4} + \frac{1}{16}$

$= 36 + \frac{12}{4} + \frac{1}{16}$

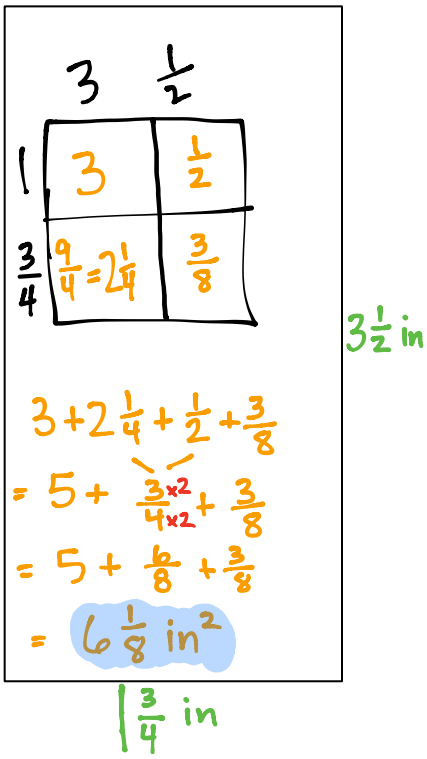
$= 36 + 3 + \frac{1}{16}$

$= 39\frac{1}{16}$

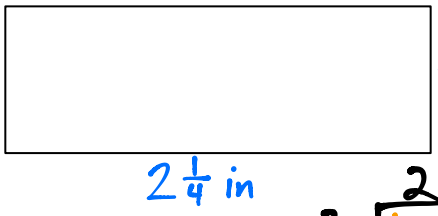
Name _____ Date _____

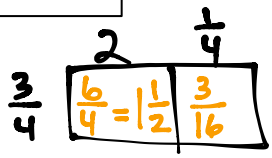
1. Measure each rectangle with your ruler, and label the dimensions. Use the area model to find the area.

a.



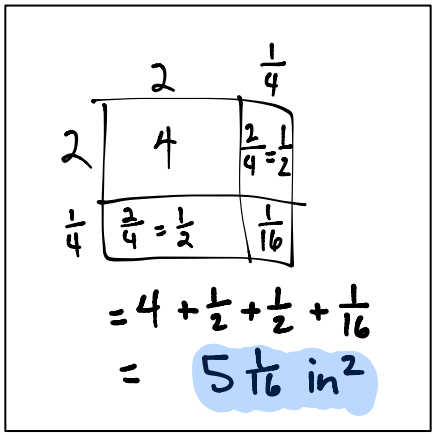
b.



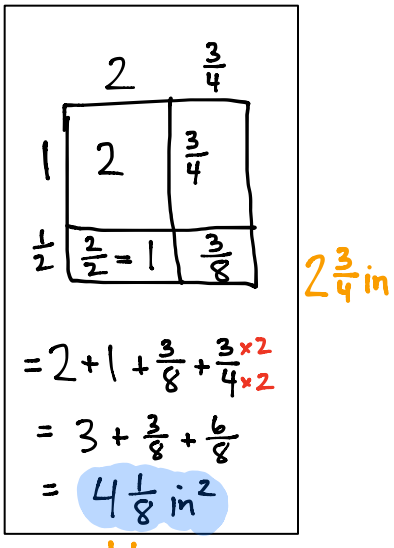


$1\frac{1}{2}\times\frac{8}{8}+\frac{3}{16}$
$=1\frac{8}{16}+\frac{3}{16}$
$=1\frac{11}{16}\text{ in}^2$

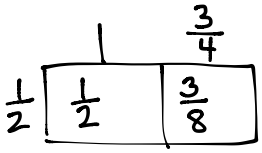
c.



d.



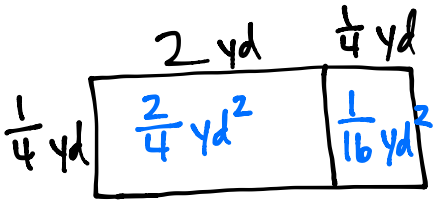
e.



$=\frac{1}{2}\times\frac{4}{4}+\frac{3}{8}$
$=\frac{4}{8}+\frac{3}{8}=\frac{7}{8}\text{ in}^2$

2. Find the area. Explain your thinking using the area model.

a. $2\frac{1}{4}$ yd × $\frac{1}{4}$ yd

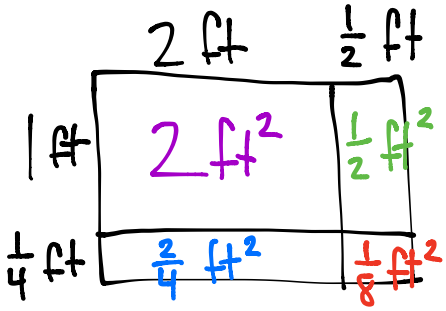


$= \frac{2}{4} \times \frac{4}{4} + \frac{1}{16}$

$= \frac{8}{16} + \frac{1}{16}$

$= \frac{9}{16}$ yd²

b. $2\frac{1}{2}$ ft × $1\frac{1}{4}$ ft

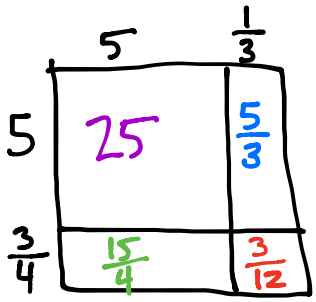


$= 2 + \frac{1}{2} + \frac{2}{4} + \frac{1}{8}$

$= 2 + 1 + \frac{1}{8}$

$= 3\frac{1}{8}$ ft²

3. Kelly buys a tarp to cover the area under her tent. The tent is 4 feet wide and has an area of 31 square feet. The tarp she bought is $5\frac{1}{3}$ feet by $5\frac{3}{4}$ feet. Can the tarp cover the area under Kelly's tent? Draw a model to show your thinking.



