Covering and Surrounding Notebook

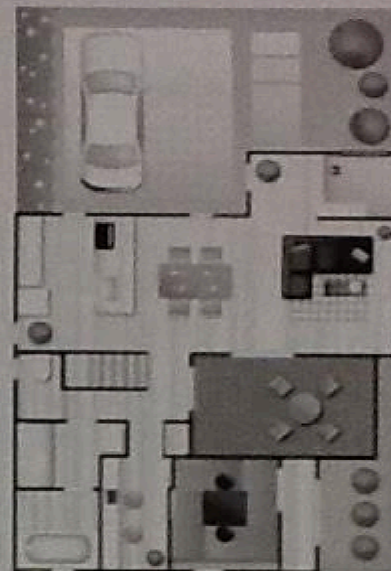
Two Dimensional Measurement

*Below you'll find images from the teachers' notebooks. Each class may have slightly different problems or examples depending on the discussions each period. Not every problem will be worked out completely, but the main ideas are present. **Do not print out my notes to glue into your notebook; use them as a guide to fill in your own notebook.*

Covering and Surrounding

Two Dimensional Measurement

You can describe the size of something in different ways. You can use words such as long, short, thin, or wide. Other words like big or small may also give a general description of size. When you want to be more specific, you can use numbers. Numbers require units of measurement, such as centimeters, square feet, or cubic inches.



All these questions involve size. In this Unit, you will learn mathematical ideas and techniques that can help you answer questions about size.

In this unit you will...

- ☐ Relate perimeter to surrounding a figure and area to covering a figure.
- ☐ Develop strategies for finding areas and perimeters of rectangles, parallelograms, and triangles.
- ☐ Investigate relationships between perimeter and area, including that one can vary while the other stays Same fixed.
- ☐ Use nets that are made from rectangles and triangles to find the surface area of prisms.
- ☐ Find the volume of rectangular prisms with fractional side lengths.
- ☐ Use perimeter, area, surface area, and volume to solve problems.

What do you already know about area and perimeter? ______________________

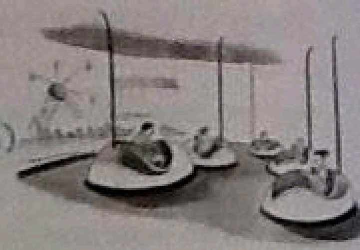
____

____

____

Date: 3·3·20

1.1 Designing Bumper Car Arenas

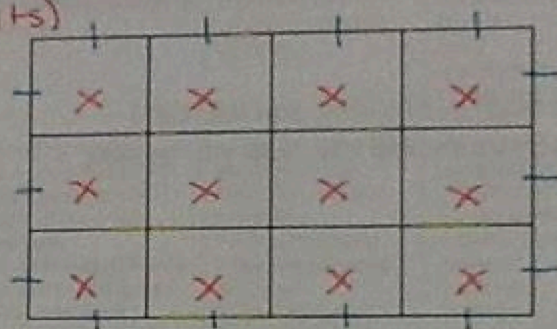


AREA
(covering)
The number of squares that fit inside a figure.

Area = 12 units^2 (square units)

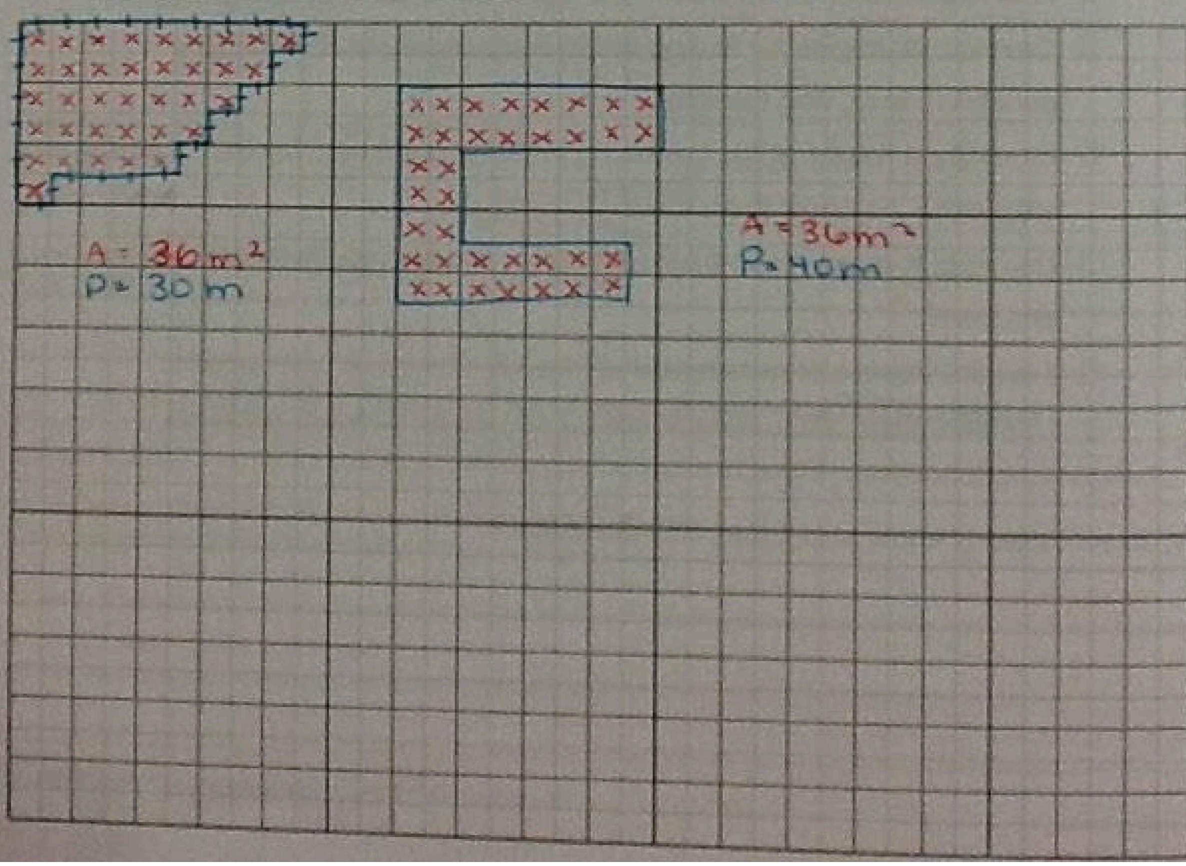
PERIMETER
(surrounding)
The distance (length) around a figure.

Perimeter = 14 units



TASK: Design various arenas with the following constraints:

- covers 36 square meters (area) fixed area
- has lots of rail sections (perimeter). different perimeters

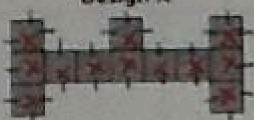


Complete the table for the following designs. Then answer the questions.

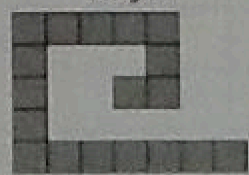
Bumper Car Floor Plans

Design	Area	Perimeter	Cost
A	$12m^2$	26m	\$1,010
B	$18m^2$	38m	
C	$12m^2$	18m	
D	$16m^2$	18m	

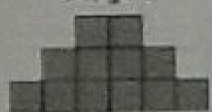
Design A



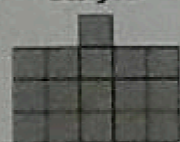
Design B



Design C



Design D



1. Which designs can be made from the same number of floor tiles? (area)

A and C

2. Do these all have the same number of rail sections? (perimeter)

No!

3. Find the total cost of each arena with the following costs. Show your work in the space below.

- \$25 per rail section perimeter
- \$30 per floor tile. area

What equation represents the total cost for one design?

$$C = (25 \cdot P) + (30 \cdot a)$$

(A) $C = (25 \cdot 26) + (30 \cdot 12)$

$= 650 + 360$

$C = \$1010$

$$\begin{array}{r} 25 \\ \times 26 \\ \hline 150 \\ +500 \\ \hline 650 \end{array} \qquad \begin{array}{r} 30 \\ \times 12 \\ \hline 60 \\ 300 \\ \hline 360 \end{array}$$

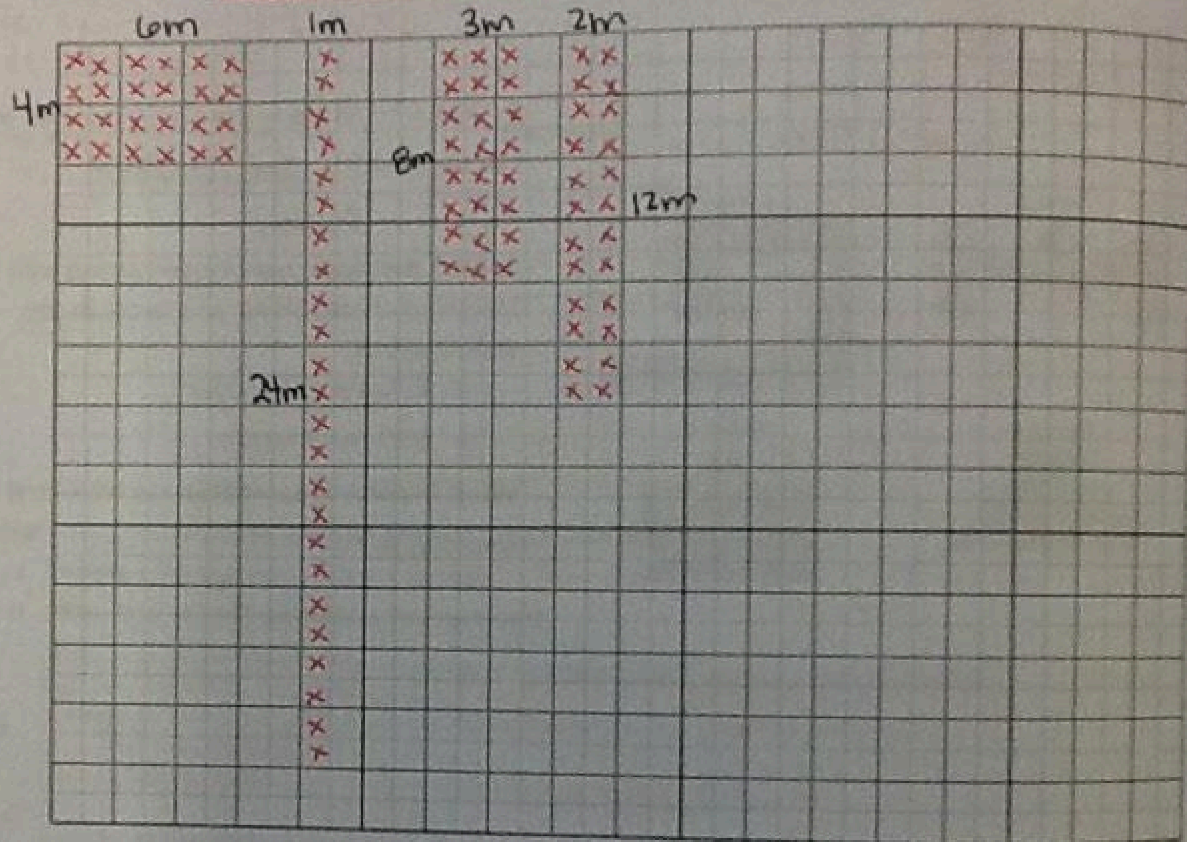
(B)

1.2 Building Storm Shelters

Date: 3·4·20

Task: Design a storm shelter with the following constraints.

