The Community Center Design Challenge

A town named Willingdon has just decided to create a community center dedicated to helping people in the town. The mayor of the community is searching for young, creative, and brilliant architects who can build a community center in Willingdon. Your challenge is to design an original model of a community center that can serve the needs of citizens using three-dimensional shapes. The mayor will need to see your plans, measurements, and a model in order to consider using your design. The community center must stand up on its own and should include the use of at least 3 different three-dimensional shapes. You must convince the mayor that the building will serve the community in positive ways to help people in need. You must complete the challenge within six class periods. You will be given a budget of 50 Willingdon dollars to complete this challenge.

A Design Portfolio- The Community Center Design

Name _____

Date _____

In this design challenge, what is the problem you need to solve?

_____

_____

_____

_____

_____

Specifications are the things that my solution must do. They are the project requirements. **Constraints** are things that limit my solution. For example, a **constraint** may be how much I'm allowed to spend, or how much time I have to complete the challenge.

Fill in the chart below with the **specifications** and **constraints** for this challenge.

Specifications	Constraints

KSB 1 Formulating Ideas –**Take Home Assignment**

Use the internet, go to the library, or take pictures of buildings that can serve as community centers and what features they have, for example, some might have kitchens, space for shelter in storms, activity spaces for children. In the table below, write down the names of the geometric solids you found within the structures. Use the attached Geometric Solids sheet to guide you.

List Geometric Solids Below
What makes a 3D figure three dimensional?

Information (3 bulleted observations/facts in the space below)

- ❖
- ❖
- ❖

Pictures of Community Center structures (3 based on your research -use back of this page)

Draw two sketches of possible buildings that you want to create. Write two reasons why each sketch fulfills the specifications

Sketch 1	**Sketch 2**

Reason 1:

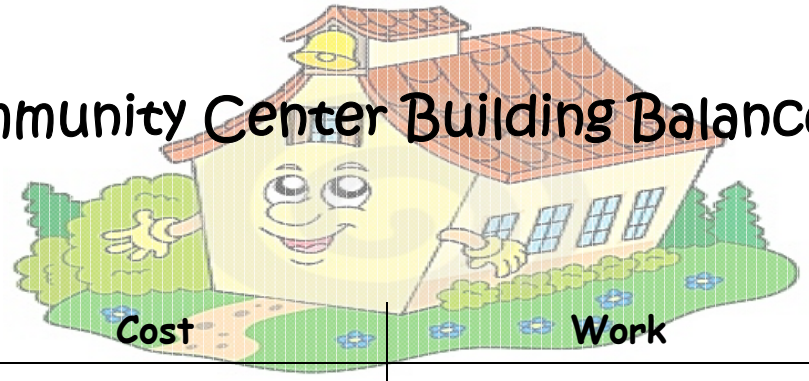
Reason 2:

Reason 1:

Reason 2:

Cost of Initial Design: _____ (See Balance Sheet)

Community Center Building Balance Sheet



3D Shape	Cost	Work	Balance

Select the best structure for the community centter and create it using the Model Maker Software. Print the image you have on the screen. Attach the page behind this one.

Reflect on the following ideas:

Reflection 1: Which net surprised you as it relates to the three dimensional shape you created? Why?

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Reflection 2: Did you learn anything about a three dimensional shape that you never saw before? If so, what is the 3D figure, and what did you learn?

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If you used three dimensional shapes you are familiar with, what was one thing you learned that you didn't know before?

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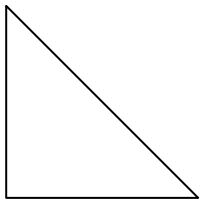
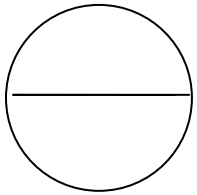
The mayor of Willingdon has added some requirements for the model community center building that you're creating. Not only must the structure stand up on its own and use at least 3 three-dimensional figures, the president has requested that the building must also have a **volume between 150cm³ and 250cm³.** The president also asked that the **surface area** of your model structure be between **170cm² and 350 cm².** In addition, you may only use a glue stick to assemble your model community center building. You still have 5 class periods to complete the challenge. The ultimate net designs will be printed out on 8 1/2" x 11" white cardstock paper.