$5\frac{1}{3} \times 5\frac{3}{4}$

$= 25 + \frac{5}{3} + \frac{15}{4} + \frac{3}{12}$

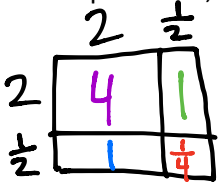
$= 25 + 1\frac{2}{3} + 3\frac{3}{4} + \frac{1}{4}$

$= 30\frac{2}{3}$ ft²

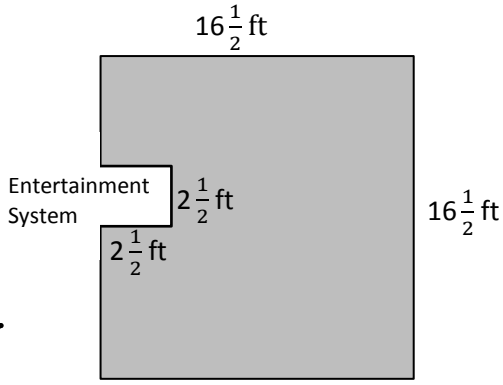
The tarp is not big enough.

4. Shannon and Leslie want to carpet a $16\frac{1}{2}$ ft by $16\frac{1}{2}$ ft square room. They can't put carpet under an entertainment system that juts out. (See the drawing below.)

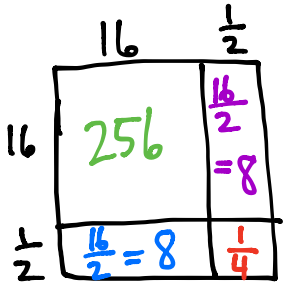
a. In square feet, what is the area of the space with no carpet?



$2\frac{1}{2} \times 2\frac{1}{2} = 6\frac{1}{4}$ ft²



b. How many square feet of carpet will Shannon and Leslie need to buy?



$16\frac{1}{2} \times 16\frac{1}{2} = 256 + 8 + 8 + \frac{1}{4}$

$= 272\frac{1}{4}$ ft²

$272\frac{1}{4} - 6\frac{1}{4} = 266$ ft²

They need to buy 266 ft² of carpet.

Name _____ Date _____

1. Find the area of the following rectangles. Draw an area model if it helps you.

a. $\frac{8}{3}$ cm × $\frac{24}{4}$ cm

$= \frac{2\cancel{8} \times \cancel{24}\,8}{\cancel{3} \times \cancel{4}\,1} = \frac{16}{1}$

$= 16\ cm^2$

b. $\frac{32}{5}$ ft × $3\frac{3}{8}$ ft

$= \frac{32}{5} \times \frac{27}{8}$

$= \frac{\cancel{32}^{4} \times 27}{5 \times \cancel{8}\,1} = \frac{108}{5}$

$= 21\frac{3}{5}\ ft^2$

$5\overline{)108}$ → $21\frac{3}{5}$, -10, 08, -5, 3

c. $5\frac{4}{6}$ in × $4\frac{3}{5}$ in

	4 in	$\frac{3}{5}$ in
5 in	$20\ in^2$	$\frac{15}{5} = 3\ in^2$
$\frac{4}{6}$ in	$\frac{16}{6} = 2\frac{4}{6}\ in^2$	$\frac{12}{30}\ in^2$

$= 20 + 3 + 2\frac{4}{6} + \frac{12}{30}$

$= 25 + \frac{20}{30} + \frac{12}{30}$

$= 25 + \frac{32}{30}$

$= 25 + 1\frac{2}{30}$

$= 26\frac{2}{30} = 26\frac{1}{15}\ in^2$

d. $\frac{5}{7}$ m × $6\frac{3}{5}$ m

$= \frac{5}{7} \times \frac{33}{5}$

$= \frac{\cancel{5}^{1} \times 33}{7 \times \cancel{5}\,1} = \frac{33}{7}$

$= 4\frac{5}{7}\ m^2$

2. Chris is making a table top from some leftover tiles. He has 9 tiles that measure $3\frac{1}{8}$ inches long and $2\frac{3}{4}$ inches wide. What is the area he can cover with these tiles?

	2 in	$\frac{3}{4}$ in
3 in	$6\ in^2$	$\frac{9}{4} = 2\frac{1}{4}\ in^2$
$\frac{1}{8}$ in	$\frac{2}{8}\ in^2$	$\frac{3}{32}\ in^2$

$3\frac{1}{8} \times 2\frac{3}{4}$

$= 6 + 2\frac{1}{4} + \frac{2}{8} + \frac{3}{32}$

$= 8 + \frac{1}{4} + \frac{1}{4} + \frac{3}{32}$

$= 8 + \frac{1}{2}^{\times 16} + \frac{3}{32}$

$= 8\frac{19}{32}\ in^2$ (for 1 tile)

$9 \times 8\frac{19}{32}$

$= (9 \times 8) + (9 \times \frac{19}{32})$

$= 72 + \frac{171}{32}$

$= 72 + 5\frac{11}{32}$

$= 77\frac{11}{32}\ in^2$

$32\overline{)171}$ → 5, -160, 11

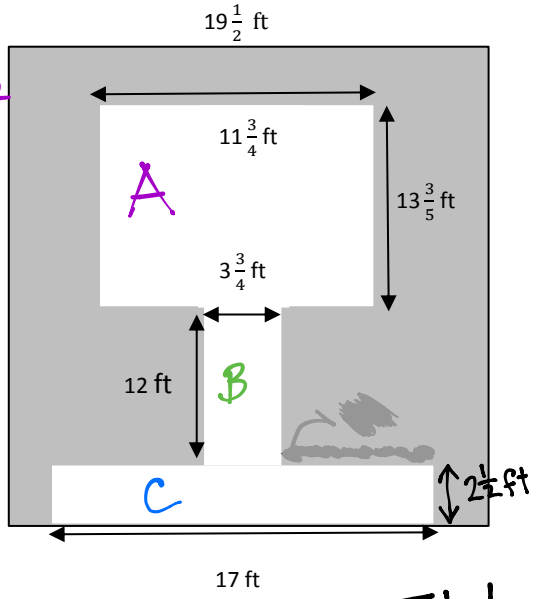
He can cover $77\frac{11}{32}\ in^2$.

3. A hotel is recarpeting a section of the lobby. Carpet covers the part of the floor as shown below in grey. How many square feet of carpeting will be needed?