- Must be rectangular
- Must have 24 square meters ($24\ m^2$) of floor space (area) fixed



Complete the table for the possible dimensions of your storm shelters.
*Don't forget to label!

Rectangle	Length	Width	Perimeter	Area
1m x 24m	1m	24m	50m	$24m^2$
2m x 12m	2m	12m	28m	$24m^2$
3m x 8m	3m	8m	22m	$24m^2$
4m x 6m	4m	6m	20m	$24m^2$

dimensions

All the factor pairs of 24!

Dimensions

measurements in each direction like length, width, height or depth.

RECTANGLE FORMULAS

AREA

Area = length × width

$A = l \cdot w$

PERIMETER

Perimeter = 2 × (length + width)

$P = 2(l + w)$

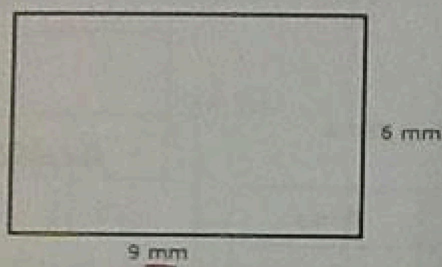
– OR –

$P = l + w + l + w$

You Try!

Always write the formula first!
Label appropriately

1)



AREA

$A = l \cdot w$

$= 9 \cdot 6$

$\boxed{A = 54 mm^2}$

PERIMETER

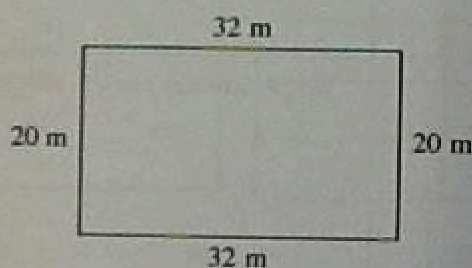
$P = 2(l + w)$

$2(9 + 6)$

$2(15)$

$\boxed{P = 30 mm}$

2)



$A = l \cdot w$

$= 32 \cdot 20$

$\boxed{A = 640 m^2}$

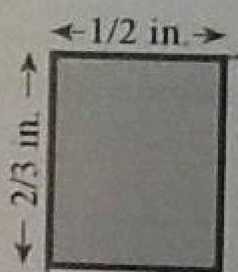
$P = 2(l + w)$

$2(32 + 20)$

$2(52)$

$\boxed{P = 104 m}$

3)



$A = l \cdot w$

$= \frac{\cancel{2}^{1}}{3} \cdot \frac{1}{\cancel{2}_{1}}$

$\boxed{A = \frac{1}{3} in^2}$

Extension: A rectangle has an area of $34 ft^2$. Its length is $5 ft$. What is its perimeter?

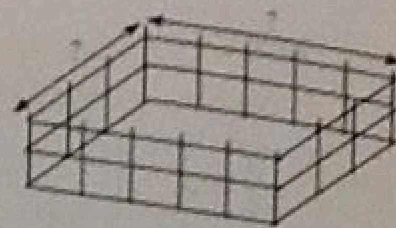
1.3 Fencing in Spaces

Date: 3·5·20

Task: Design a dog pen with the following constraints.

- Must be rectangular
- You only have 24 meters (24m) of fencing

(fixed perimeter)



REMINDER:

Perimeter = distance around

Area = # of square units inside

Complete the table for the possible dimensions of your dog pens.
*Don't forget to label!

Rectangle	Length	Width	Perimeter	Area
1m x 11m	1m	11m	24m	$11m^2$
2m x 10m	2m	10m	24m	$20m^2$
3m x 9m	3m	9m	24m	$27m^2$
4m x 8m	4m	8m	24m	$32m^2$
5m x 7m	5m	7m	24m	$35m^2$
6m x 6m	6m	6m	24m	$36m^2$

Strategies

- l+w should equal 12
- *12 is half of the perimeter
- Start with 1
- 1 + □ = half the perimeter

1) Which dimensions give the largest area for the dogs?

6m x 6m

2) Which dimensions would give the smallest area for the dogs?

1m x 11m

3) Analyze the table: If you need 5 square meters per small dog, which enclosure will fit the most small dogs? How many dogs will fit?

$5m \times 7m = 35m^2$ - or - $6m \times 6m = 36m^2$

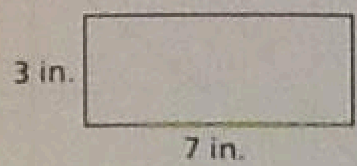
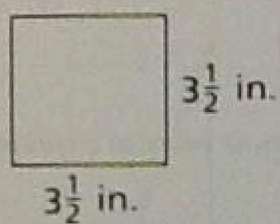
$35m^2 \div 5m^2 =$ $\boxed{7 \text{ dogs}}$

$36m^2 \div 5m^2$ $\boxed{7 \text{ dogs}}$ with $1m^2$ of extra space

$36 \div 5 = 7$, $36 - 35 = 1$

Area and Perimeter of Rectangles Practice.

- **Always write the formula first!**
- **Label appropriately**

Rectangle	**Area**	**Perimeter**
	$A = l \cdot w$	$P = 2(l + w)$
	$A = l \cdot w$ $= 3\frac{1}{2} \cdot 3\frac{1}{2}$ $= \frac{7}{2} \cdot \frac{7}{2}$ $= \frac{49}{4}$ OR $\boxed{12\frac{1}{4} in^2}$	$P = 2(l + w)$ $2(3\frac{1}{2} + 3\frac{1}{2})$ $2(7)$ $\boxed{P = 14 in}$
length : 25cm; width: 8cm	$A = l \cdot w$	$P = 2(l + w)$
Length: $6\frac{1}{4}cm$ **; width:** $4\frac{4}{9}cm$	$A = l \cdot w$	$P = 2(l + w)$

Find the dimensions of all the possible rectangles that have a perimeter of 16in. Record the length, width, area, and perimeter in a table.

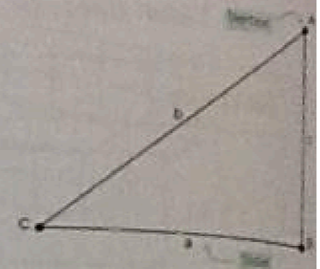
length	width	perimeter	area
1in	7in	16in	
2in	6in	16in	
3in	5in	16in	
4in	4in	16in	
		16in	

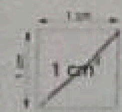
Explain how you made sure you did not miss any dimensions:

2.1 Exploring Area of Triangles

Date: 3·10·20

In investigation 1, you studied rectangles and other figures that are examples of polygons. A **polygon** is a shape composed of line segments, called *sides* that are joined together. A **vertex** (plural *vertices*) of a polygon is where two sides of the polygon meet.





Square centimeter
(cm^2)

Above is a square centimeter. Draw one diagonal in the square to find two triangles.

- What is the area of each triangle? $\frac{1}{2}$ cm^2
- Is the perimeter of each of the triangles greater than, less than, or equal to 3 centimeters? Explain your thinking. The perimeter is greater than 3cm because the diagonal is longer than 1cm.

Part 1: On the next page, six triangles labeled A-F are drawn on a centimeter grid. Find the area (to the nearest cm^2) of each triangle. Record the data in the table below.

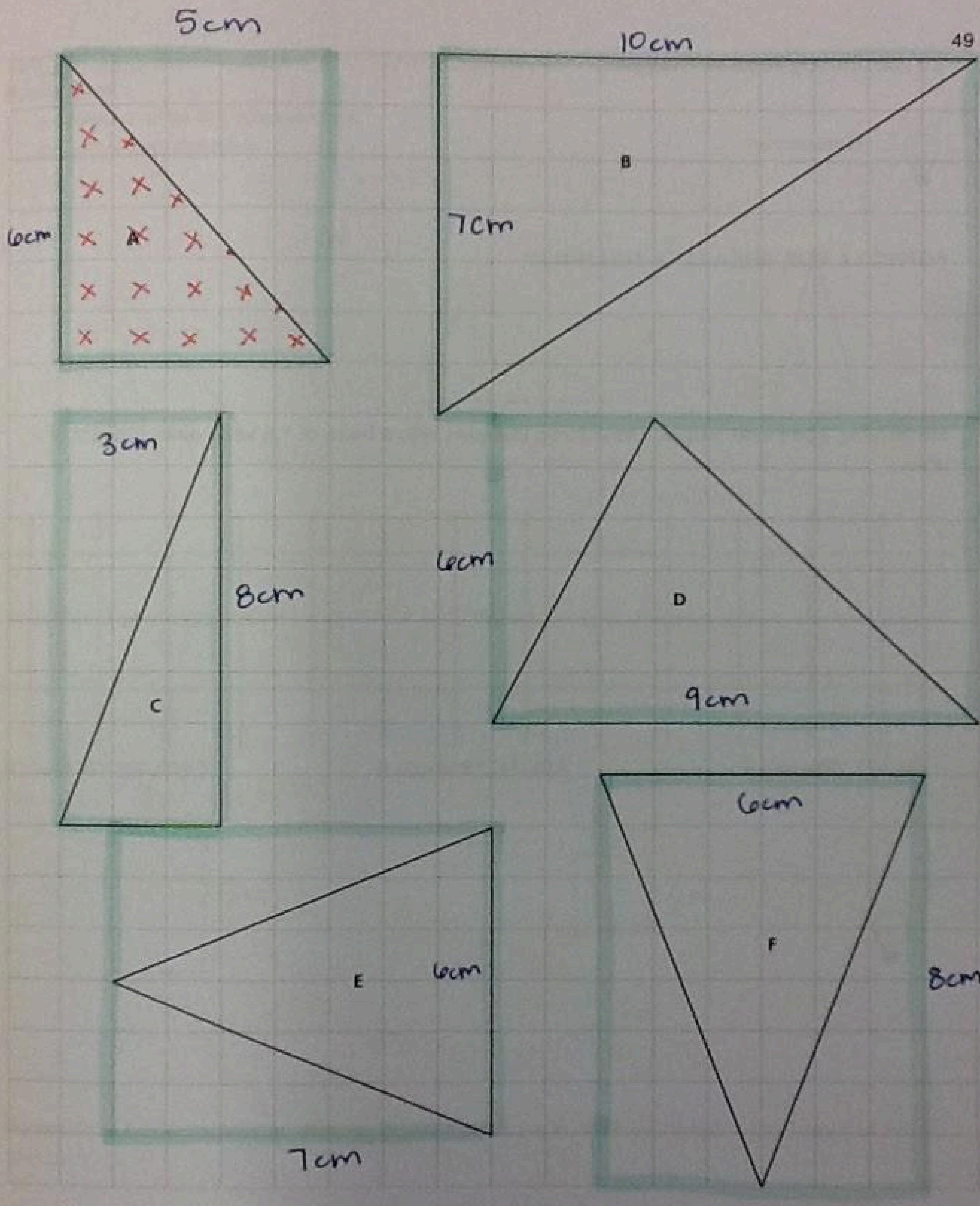
Figure	Part 1: Approximate Area of Triangle (cm^2)	Part 2: Area of smallest rectangle surrounding triangle (cm^2)
A	(15cm²) ~ 16cm²	30cm²
B	(35cm²) ~ 34 cm²	70cm²
C	12 cm²	24cm²
D	27 cm²	54 cm²
E	(21cm²) 19 cm²	42 cm²
F	24 cm²	48cm²

Part 2: Use the grid lines to draw the smallest possible rectangle around each triangle.