Area of large rectangle $= 31\frac{7}{8}\text{ ft} \times 19\frac{1}{2}\text{ ft}$

$= \frac{255}{8} \times \frac{39}{2} = \frac{9945}{16} = 621\frac{9}{16}\text{ ft}^2$

$16\overline{)9945}$ -9936 9 $621\frac{9}{16}$



$\text{Area}_A = 11\frac{3}{4} \times 13\frac{3}{5}$

$= \frac{47}{4} \times \frac{68}{5}^{17} = \frac{799}{5} = 159\frac{4}{5}\text{ ft}^2$

$\text{Area}_B = 12 \times 3\frac{3}{4}$

$= (12 \times 3) + (\frac{3}{12} \times \frac{3}{4})$

$= 36 + 9$

$= 45\text{ ft}^2$

$\text{Area}_C = 17 \times 2\frac{1}{2}$

$= (17 \times 2) + (17 \times \frac{1}{2})$

$= 34 + \frac{17}{2}$

$= 34 + 8\frac{1}{2}$

$= 42\frac{1}{2}\text{ ft}^2$

$\text{Area}_A + \text{Area}_B + \text{Area}_C =$

$= 159\frac{4}{5} + 45 + 42\frac{1}{2}$

$= 246 + \frac{4}{5}\overset{\times 2}{} + \frac{1}{2}\overset{\times 5}{}$

$= 246 + \frac{8}{10} + \frac{5}{10}$

$= 246 + 1\frac{3}{10}$

$= 247\frac{3}{10}$

Total − Uncarpeted

$= 621\frac{9}{16} - 247\frac{3}{10}$

$= 374\frac{9}{16}\overset{\times 5}{} - \frac{3}{10}\overset{\times 8}{}$

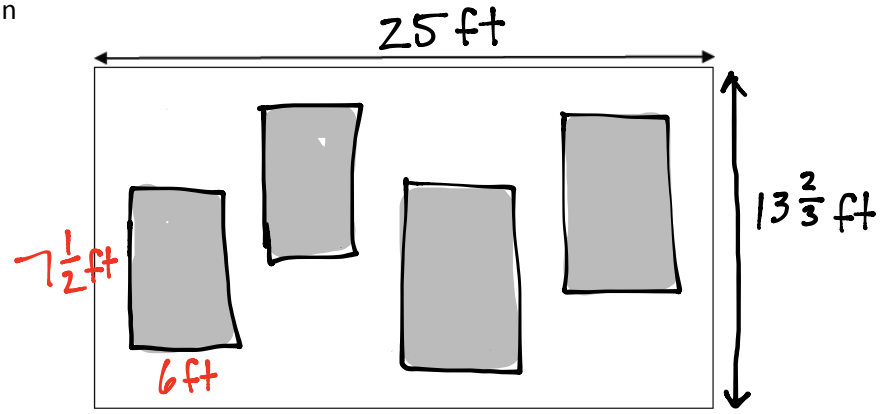
$= 374\frac{45}{80} - \frac{24}{80}$

$= 374\frac{21}{80}\text{ ft}^2$

We will need $374\frac{21}{80}\text{ ft}^2$ of carpeting.

Name _____ Date _____

1. Mr. Albano wants to paint menus on the wall of his café in chalkboard paint. The grey area below shows where the rectangular menus will be. Each menu will measure 6 feet wide and $7\frac{1}{2}$ ft long.



a. How many square feet of menu space will Mr. Albano have?

$6\text{ ft} \times 7\frac{1}{2}\text{ ft} = (6\times 7) + (6\times\frac{1}{2})$
$= 42 + \frac{6}{2}$
$= 42 + 3$
$= 45\text{ ft}^2$

$4 \times 45\text{ ft}^2 = 180\text{ ft}^2$

Total space for menus = 180 ft^2

b. What is the area of wall space that is not covered by chalkboard paint?

Big board: $25 \times 13\frac{2}{3}$
$= (25\times 13) + (25\times\frac{2}{3})$
$= 325 + \frac{50}{3}$
$= 325 + 16\frac{2}{3} = 341\frac{2}{3}\text{ ft}^2$

$341\frac{2}{3} - 180 = 161\frac{2}{3}\text{ ft}^2$

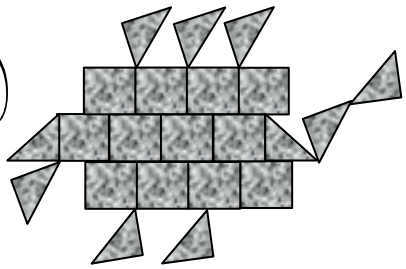
Area not covered = $161\frac{2}{3}\text{ ft}^2$

2. Mr. Albano wants to put tiles in the shape of a dinosaur at the front entrance. He will need to cut some tiles in half to make the figure. If each square tile is $4\frac{1}{4}$ inches on each side, what will the total area of the figure be?

$4\frac{1}{4}\text{ in} \times 4\frac{1}{4}\text{ in} = 18\frac{1}{16}\text{ in}^2$ (one tile)

	4	$\frac{1}{4}$
4	16	1
$\frac{1}{4}$	1	$\frac{1}{16}$

$17 \times 18\frac{1}{16}$
$= (17\times 18) + (17\times\frac{1}{16})$
$= 306 + \frac{17}{16}$
$= 306 + 1\frac{1}{16}$
$= 307\frac{1}{16}\text{ in}^2$ ← Total area



3. A-Plus Glass is making windows for a new house that is being built. The box shows the list of sizes they must make.

15 windows $4\frac{3}{4}$ ft long and $3\frac{3}{5}$ ft wide
7 windows $2\frac{4}{5}$ ft wide and $6\frac{1}{2}$ ft long

How many square feet of glass will they need?

$4\frac{3}{4} \times 3\frac{3}{5} = \frac{19}{4} \times \frac{18}{5} = \frac{171}{10} = 17\frac{1}{10}$ ft^2

$15 \times 17\frac{1}{10} = (15 \times 17) + (15 \times \frac{1}{10}) = 255 + \frac{15}{10} = 255 + 1\frac{5}{10} = 256\frac{1}{2}$ ft^2

$2\frac{4}{5} \times 6\frac{1}{2} = \frac{14}{5} \times \frac{13}{2} = \frac{91}{5} = 18\frac{1}{5}$ ft^2

$7 \times 18\frac{1}{5} = (7 \times 18) + (7 \times \frac{1}{5}) = 126 + \frac{7}{5} = 126 + 1\frac{2}{5} = 127\frac{2}{5}$ ft^2

$256\frac{1}{2} + 127\frac{2}{5} = 256\frac{5}{10} + 127\frac{4}{10} =$ $383\frac{9}{10}$ ft^2 is needed

4. Mr. Johnson needs to buy seed for his backyard lawn.

a. If the lawn measures $40\frac{4}{5}$ ft by $50\frac{7}{8}$ ft, how many square feet of seed will he need?

	50	$\frac{7}{8}$
40	2000	35
$\frac{4}{5}$	40	$\frac{28}{40}$

$= 2000 + 35 + 40 + \frac{28}{40}$

$= 2075\frac{28}{40}$

$= 2075\frac{7}{10}$ ft^2

He will need $2075\frac{7}{10}$ ft^2 of seed.

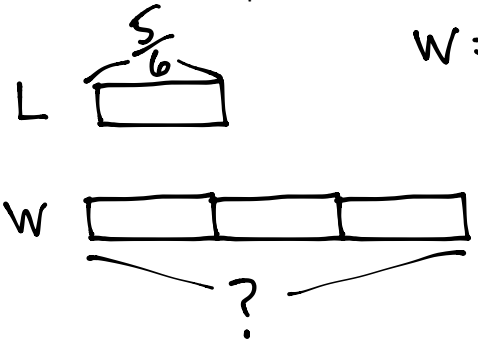
b. One bag of seed will cover 500 square feet if he sets his seed spreader to its lowest setting and 300 square feet if he sets the spreader to its highest setting. How many bags of seed will he need if he uses the highest setting? The lowest setting?

$300 \times 6 = 1{,}800$
$300 \times 7 = 2{,}100$
> At the lowest setting, he would need 7 bags.

$500 \times 4 = 2{,}000$
$500 \times 5 = 2{,}500$
> At the highest setting, he would need 5 bags.

Name _____ Date _____

1. The width of a picnic table is 3 times its length. If the length is $\frac{5}{6}$ yd long, what is the area in square feet?



$W = 3 \times \frac{5}{6} = \frac{3 \times 5}{6} = \frac{5}{2} = 2\frac{1}{2}$ yd

Area $= \frac{5}{6} \times 2\frac{1}{2}$

$= \frac{5}{6} \times \frac{5}{2} = \frac{25}{12} = 2\frac{1}{12}$ yd^2

$= 18\frac{3}{4}$ ft^2

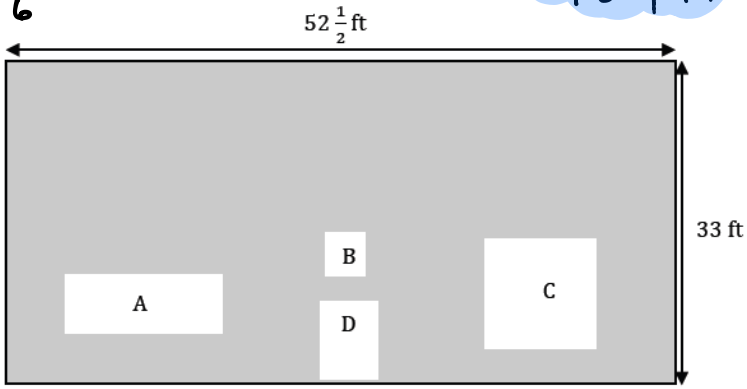
2. A painting company will paint this wall. The homeowner gives them the following dimensions:

Window A is $6\frac{1}{4}$ ft × $5\frac{3}{4}$ ft

Window B is $3\frac{1}{8}$ ft × 4 ft

Window C is $9\frac{1}{2}$ ft square

Door D is 8 ft × 4 ft



What is the area of the painted part of the wall?

Wall: $33 \times 52\frac{1}{2} = (33 \times 52) + (33 \times \frac{1}{2}) = 1716 + \frac{33}{2} = 1716 + 16\frac{1}{2} = 1732\frac{1}{2}$ ft^2

Window A: $6\frac{1}{4} \times 5\frac{3}{4} = \frac{25}{4} \times \frac{23}{4} = \frac{575}{16} = 35\frac{15}{16}$ ft^2

Window B: $3\frac{1}{8} \times 4 = (3 \times 4) + (\frac{1}{8} \times 4) = 12 + \frac{4}{8} = 12\frac{1}{2}$ ft^2

Window C: $9\frac{1}{2}$ ft^2

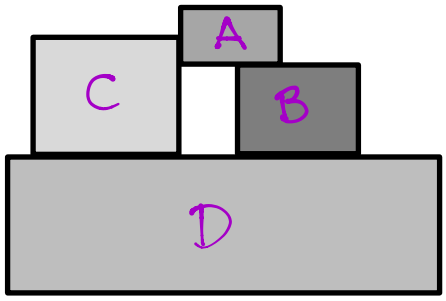
Door D: $8 \times 4 = 32$ ft^2

$35\frac{15}{16} + 12\frac{1}{2} + 9\frac{1}{2} + 32$

$= 89\frac{15}{16}$ ft^2

$1732\frac{1}{2} - 89\frac{15}{16} = 1732\frac{8}{16} - 89\frac{15}{16} = 1643\frac{8}{16} - \frac{15}{16} = 1642\frac{9}{16}$ ft^2

3. A decorative wooden piece is made up of four rectangles as shown to the right. The smallest rectangle measures $4\frac{1}{2}$ inches by $7\frac{3}{4}$ inches. If $2\frac{1}{4}$ inches is added to each dimension as the rectangles get larger, what is the total area of the entire piece?



A: $4\frac{1}{2} \times 7\frac{3}{4} = \frac{9}{2} \times \frac{31}{4} = \frac{279}{8} = 34\frac{7}{8}$ in^2

B: $6\frac{3}{4} \times 10 = (6 \times 10) + (\frac{3}{4} \times 10) = 60 + \frac{30}{4} = 60 + 7\frac{1}{2} = 67\frac{1}{2}$ in^2

C: $9 \times 12\frac{1}{4} = (9 \times 12) + (9 \times \frac{1}{4}) = 108 + \frac{9}{4} = 108 + 2\frac{1}{4} = 110\frac{1}{4}$ in^2

D: $11\frac{1}{4} \times 14\frac{1}{2} = \frac{45}{4} \times \frac{29}{2} = \frac{1305}{8} = 163\frac{1}{8}$ in^2

Total:

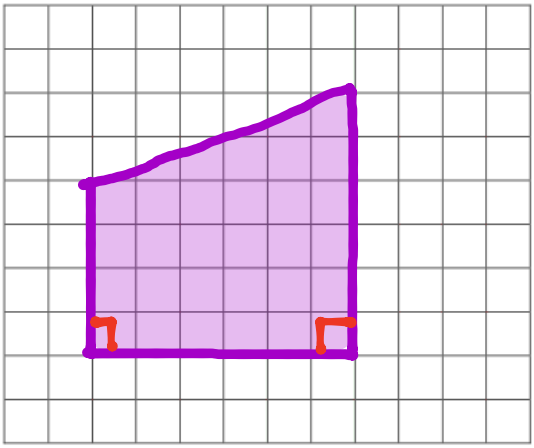
$34\frac{7}{8} + 67\frac{1}{2} + 110\frac{1}{4} + 163\frac{1}{8} = 374 + \frac{7}{8} + \frac{1}{8} + \frac{1}{2} + \frac{1}{4}$