1. Compare the area of the rectangle to the area of the triangle. Describe a pattern that tells how the two are related. The area of the triangle is half the area of a rectangle.

2. Use your results from question 1 to write a formula to find the area of any triangle.
$A = (l \cdot w) \div 2$ -OR- $A = \frac{l \cdot w}{2}$

Extension: Use your formula to find the area of a triangle with a base of 8 inches and a height of 3 ½ inches.


5cm
6cm
A
10cm
B
7cm
3cm
8cm
C
6cm
D
9cm
6cm
F
8cm
E
6cm
7cm

2.2 Calculating Area of Triangles

Date: 3·11·20

Remember: The area of a triangle is HALF the area of the smallest rectangle surrounding it.

FORMULA FOR AREA OF A TRIANGLE:

Area $= \frac{1}{2}$ (base · height)

$A = \frac{1}{2}(b \cdot h)$

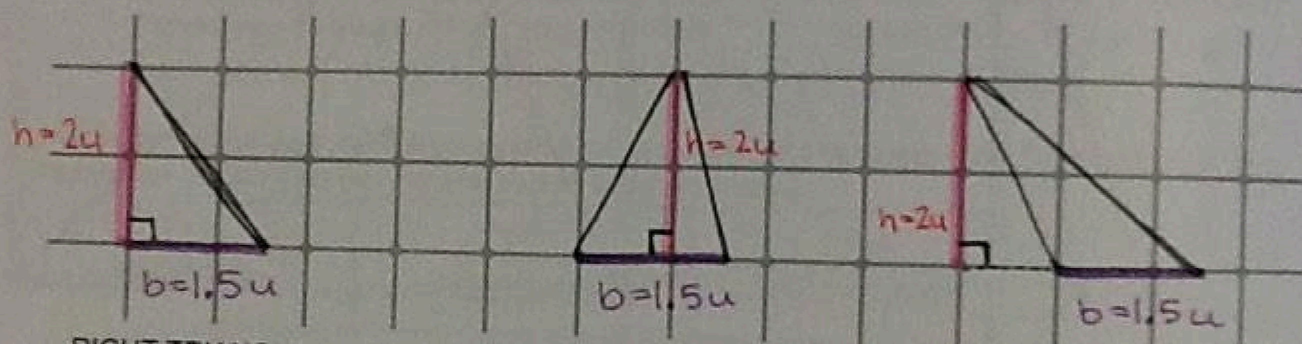
* use with fractions

OR

Area = (base · height) ÷ 2

$A = \frac{b \cdot h}{2}$

Identifying base and height. Draw three triangles with a base of 1.5 units, and a height of 2 units.



RIGHT TRIANGLE

* height is one side of triangle

ACUTE TRIANGLE

* height is inside triangle

OBTUSE TRIANGLE

* height is outside triangle

The height (h) is always perpendicular (at a 90° angle) to the base (b).

$A = \frac{b \cdot h}{2}$

$= \frac{1.5 \cdot \cancel{2}}{\cancel{2}}$

$\boxed{A = 1.5 \text{ units}^2}$

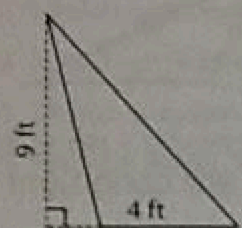
* same for all 3 triangles!

You Try: Calculate the <u>AREA</u> of the following figures.

Remember:

- Always write the formula first!
- Label appropriately

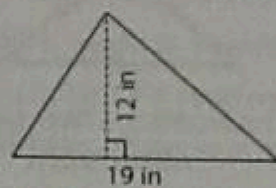
1)



$A = \frac{b \cdot h}{2}$

$\frac{{}^{2}\cancel{4} \cdot 9}{\cancel{2}_{1}} = \boxed{18 ft^2}$

2)

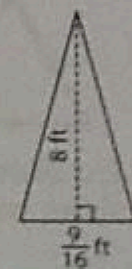


$A = \frac{b \cdot h}{2}$

$\frac{19 \cdot \cancel{12}^{6}}{{}_{1}\cancel{2}} = \begin{array}{r} {}^{5}19 \\ \times 6 \end{array}$

$\boxed{114 in^2}$

3)



$A = \frac{1}{2}(b \cdot h)$

$\frac{1}{2}\left(\frac{9}{\cancel{16}_{2}} \cdot \frac{\cancel{8}^{1}}{1}\right)$

$\frac{1}{2}\left(\frac{9}{2}\right)$

$\frac{9}{4}$ or $\boxed{2\frac{1}{4} ft^2}$

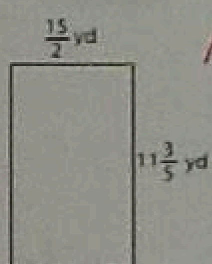
4) base = 3 yd, height = 8 yd

$A = \frac{b \cdot h}{2}$

5) base = $3\frac{3}{4}$ in, height = $\frac{2}{5}$ in

$A = \frac{1}{2}(b \cdot h)$

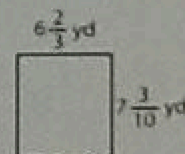
6)



$A = l \cdot w$

7)

$A = l \cdot w$



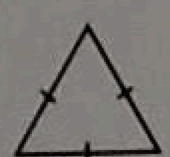
Extension: A triangle has an area of 192 yd^2 and a base of 12 yd. What is the height of the triangle?

Date: 3·12·20

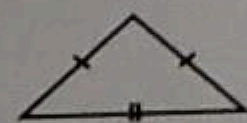
2.3 Calculating Perimeter of Triangles

$P = S_1 + S_2 + S_3$

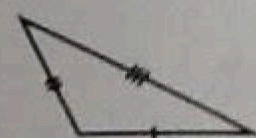
Classifying Triangles by their Sides



Equilateral - all sides congruent
(the same)



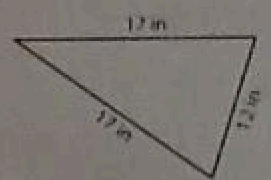
Isosceles - two sides congruent
same odd same



Scalene - no sides are congruent
leans

Classify the following triangles according to their sides. Then find the perimeter.

1) Isosceles



$P = S + S + S$

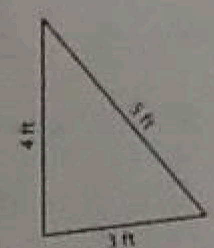
$17 + 17 + 12$

Perimeter = ______

$34 + 12$

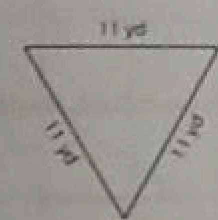
$\boxed{P = 46 \text{ in}}$

2)



Perimeter = ______

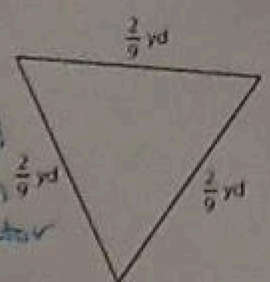
3)



Perimeter = ______

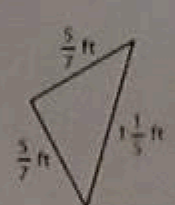
4)

You need a common denominator to add fractions!



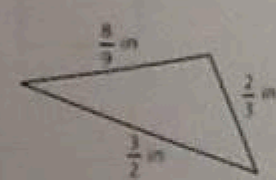
Perimeter =

5)



Perimeter =

6)



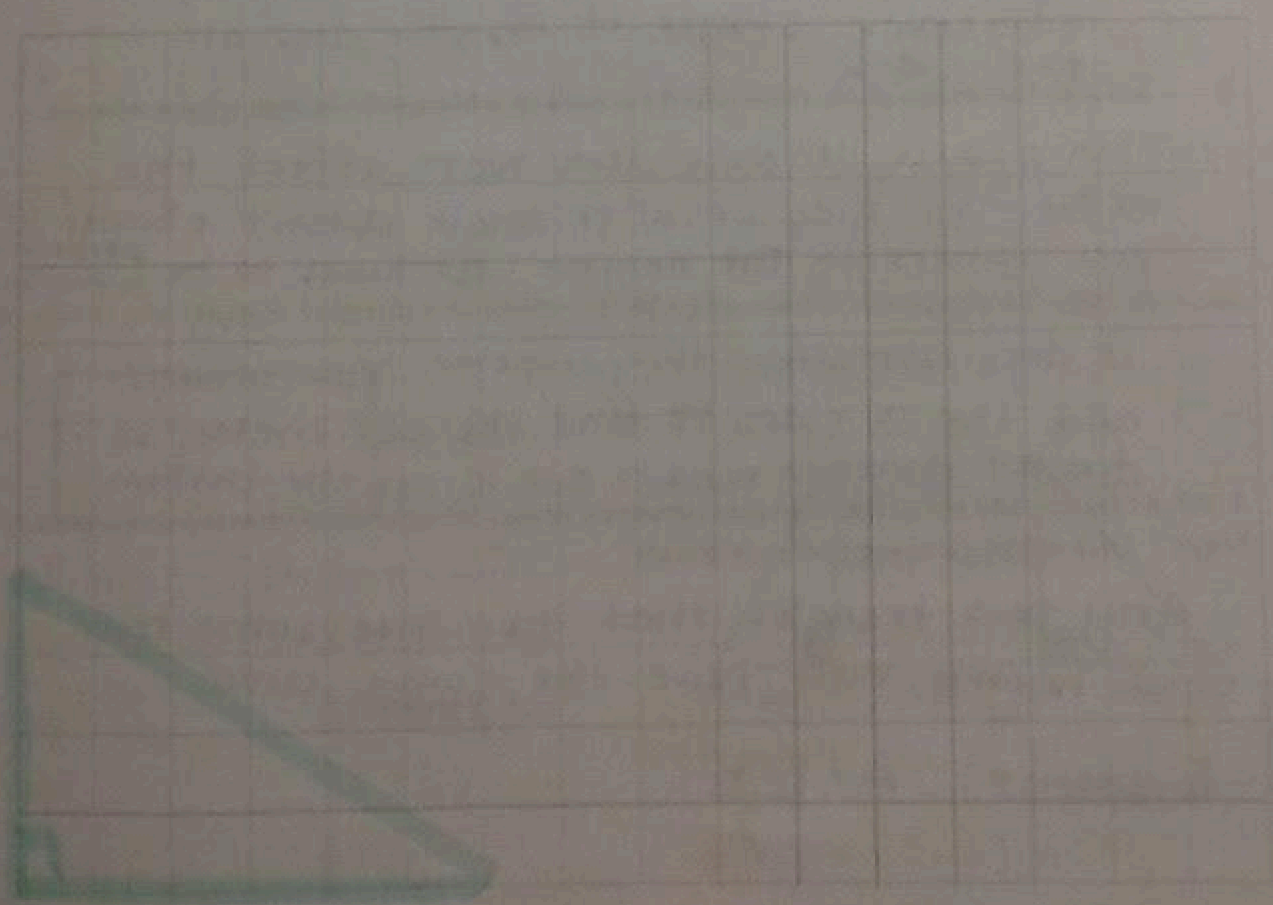
Perimeter =

The word *family* can be used to describe relationships among objects. In this Problem, you will make a triangle family on a coordinate grid.