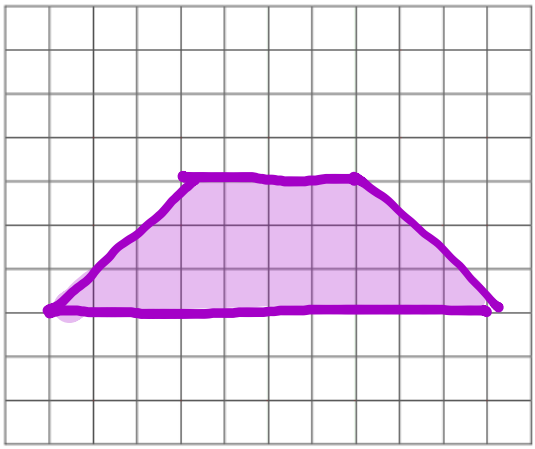
$= 375\frac{3}{4}$ in^2

The total area is $375\frac{3}{4}$ in^2.

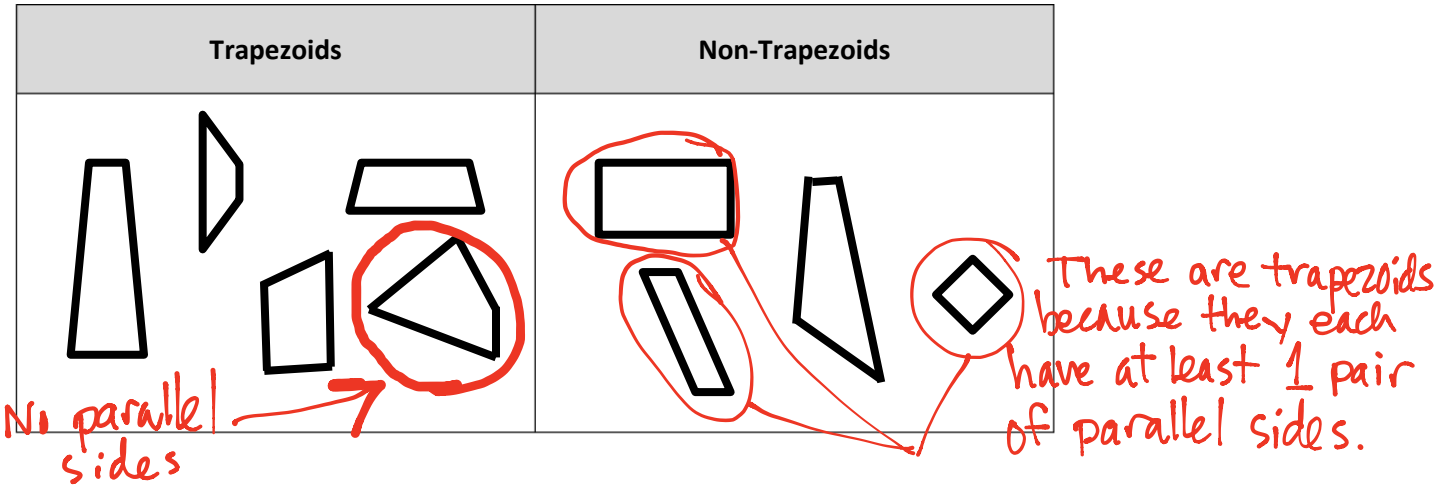
Name _____ Date _____

1. Use a straightedge and the grid paper to draw:
   a. A trapezoid with exactly 2 right angles.
   b. A trapezoid with no right angles.





2. Kaplan incorrectly sorted some quadrilaterals into trapezoids and non-trapezoids as pictured below.
   a. Circle the shapes that are in the wrong group and tell why they are missorted.

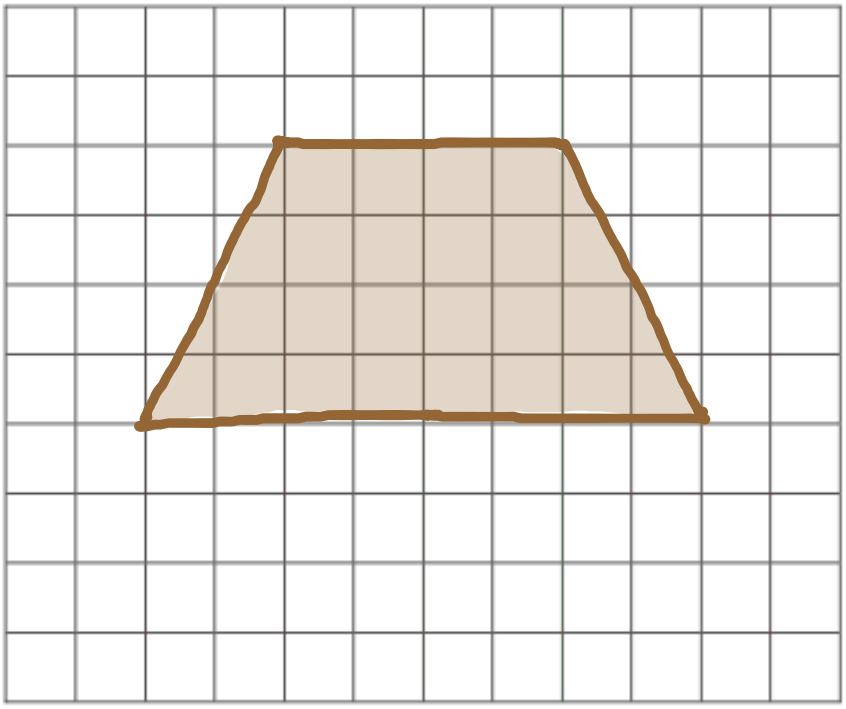


   b. Explain what tools would be necessary to use to verify the placement of all the trapezoids.

Answers will vary: We would need some sort of tool that allows us to find parallel lines.