For each triangle in Question A, draw a segment **6 centimeters long** on the grid paper. Use the segment as a **base** for the triangle.

A)
1. Sketch a right triangle with a height of 4 centimeters.
2. Sketch a different right triangle with a height of 4 centimeters.
3. Sketch an isosceles triangle with a height of 4 centimeters.
4. Sketch a scalene triangle with a height of 4 centimeters.
5. Find the areas of these four triangles. Show your work.

6. What do you notice about their areas?
7. Why do you think these four triangles can be called a triangle family?



Mathematical Reflections and Review

Date: 3.17.20

1. a. Describe how to find the area of a triangle.

Since triangles are half of a rectangle or parallelogram, you just multiply the base and height and divide by 2.

b. Explain why your method works.

Triangles are half the area of the smallest rectangle that surrounds them.

2. a. Describe how to find the perimeter of a triangle.

Add the lengths of all 3 sides.

b. Explain why your method works.

Perimeter is the distance <u>around</u>, so whatever shape it is, you add all the sides.

3. a. Does the choice of the base affect the area of a triangle? Explain why or why not.

The choice of base does NOT affect the area. The side of a triangle doesn't change if you rotate it. The height just needs to be perpendicular to the base

b. Does the choice of the base affect the perimeter of a triangle? Explain why or why not.

It does NOT affect the perimeter. You always add the 3 sides to find the perimeter, so it doesn't matter which one is on the bottom.

4. What can you say about the area and perimeter of two triangles that have the same base and height? Give evidence to support your answer.

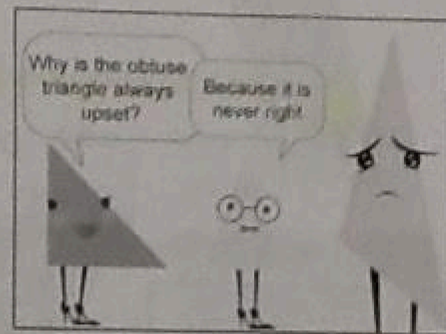
Any two trangles that have the same base and height will have the <u>same</u> area.

Evidence: $A = \frac{b \cdot h}{2}$

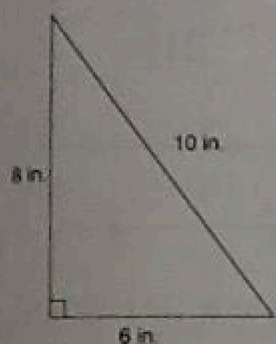
Find the **AREA** and **PERIMETER** of figures 1-3 below.

Remember:

- **Always write the formula first!**
- **Label appropriately**



1.



$A = \frac{b \cdot h}{2}$

$\frac{3\cancel{6} \cdot 8}{\cancel{2}_1}$

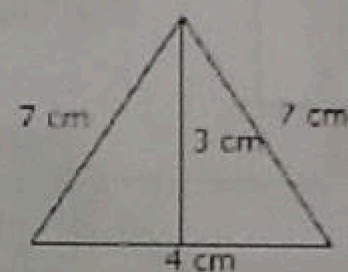
$\boxed{A = 24 in^2}$

$P = s + s + s$

$= 6 + 8 + 10$

$\boxed{P = 24in}$

2.



$A = \frac{b \cdot h}{2}$

$\frac{2\cancel{4} \cdot 3}{\cancel{2}_1}$

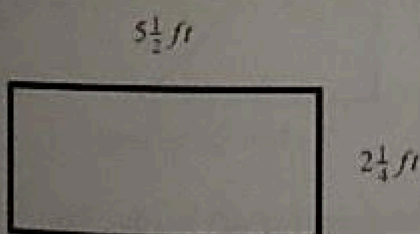
$\boxed{A = 6cm^2}$

$P = s + s + s$

$= 4 + 7 + 7$

$\boxed{P = 18cm}$

3.



$A = l\, w$

$= 5\frac{1}{2} \cdot 2\frac{1}{4}$

$= \frac{11}{2} \cdot \frac{9}{4}$

$= \frac{99}{8}$

$\boxed{A = 12\frac{3}{8} ft^2}$

$P = 2(l + w)$

$2(5\frac{1}{2} + 2\frac{1}{4})$

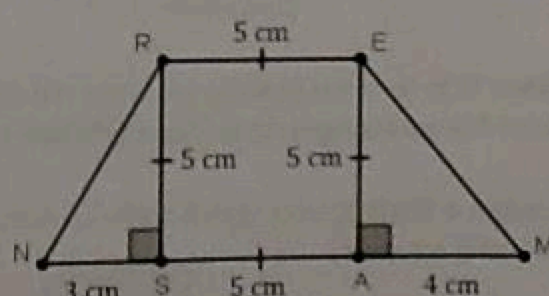
$2(5\frac{2}{4} + 2\frac{1}{4})$

$2(7\frac{3}{4})$

$\frac{\cancel{2}}{1}\left(\frac{31}{\cancel{4}_2}\right)$

$P = \frac{31}{2}$ or $\boxed{15\frac{1}{2} ft}$

4. Find the area of the trapezoid. Write formulas to support your answer



$A = \left(\frac{b \cdot h}{2}\right) + (l \cdot w) + \left(\frac{b \cdot h}{2}\right)$

$\left(\frac{3 \cdot 5}{2}\right) + (5 \cdot 5) + \left(\frac{4 \cdot 5}{2}\right)$

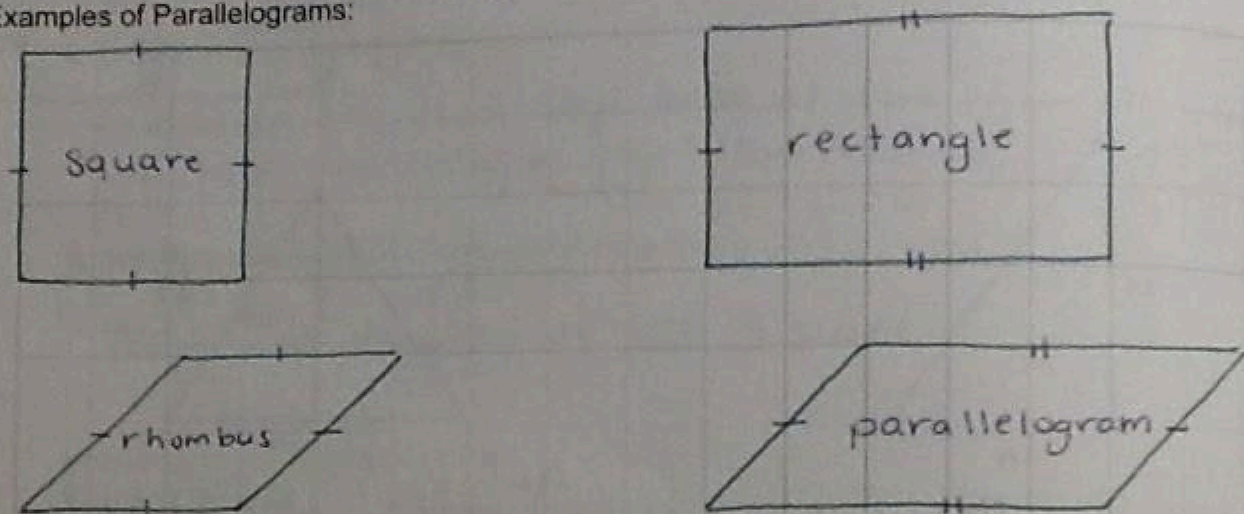
$7\frac{1}{2} + 25 + 10 = \boxed{42\frac{1}{2} cm^2}$

3.1 Exploring Area of Parallelograms

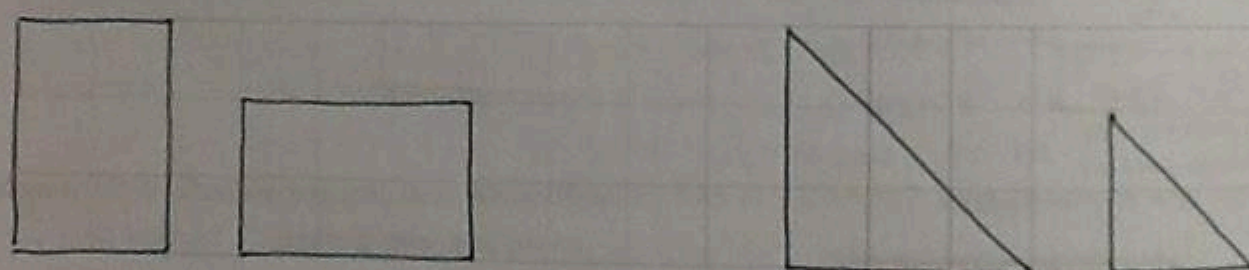
Date: 3·19·20

PARALLELOGRAMS- A four sided figure with two sets of parallel sides that are the same length. like train tracks

Examples of Parallelograms:



CONGRUENT- same shape and size



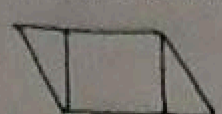
Congruent

Not Congruent

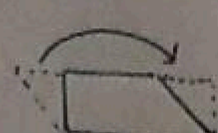
Task: With your lab groups, calculate the area of the parallelograms given to you. Feel free to cut apart the parallelograms to make different shapes you can calculate the area of.

Explain a strategy your group came up with for calculating the area of a parallelogram (without counting squares).

* possible strategies



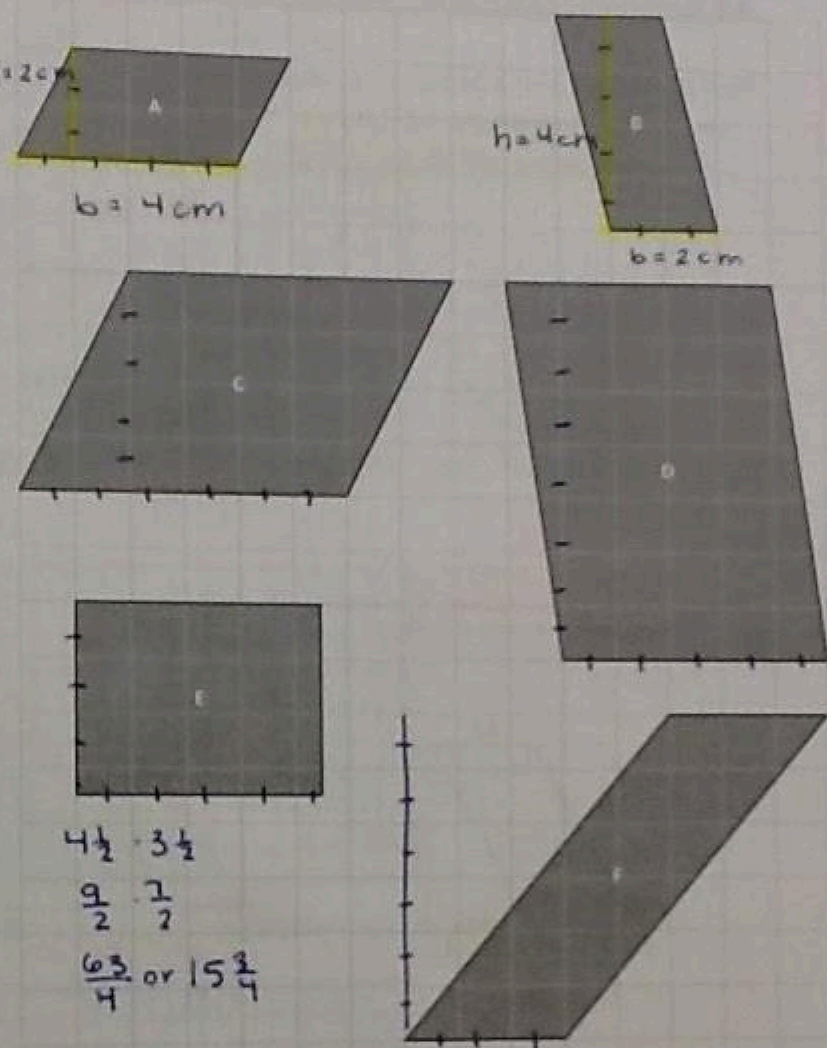
* find area of two triangles and rectangle and add together



* cut off one triangle and move to create a rectangle. Find area of rectangle

A) For each parallelogram, use a strategy you came up with your group to determine the area of the following rectangles. Record the base, height, and area in the table.

	base	height	area
A	4cm	2cm	$8cm^2$
B	2cm	4cm	$8cm^2$
C	6cm	4cm	$24cm^2$
D	5cm	7cm	$35cm^2$
E	$4\frac{1}{2}$cm	$3\frac{1}{2}$cm	$15\frac{3}{4}cm^2$
F	3cm	6cm	$18cm^2$



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

$\frac{9}{2} \cdot \frac{7}{2}$

$\frac{63}{4}$ or $15\frac{3}{4}$

a) Describe any patterns you see in the data.

The area is the product of the base and height.

b) Write a **FORMULA for the area of a parallelogram** based on this pattern.

Area = base × height

$A = b \cdot h$

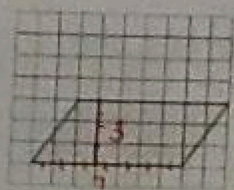
3.2 Parallelograms with Constraints

Date: 3-20-20

Find the **AREA** of the following parallelograms.

- Write the **formula** each time
- **Label** your answers appropriately

1.

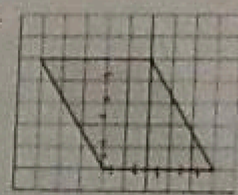


$A = b \cdot h$

$= 7 \cdot 3$

$\boxed{A = 21 \text{ units}^2}$

2.

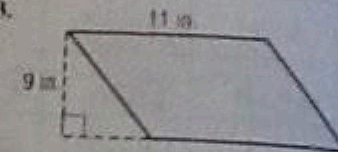


$A = b \cdot h$

$5 \cdot 5$

$\boxed{A = 25 \text{ units}^2}$

3.

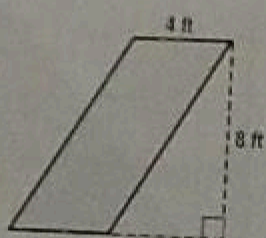


$A = b \cdot h$

$11 \cdot 9$

$\boxed{A = 99 \text{ in}^2}$

4.

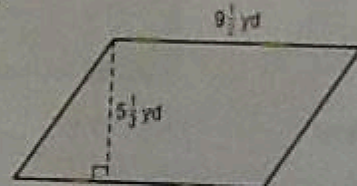


$A = b \cdot h$

$4 \cdot 8$

$\boxed{A = 32 \text{ ft}^2}$

5.



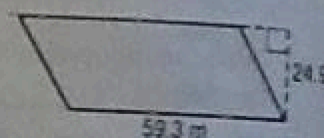
$A = b \cdot h$

$9\frac{1}{2} \cdot 5\frac{1}{3}$

$\frac{19}{2} \cdot \frac{16}{3}$

$\frac{152}{3}$ or $\boxed{50\frac{2}{3} \text{ yd}^2}$

6.



$A = b \cdot h$

59.3

$\times 24.9$

5337

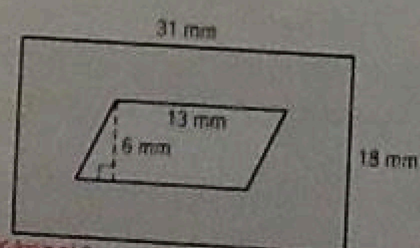
23720

118600

$\boxed{1476.57 \text{ m}^2}$

***Extension**: Find the area of the shaded region of each figure

7.



rectangle parallelogram

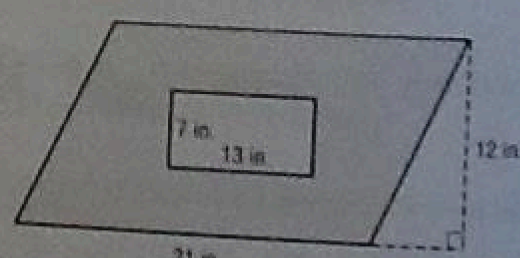
$A = (l \cdot w) - (b \cdot h)$

$(18 \cdot 31) - (13 \cdot 6)$

$558 - 96$

$\boxed{A = 462 \text{ mm}^2}$

8.



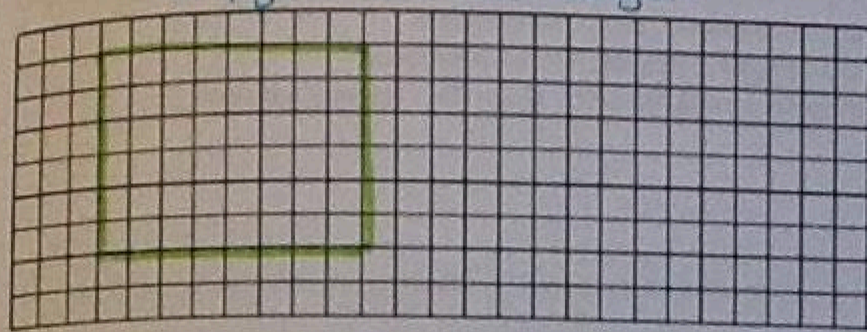
$A = (b \cdot h) - (l \cdot w)$

$(21 \cdot 12) - (13 \cdot 7)$

$252 - 91$

$\boxed{A = 161 \text{ in}^2}$

1. Draw a rectangle with a **base** of 8 centimeters and a **perimeter** of 28 centimeters. Then find the area. *look at page 46 for a hint for how to figure out the height

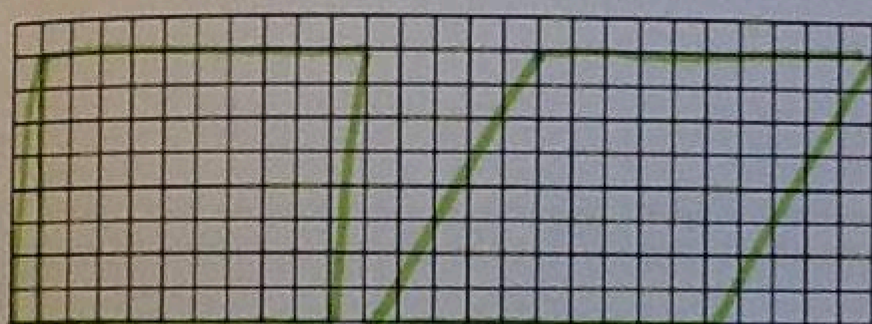


$A = b \cdot h$

$8 \cdot 6$

$\boxed{A = 48 cm^2}$

2. Draw a non rectangular parallelogram with a **base** of 10 centimeters and a **height** of 8 centimeters. Then find the area.

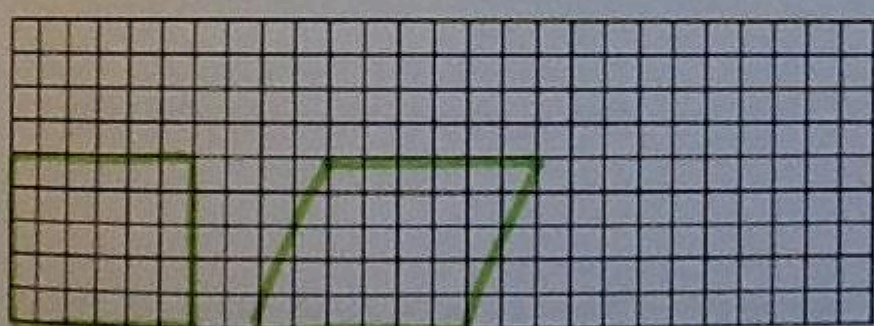


$A = b \cdot h$

$10 \cdot 8$

$\boxed{A = 80 cm^2}$

3. Draw two different parallelograms with a **base** of 6 centimeters and an **area** of 30 cm^2.



$A = b \cdot h$

$\frac{30}{6} = \frac{\cancel{6} \cdot h}{\cancel{6}}$

$\boxed{5_{cm} = h}$

*solve to find the height

4. Draw two different triangles with a **base** of 8 centimeters and an **area** of 32 cm^2

$A = \frac{b \cdot h}{2}$

$32 = \frac{\overset{4}{\cancel{8}} \cdot h}{\cancel{2}_1}$

$\frac{32}{4} = \frac{4h}{4}$

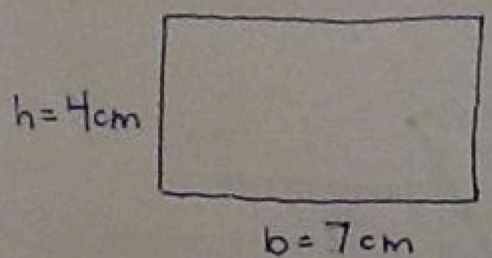
$\boxed{8_{cm} = h}$

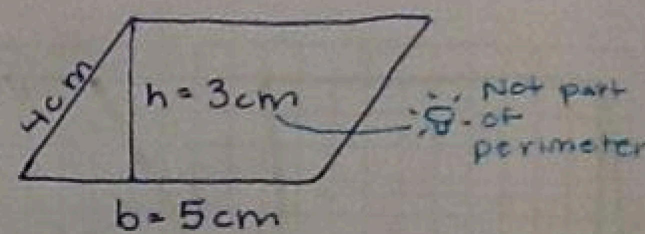
3.3 Formula Review Date: 3·23·20

In the space below, make your own notes to summarize the following information:

- **Area** formulas for rectangles, triangles, and parallelograms
- **Perimeter** formulas for rectangles, triangles, and parallelograms
- Show examples of each (you can use the same shape for area and perimeter)

* Remember, a rectangle is a type of parallelogram, so we can use the same formulas for both.