3. Use a straightedge to draw an isosceles trapezoid on the grid paper.

Answers will vary

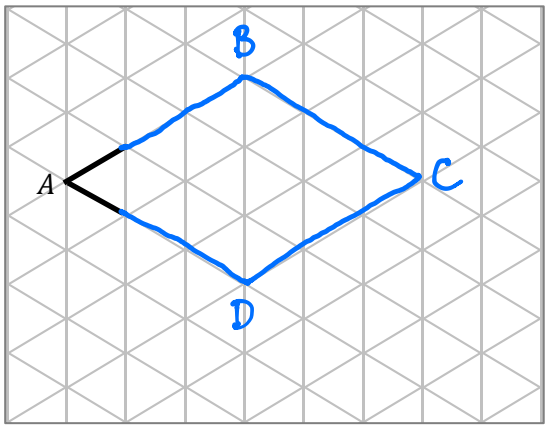


a. Why is this shape called an isosceles trapezoid?

It is an isosceles trapezoid because the two slanted sides are the same length.

Name _____ Date _____

1. $\angle A$ measures 60°. Extend the rays of $\angle A$ and draw parallelogram $ABCD$ on the grid paper.



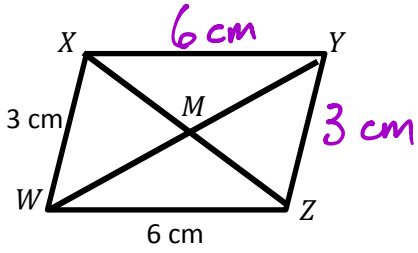
   a. What are the measures of $\angle B$, $\angle C$, and $\angle D$?

$\angle A = 60^\circ$
$\angle B = 120^\circ$
$\angle C = 60^\circ$
$\angle D = 120^\circ$

2. $WXYZ$ is a parallelogram not drawn to scale.

   a. Using what you know about parallelograms, give the measure of sides XY and YZ.

$XY = 6$ cm
$YZ = 3$ cm

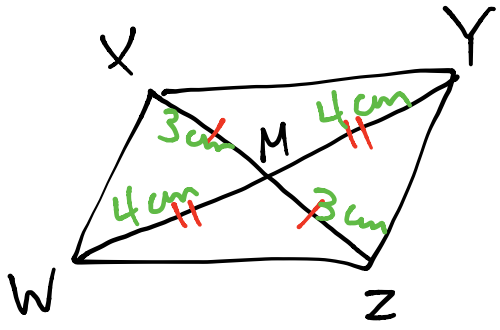


   b. $\angle WXY = 113°$. Use what you know about angles in a parallelogram to find the measure of the other angles.

$\angle XYZ =$ 67° $\angle YZW =$ 113° $\angle ZWX =$ 67°

3. Jack measured some segments in Problem 2. He found that $\overline{WY} = 8$cm and $\overline{MZ} = 3$ cm. Give the lengths of the following segments:

$WM =$ 4 cm $MY =$ 4 cm
$XM =$ 3 cm $XZ =$ 6 cm

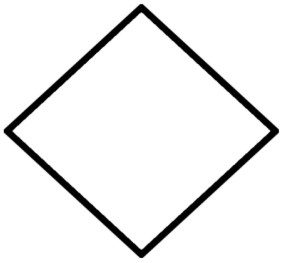


4. Using the properties of the shapes, explain why all parallelograms are trapezoids.

Answers will vary: All parallelograms must have two pairs of parallel lines. Trapezoids must have at least one pair of parallel lines. This means all parallelograms are also trapezoids.

5. Teresa says that because the diagonals of a parallelogram bisect each other, if one diagonal is 4.2 cm, the other diagonal must be half that length. Use words and pictures to explain Teresa's error.

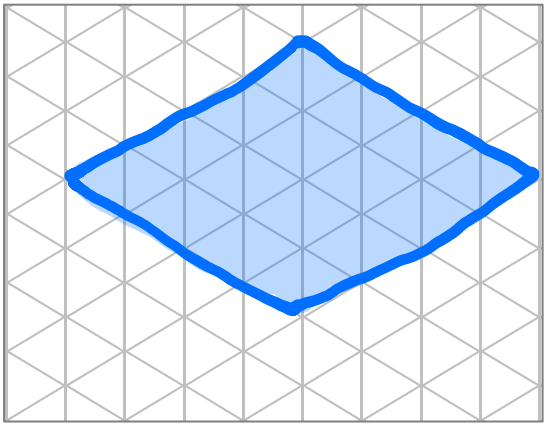
An example to show that Teresa is wrong is a rhombus that is also a square (see image to right). This is a parallelogram in which the diagonals are the same length, rather than one being half the length of the other.



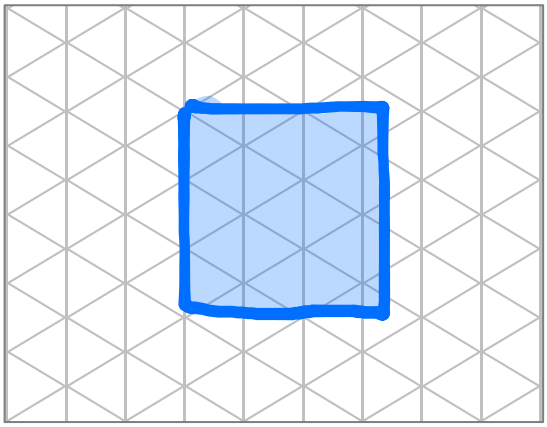
Name _____ Date _____

1. Use the grid paper to draw.

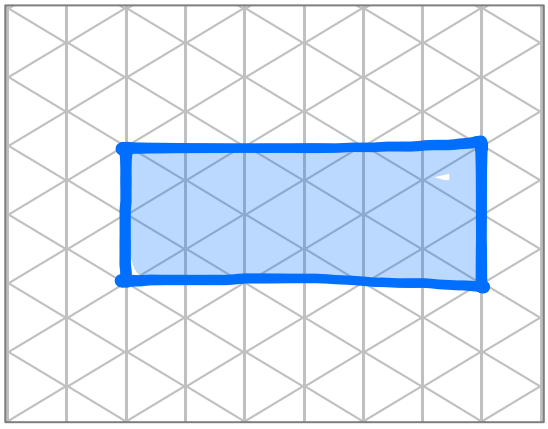
a. A rhombus with no right angles.



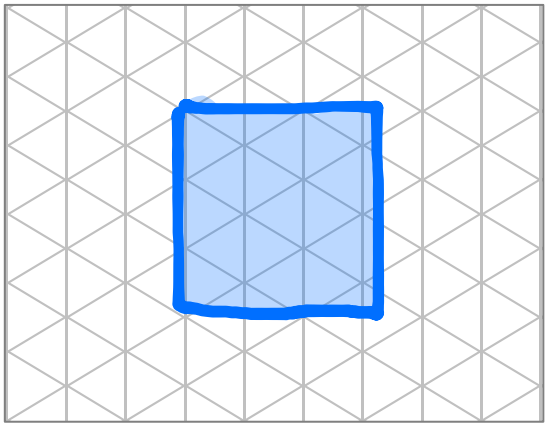
b. A rhombus with 4 right angles.