$A = b \cdot h$

$7 \cdot 4$

$\boxed{A = 28cm^2}$

$P = 2(l + w)$

$2(4+7)$

$2(11)$

$\boxed{P = 22cm}$

$A = b \cdot h$

$5 \cdot 3$

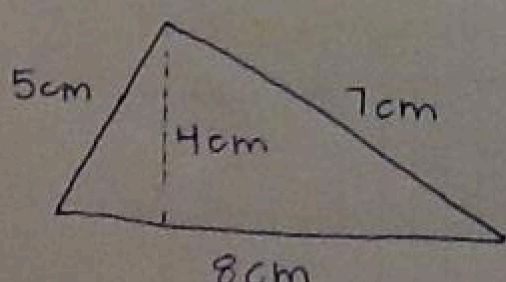
$\boxed{A = 15cm^2}$

$P = s + s + s + s$

$\underbrace{4+5}_{9} + \underbrace{4+5}_{9}$

$\boxed{P = 18cm}$

* Remember the area of a triangle is HALF that of the smallest rectangle that surrounds it.



$A = \frac{b \cdot h}{2}$ or $A = \frac{1}{2}(b \cdot h)$

$\frac{8 \cdot \cancel{4}^{2}}{{}_{1}\cancel{2}}$

$\boxed{A = 16cm^2}$

$\frac{1}{2}(8 \cdot 4)$

$\frac{1}{\cancel{2}_{1}} \cdot \frac{\cancel{32}^{16}}{1}$

$\boxed{A = 16cm^2}$

$P = s + s + s$

$5 + 7 + 8$

$\boxed{P = 20cm}$

Remember, when solving for a variable, use inverse operations to get the variable by itself.

1. The area of a rectangle is 68 feet squared. The length of the rectangle is 4 feet. What is the width of the rectangle? Use the formula and/or a diagram to help you solve.

$A = l \cdot w$

$\frac{68}{4} = \frac{\cancel{4} \cdot w}{\cancel{4}}$ * divide each side by 4 to get the variable by itself

$\boxed{17ft = w}$

2. The area of a triangle is 18 cm squared. The base of the triangle is 3 cm. What is the height of the triangle?
Use the formula and/or a diagram to help you solve.

$A = \frac{b \cdot h}{2}$

$2 \times 18 = \frac{3 \cdot h}{\cancel{2}} \cancel{\times 2}$

$\frac{36}{3} = \frac{\cancel{3} \cdot h}{\cancel{3}}$

$\boxed{12cm = h}$

3. Rapid City is having its annual citywide celebration. The city wants to rent a bumper-car ride. The pieces used to make the floor are 4 foot-by-5-foot rectangles. The ride covers a rectangular space that is 40 feet by 120 feet. - dimensions

a. What is the area of one piece?

$A = l \cdot w$

$4 \cdot 5$

$\boxed{A = 20ft^2}$

b. What is the area of the entire bumper car ride?

$A = l \cdot w$

$40 \cdot 120$

$\boxed{A = 4800 ft^2}$

c. How many rectangular floor pieces are needed to make the entire ride?

Area of entire ride ÷ Area of one piece

$4800 \div 20 = 240$

-40

80

$\boxed{\text{240 floor pieces}}$

4. Mr. Lee wants to install ceiling tiles in his recreation room. The room is a rectangle and measures 24 feet by 18 feet. Each ceiling tile is 2 feet by 3 feet. How many ceiling tiles will Mr. Lee need? (Use the same steps as you did for number 3 above).

tile

$A = l \cdot w$

$2 \; 3$

$A = 6ft^2$

room

$A = l \cdot w$

24
$\times 18$
192
$+240$

$432 \div 6 = 72$

-42

12

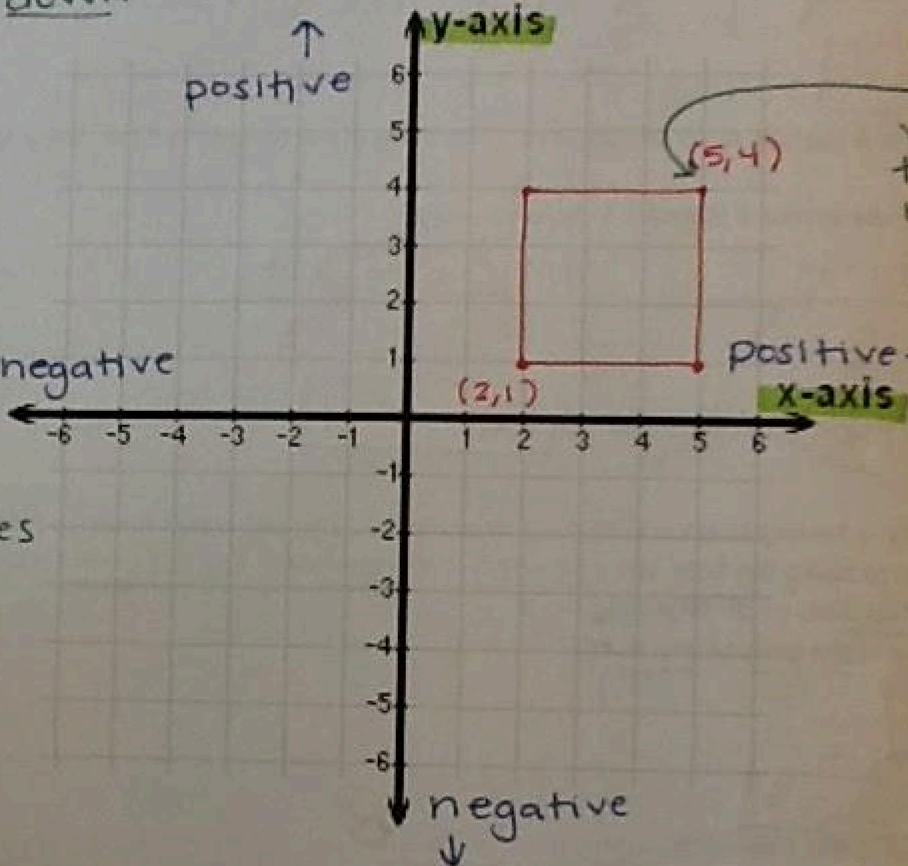
$\boxed{\text{He will need 72 ceiling tiles}}$

3.4 Polygons on a Coordinate Grid

Date: 3·24·20

Coordinates- (x, y) values on a coordinate grid

tip - go over to the elevator first, then go up or down



Vertex- where two lines meet

Origin- (0,0) where the x-axis crosses the y-axis

Coordinates of a Square - determine the missing x-values * draw above

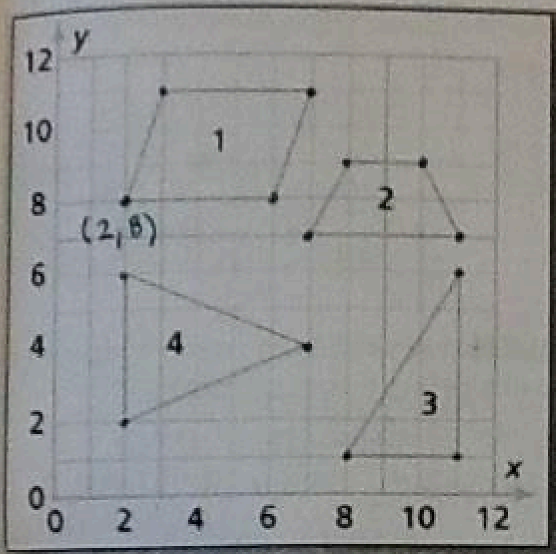
(2 , 1) (5,1) (5 , 4) (2, 4)

Same y-values 3 units away, so x-values should also be 3 units away

Dimensions of Square 3 x 3

:B- Your coordinates don't have to be in the same order

The midway Amusement Rides Company (MARS) is working on new polygon designs for bumper-car floor plans. They use a computer program that places the polygons on a coordinate grid.



(A) The diagram shows four polygons on a coordinate grid. specifically name the polygon (i.e. acute triangle, not just triangle) and find the coordinates of each.

1. Type of polygon: parallelogram

Coordinates: (2,8)(6,8)(3,11)(7,11)

2. Type of polygon: trapezoid

Coordinates: (7,7)(11,7)(8,9)(10,9)

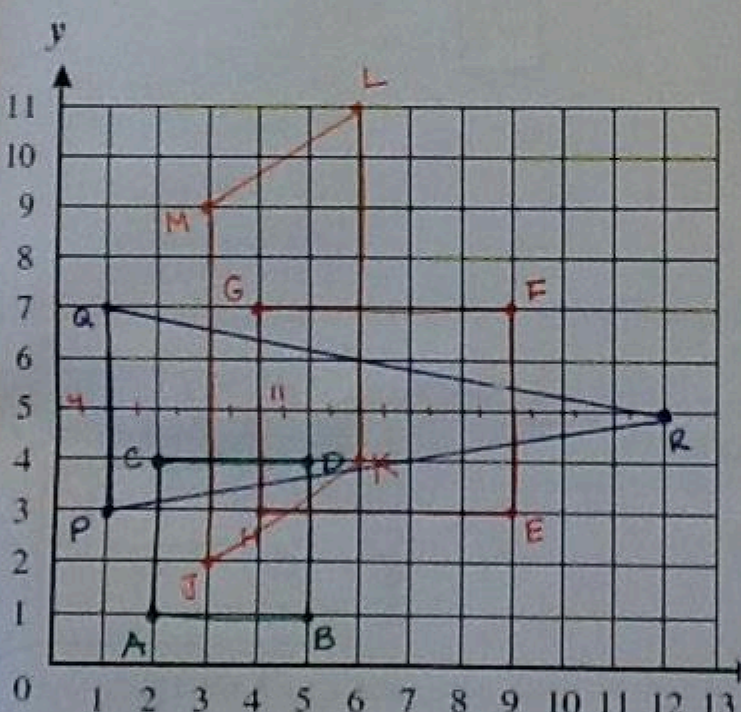
3. Type of polygon: right, scalene triangle

Coordinates: (8,1)(11,1)(11,6)

4. Type of polygon: acute, isosceles triangle

Coordinates: (2,2)(2,6)(7,4)

(B) For each polygon listed in Question B, follow the steps below.
- Find all of the missing coordinates of the vertices of the polygon.
- Draw the polygon on a coordinate grid. *Use a different color for each shape!
- Find the area of the polygon. *Start with the formula



1. A **square** with vertices A(2,1), B(5,1), C(2,4), and D(5,4).
Area= $l \cdot w$
$3 \cdot 3$
$\boxed{A = 9 \text{ units}^2}$

2. An **isosceles triangle** with vertices P(1,3), Q(1,7), and R(12,5) — remember the height is at the center of the triangle
Area= $\frac{b \cdot h}{2}$
$2 \frac{4 \cdot 11}{2}$ $\boxed{A = 22 \text{ units}^2}$

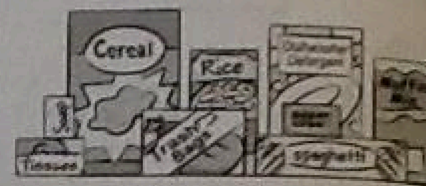
3. A **rectangle** with vertices E(9,3), F(9,7), G(4,7), and H(4,3).
Area= $l \cdot w$
$5 \cdot 4$
$\boxed{A = 20 \text{ units}^2}$

4. A **parallelogram** with vertices J(3,2), K(6,4), L(6,11), and M(3,9).
Area= $b \cdot h$
$7 \cdot 3$
$\boxed{A = 21 \text{ units}^2}$

4.1 Making Rectangular Boxes: Finding Surface Area **Date:** 3·26·20

The most common type of package is the rectangular box. Rectangular boxes hold everything from cereal to shoes to pizza to paper clips. Most rectangular boxes begin as flat sheets of cardboard, which are cut and then folded into a box shape.

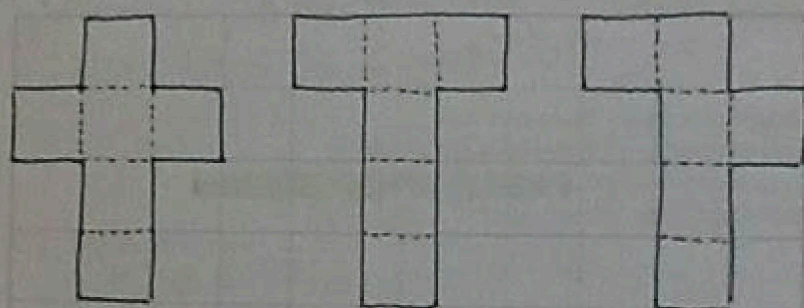
Amy is a packaging engineer at the Save-a-Tree packaging company. Mr. Shu asks Amy to his class and explain her job to his students. She gives the class some tasks to design rectangular boxes.



A) On the grid paper below, draw at least three different **nets** that will fold into a box shaped like a **unit cube**.

* like dice
1 × 1 × 1

a pattern that you can cut out and fold to make a solid shape; from 2-D to 3-D

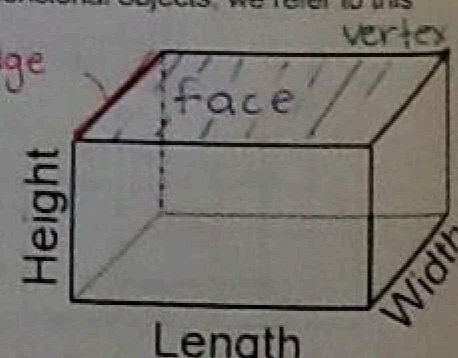


1. What is the total **area** of each net, in square units? For 3-dimensional objects, we refer to this as the Surface Area.

the total area of all the faces of a 3-D figure

3-dimensional

length × width × height
(l) (w) (h)

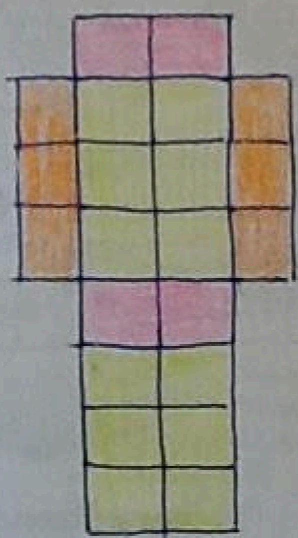


6 faces
12 edges

B) An engineer at the Save-a-Tree packaging company drew nets for boxes. Use the net your teacher gives you to do the following:

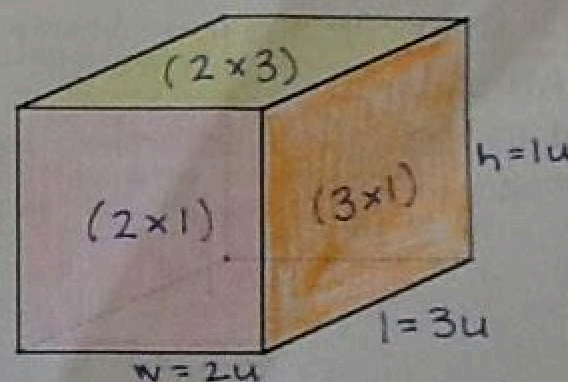
1. Draw in the fold lines.
2. Cut out the pattern and fold it to form a box.
3. Color each pair of opposite faces the same color
4. Then glue it down flat in the space below so that all faces are showing.

Draw and color example shown.



1. What are the dimensions of your box? 2u × 3u × 1u

*label the dimensions on the rectangular prism below, and then color the corresponding faces to match the net on the left.



2. How are the dimensions of the box related to the dimensions of its faces?

They form the length, width, and height.

3. What is the surface area of the box? Write out the **formula** with you teacher, then solve.

Find the area of each face and add them.

$2(2\times3)+2(3\times1)+2(2\times1)$

$2(6)+2(3)+2(2)$

$12+6+4=\boxed{22u^2}$

4. How would the formula differ if you were finding the surface area of a cube?

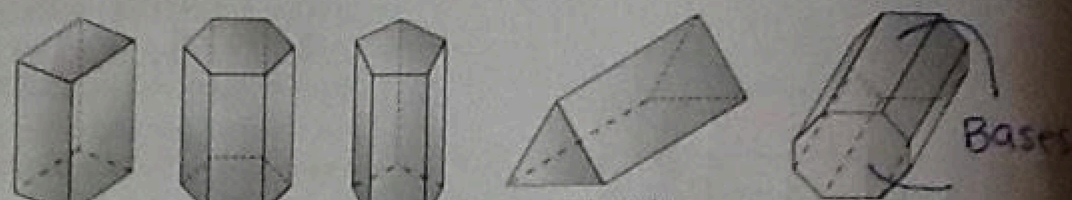
You could find the area of one face and then multiply it by 6.

Date: 3-27-20

4.2 Designing Gift Boxes - Finding Surface Area of Different 3-Dimensional Shapes

PRISM
- 2 Bases
- All other faces are rectangles

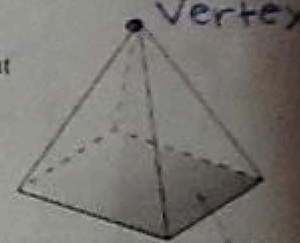
A **prism** is named for the shape of its base—triangular, rectangular, pentagonal, hexagonal, etc. You can draw a net that will fold up to a three-dimensional figure for every kind of prism. Drawing these nets will help you to find the surface area of nonrectangular prisms.



rectangular prism | hexagonal prism | pentagonal prism | triangular prism | octagonal prism

PYRAMID
- 1 Base
- All other faces are triangles

A **pyramid** is a three-dimensional shape with one base that can be any polygon. The lateral sides of a pyramid are triangles that meet at a vertex opposite the base.



*rectangular pyramid

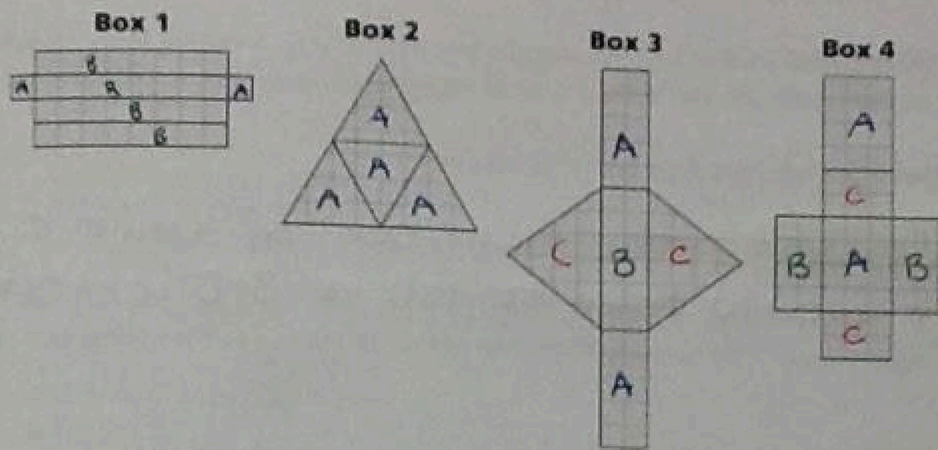
The Save-a-Tree packaging company is sponsoring a contest for students to design gift boxes. Each school submits two designs along with the amount of material required for those designs.

Save-a-Tree Contest Rules

- Each design will be a net that can be folded into a closed box.
- The faces of each box will be either rectangles or triangles.
- Designs may include shapes other than rectangular prisms.

faces that are the same.

Star Middle School has designed the following nets for the contest.



A) Fill out the following table of information for each of the boxes above:

	Box 1	Box 2	Box 3	Box 4
Shape Name	Rectangular Prism	Triangular Pyramid	Triangular Prism	Rectangular Prism
Dimensions of different faces	rectangle A $l=1, w=1$ rectangle B $l=1, w=8$	triangle A $b=4, h=3\frac{1}{2}$ 4 triangles	Rectangle A $l=2, w=5$ Rectangle B $l=2, w=6$ Triangle C $b=6, h=4$	rectangle A $l=4, w=3$ rectangle B $l=4, w=2$ rectangle C $l=2, w=3$
Surface Area	$2(1\cdot1)+4(1\cdot8)$ $2(1)+4(8)$ $2+32$ $\boxed{34\text{units}^2}$	$4\left[\frac{1}{2}(4\cdot3\frac{1}{2})\right]$ $4\left[\frac{1}{2}(\frac{4}{1}\cdot\frac{7}{2})\right]$ $4\left[\frac{1}{2}(\frac{14}{1})\right]$ $4[7]=\boxed{28u^2}$	$2(2\cdot5)+(2\cdot6)+2(\frac{6\cdot4}{2})$ $2(10)+12+2(\frac{24}{2})$ $20+12+24$ $\boxed{56\text{units}^2}$	$2(4\cdot3)+2(4\cdot2)+2(2\cdot3)$ $2(12)+2(8)+2(6)$ $24+16+12$ $\boxed{52\text{units}^2}$

there are 2 Rectangle A and 2 Triangle C* so multiply by 2

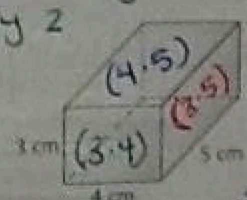
*Describe a method for finding the surface area of any box.

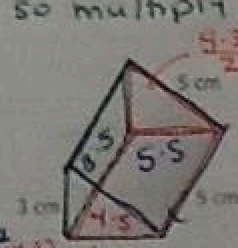
Find the area of all faces and add them together.

B) Valley View Middle School submitted the two boxes at the right.

1) Find the surface area of each.