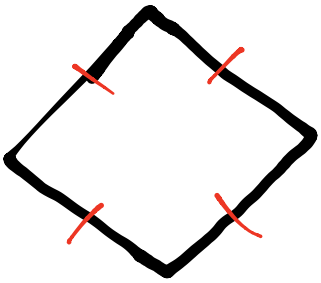
c. A rectangle with not all sides equal.



d. A rectangle with all sides equal.



2. A rhombus has a perimeter of 217 cm. What is the length of each side of the rhombus?



Perimeter = 217 cm
4 sides = 217 cm
1 side = $54\frac{1}{4}$ cm

Each side is $54\frac{1}{4}$ cm long.

$$4\overline{)217} \quad 54\ \tfrac{1}{4}$$
$$-20$$
$$17$$
$$-16$$
$$1$$

3. List the properties that all rhombuses share.

- 4 sides of equal length
- opposite angles are congruent
- opposite sides are parallel

4. List the properties that all rectangles share.

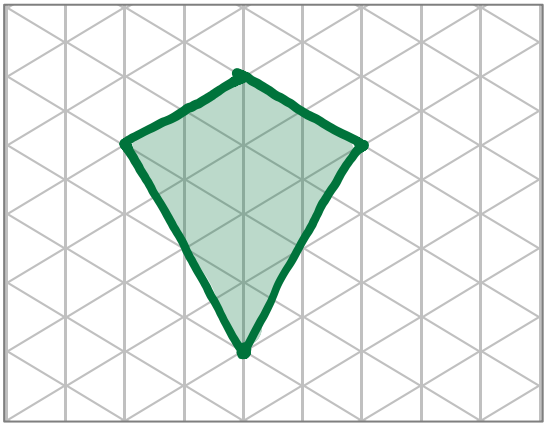
- opposite sides are equal lengths.
- two pairs of parallel sides.
- four right angles

Name _____ Date _____

1.

a. Draw a kite that is not a parallelogram on the grid paper.

b. List all the properties of a kite.



- four sides
- adjacent sides are equal
- diagonals form right angles

c. When can a parallelogram also be a kite?

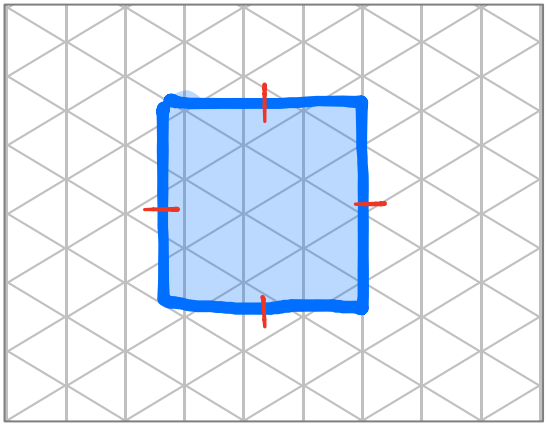
A parallelogram can also be a kite when it has 2 pairs of equal adjacent sides. Rhombuses and squares are examples.

2. If rectangles must have right angles, explain how a rhombus could also be called a rectangle.

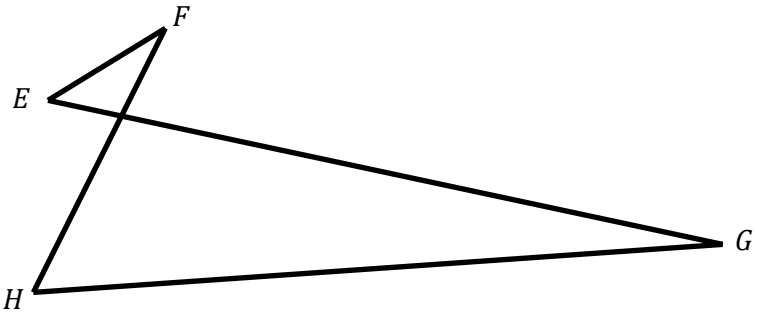
– A rhombus can also be a rectangle when all four sides are equal and all angles are 90°.

3. Draw a rhombus that is also a rectangle on the grid paper.

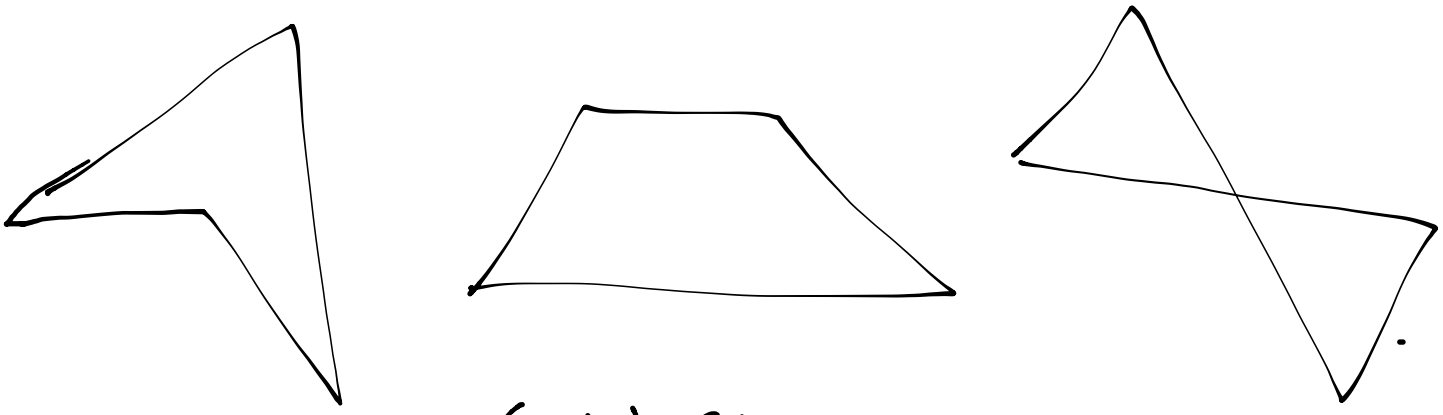
I will be a square.



4. Kirkland says that figure $EFGH$ below is a quadrilateral because it has four points in the same plane and four segments with no three endpoints collinear. Explain his error.