2) Sketch a net that would fold up to make each box (make sure you label the length of each dimension)



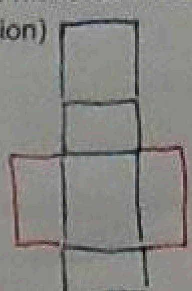


$2(4\cdot5)+2(3\cdot4)+2(3\cdot5)$

$2(20)+2(12)+2(15)$

$40+24+30$

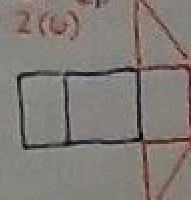
$\boxed{94cm^2}$



$(5\cdot5)+(3\cdot5)+(4\cdot5)+2(\frac{4\cdot3}{2})$

$25+15+20+2(6)$

$\boxed{70cm^2}$



4.3 Filling the Boxes: Finding Volume

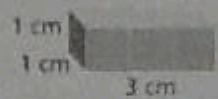
Date: 3.30.20

Finding the right box for a product requires thought and planning. A company must consider how much the box can hold as well as the amount and the cost of the material needed to make the box.

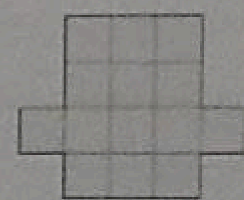
The amount that a box can hold depends on its **volume**.

Volume - the number of unit cubes it would take to fill a 3-D object

It would take three 1-centimeter cubes to fill the box below, so the box has a volume of 3 cubic centimeters or $3 cm^3$

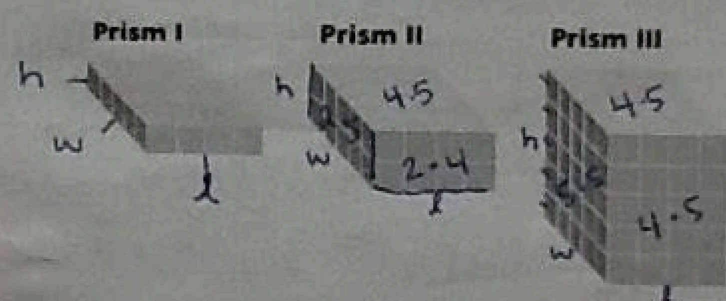


volume = 3 cubic centimeters



surface area = 14 square centimeters

A) These rectangular prisms are made from centimeter cubes.



1. Fill out the following table of information for each of the boxes above:

	Prism I	Prism II	Prism III
length	4cm	4cm	4cm
width	5cm	5cm	5cm
height	1 cm	2 cm	5cm
Volume	20 cm^3 $\boxed{\text{3 dimensions}}$	40 cm^3	100 cm^3
Surface Area	2(5) + 2(4) + 2(20) 58 cm^2 $\boxed{\text{2 dimensions}}$	2(2·4) + 2(2·5) + 2(4·5) 2(8) + 2(10) + 2(20) 16 + 20 + 40 $\boxed{76\ cm^2}$	4(4·5) + 2(5·5) 4(20) + 2(25) 80 + 50 $\boxed{130 cm^2}$

Describe your thinking: Without counting cubes, how could you calculate the volume of a rectangular prism?

find area of base ($l \cdot w$), then multiply by the height

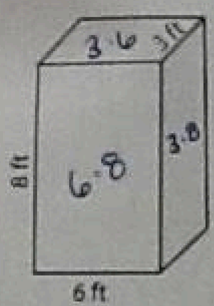
Formula for Volume

Volume = length x width x height

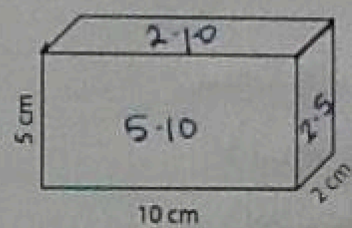
$\boxed{V = l \cdot w \cdot h}$

Use rectangular prisms I, 2, and 3 to answer the questions below.

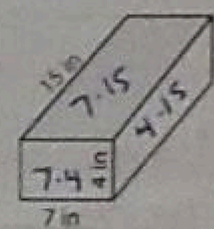
1)



2)



3)



	Prism I	Prism 2	Prism 3
Volume (start with the formula)	$V = l \cdot w \cdot h$ $6 \cdot 3 \cdot 8$ $18 \cdot 8$ $\boxed{144\ ft^3}$	$V = l\ w\ h$ $10 \cdot 2 \cdot 5$ $20 \cdot 5$ $\boxed{100\ cm^3}$	$V = l \cdot w \cdot h$ $7 \cdot 15 \cdot 4$ $7 \cdot 60$ $\boxed{420\ in^3}$
Surface Area (show all work)	$2(6 \cdot 8) + 2(3 \cdot 8) + 2(3 \cdot 6)$ $2(48) + 2(24) + 2(18)$ $96 + 48 + 36$ $\boxed{180\ ft^2}$	$2(5 \cdot 10) + 2(2 \cdot 5) + 2(2 \cdot 10)$ $2(50) + 2(10) + 2(20)$ $100 + 20 + 40$ $\boxed{160\ cm^2}$	challenge $2(7 \cdot 4) + 2(4 \cdot 15) + 2(7 \cdot 15)$ $2(28) + 2(60) + 2(105)$ $56 + 120 + 210$ $\boxed{386\ in^2}$

remember we can only see half of the faces, so multiply each by 2

Extension: A rectangular prism has a volume of $104\frac{5}{8} in^3$. If the length is $3\frac{3}{4} in$ and the width is $4\frac{1}{2} in$, what is the height?

$V = l \cdot w \cdot h$

$104\frac{5}{8} = 3\frac{3}{4} \cdot 4\frac{1}{2} \cdot h$

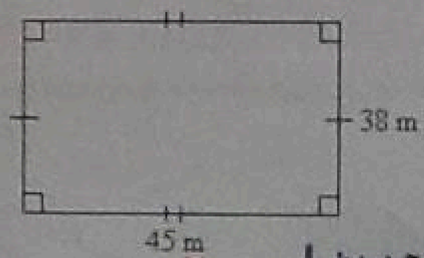
Unit Review **Date:** 4-1-20

For each exercise below, find the **area** and **perimeter** of each figure.

Remember:

- **Always write the formula first!**
- **Label appropriately**

1.



$l + w + l + w$

A = $l \cdot w$

$45 \cdot 38$

$\boxed{A = 1{,}710\ m^2}$

$$\begin{array}{r} 45 \\ \times 38 \\ \hline 360 \\ 1350 \\ \hline 1710 \end{array}$$

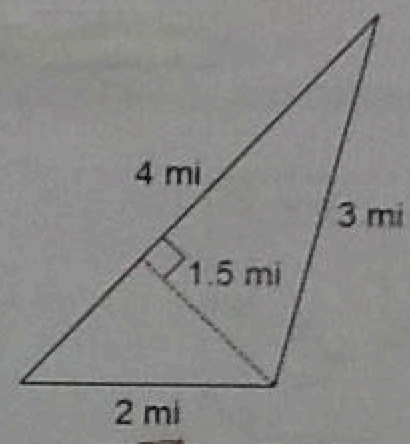
P= $2(l + w)$

$2(45 + 38)$

$2(83)$

$\boxed{P = 166\ m}$

2.



A = $\frac{b \cdot h}{2}$

$\frac{\cancel{4} \cdot 1.5}{\cancel{2}}$

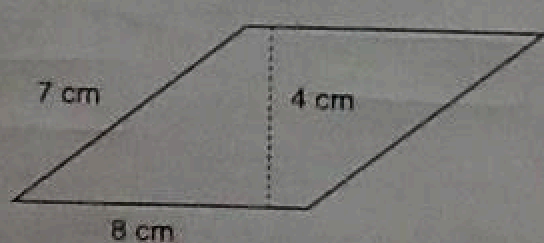
$\boxed{A = 3\ m^2}$

P= $S_1 + S_2 + S_3$

$2 + 3 + 4$

$\boxed{P = 9\ mi}$

3.



A = $b \cdot h$

$8 \cdot 4$

$\boxed{A = 32\ cm^2}$

P= $S + S + S + S$

$2(b + w)$

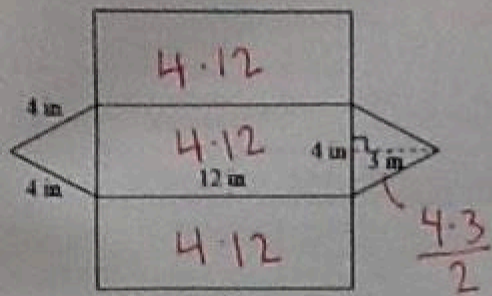
$2(8 + 7)$

$2(15)$

$\boxed{P = 30\ cm}$

For each exercise below, find the **surface area** of each figure. Be sure to neatly show all your work and label your answers correctly.

4.



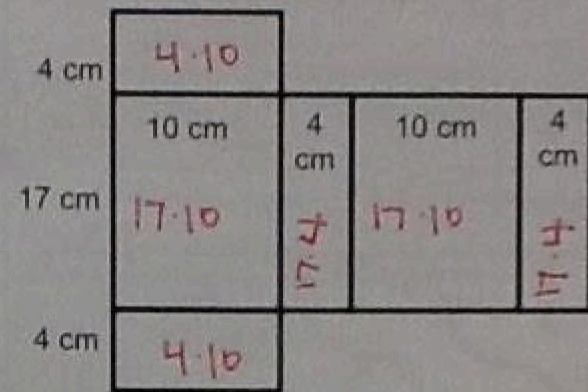
SA= $3(4\cdot12) + 2\left(\frac{\cancel{4}^{2}\cdot3}{\cancel{2}_{1}}\right)$

$3(48) + 2(6)$

$144 + 12$

$\boxed{SA = 156\ in^2}$

5.



SA= $2(4\cdot10) + 2(17\cdot10) + 2(17\cdot4)$

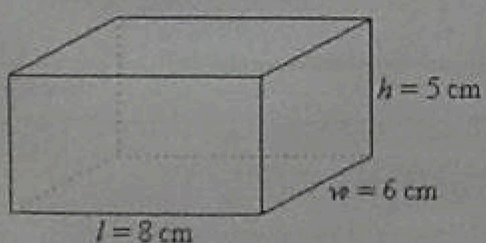
$2(40) + 2(170) + 2(68)$

$80 + 340 + 136$

$\boxed{SA = 556\ cm^2}$

find the **volume** of each figure. Be sure to clearly show all your work and label your answers correctly.

6.



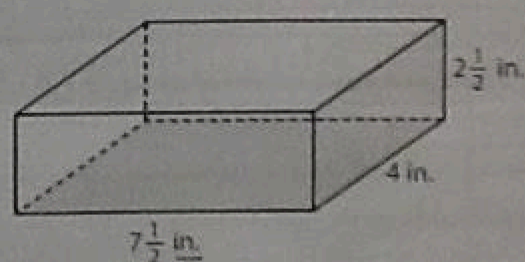
V= $l\cdot w\cdot h$

$8\cdot6\cdot5$

$8\cdot30$

$\boxed{V = 240\ cm^3}$

7.



V= $l\cdot w\cdot h$

$7\frac{1}{2}\cdot4\cdot2\frac{1}{2}$

$\frac{15}{\cancel{2}_{1}}\cdot\frac{\cancel{4}^{2}}{1}\cdot\frac{5}{\cancel{2}_{1}}$

$\boxed{V = 75\ in^3}$