This is considered a complex quadrilateral. For the purposes of this module, we will say it is not a quadrilateral.



Concave

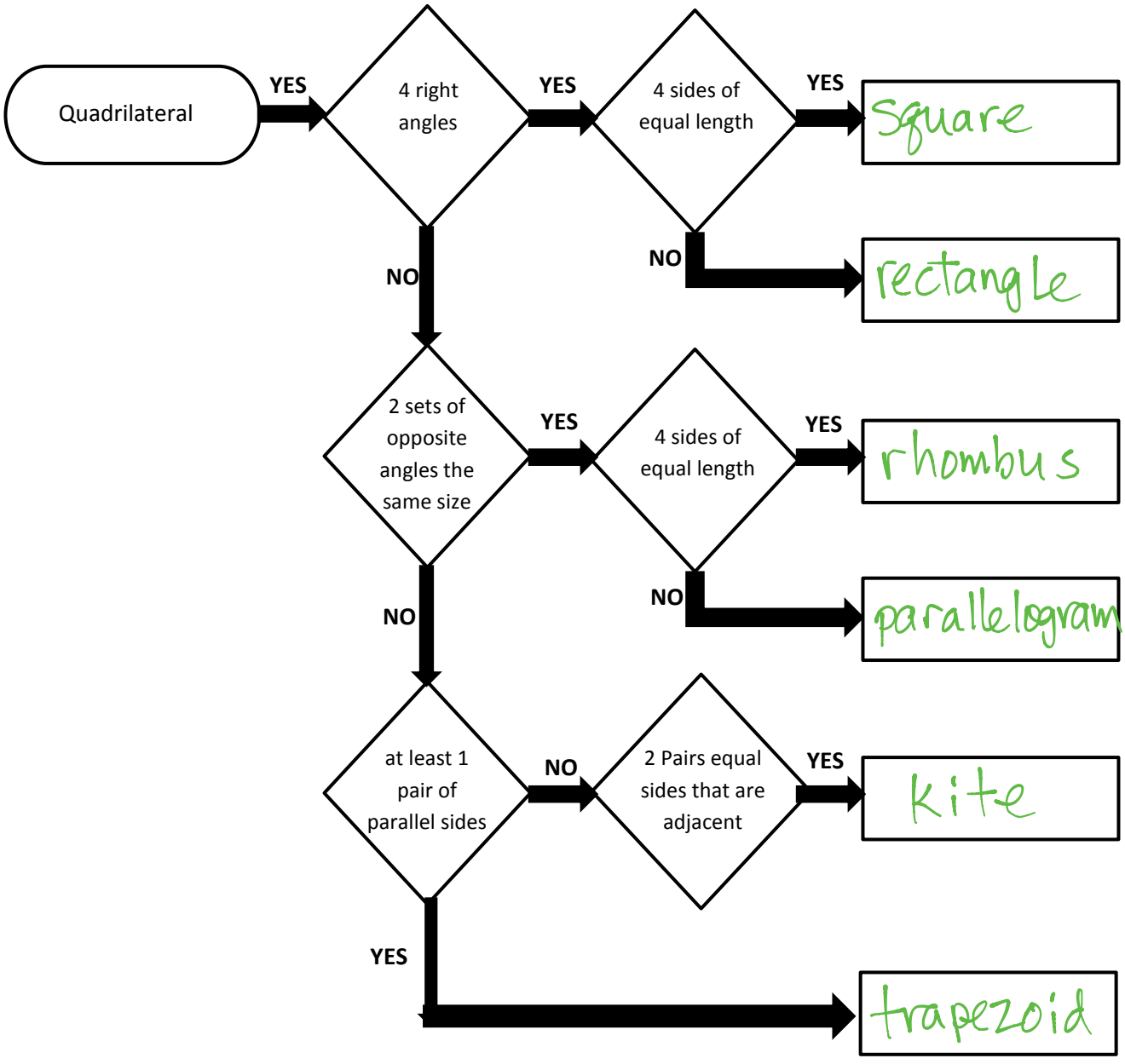
Convex

Complex

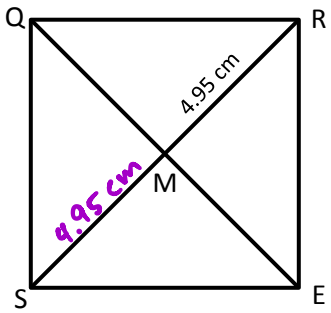
types of quadrilaterals

Name _____ Date _____

1. Follow the flow chart and put the name of the figure in the boxes.



2. $SQRE$ is a square with area 49 cm^2 and RM = 4.95 cm. Find the measurements using what you know about the properties of squares.



a. RS = 9.9 cm

b. QE = 9.9 cm

c. Perimeter = 28 cm

d. $m\angle QRE$ = 90°

e. $m\angle RMQ$ = 90°

7cm A=49cm² 7cm

A = l·w
= 7·7
= 49cm²

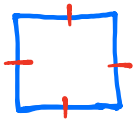
Since the area is 49cm², each side length is 7cm. This means the perimeter is 7cm+7cm+7cm+7cm which is 28cm.

Name _____ Date _____

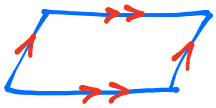
1. Answer the questions by checking the box.

	Sometimes	Always
a. Is a square a rectangle?		✓
b. Is a rectangle a kite?	✓	
c. Is a rectangle a parallelogram?		✓
d. Is a square a trapezoid?		✓
e. Is a parallelogram a trapezoid?		✓
f. Is a trapezoid a parallelogram?	✓	
g. Is a kite a parallelogram?	✓	

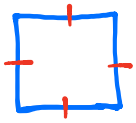
h. For each statement that you answered with "sometimes," draw and label an example that justifies your answer.

b. 

When the rectangle is a square

f. 

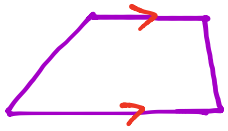
When the trapezoid has 2 pairs of parallel sides.

g. 

When the kite is also a square.

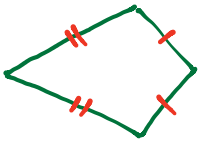
2. Use what you know about quadrilaterals to answer each question below

a. Explain when a trapezoid is not a parallelogram. Sketch an example.



When the trapezoid has only 1 pair of parallel sides.

b. Explain when a kite is not a parallelogram. Sketch an example.



When adjacent sides are congruent, but opposite sides are not parallel.