Fill in the chart below with all of the **specifications** and **constraints** for this challenge. Write the original specifications and constraints in pencil and the new ones in colored pencil.

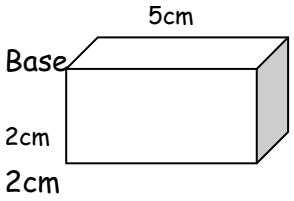
Specifications	Constraints

KSB 2- Surface Area

Find the area for each shape using the formulas given.

Shape and Formula for Surface Area	Example	Work Space	Properties of Each Shape(Ex: What makes a circle a circle?)
Parallelogram (square, rectangle) A= Base x Height	5 centimeters  3 Base = Height = Area =		
Triangle A= (Base x Height) ÷ 2	 Base = 4 cm Height = 8 cm Area =		
Circle r= radius $r^2 = r \times r$ π= 3.14 $A = \pi r^2$	 Diameter = 12 cm. Area =		

KSB 3- Volume – The volume for the extruded figures in the chart below (rectangular prism, cylinder, triangular prism) can be determined by multiplying the area of the base by the height of the figure. Draw each three-dimensional figure in the example box. Use the measurements that you created in the surface area chart on the previous page as the measurements for the faces of the three-dimensional figures on this chart where it applies. Draw the 3D shape in the example boxes. Find the volume for each three-dimensional shape using the formulas given below.

3D Figure & Formula For Volume	**Example**	**Properties of 3D Figure**	**Predict the Net**
Rectangular prism V= Area of Base x Height	 V= Area of V= 15cm² x V= 30cm³		
Cylinder V= Area of Base x Height			
Triangular Prism V= Area of Base x Height			

3D Figure	Example	Properties of 3D Figure	Predict the Net
Cone V= (Area of base x Height) ÷ 3			
Square Base Pyramid V= (Area of Base x Height) ÷ 3			
Triangle Base Pyramid V= (Area of Base x Height) ÷ 3			
Sphere V= π r			

Which three-dimensional figure(s) included in the chart would roll from one side of a table to the other the best? Why? _____

_____

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_____

STOP! You must get your work signed by the teacher in order to continue.

Teacher's Signature_____

KSB 4- Using ModelMaker

Open the ModelMaker software and create each of the three-dimensional figures you found the volume for on the previous pages. Use the same dimensions and units that you used in the chart above. After you create each figure, right click on it, and go to Properties. Scroll to the bottom to view the calculated volume and record it in the space provided below. Repeat for each figure you create. Print the images you have and paste each one in last column.

Three-dimensional Figure	Volume	**Pasted Modelmaker 3D Figure**
Rectangular Prism		
Cone		
Cylinder		
Triangular Prism		

Square Base Pyramid		
Triangle Base Pyramid		

Does the volume for each figure match the volume you calculated in the chart? If not, make sure you used the same dimensions and units in your chart example and in ModelMaker. You may also want to go over the computations in your example.

Was there an error? _____

Which figures had an error? _____

Where did you find the error? (You may want to look back to your computations for surface area and volume. Did you use the formulas correctly? Did you complete the multiplication correctly? Did you copy a number incorrectly?)

_____

_____

_____

Revised Optimum Community Center Design

Using Model Maker, create a revised design of the community center building that meets the new requests of the mayor of Willingdon. Print the image that you have on the screen and attach it to the back of this page. This is the design that you will be constructing.

Revised Cost: _____ (See Balance Sheet)

STOP! Your teacher must approve your community center design.

Teacher's Signature _____

Once your teacher signs your portfolio you may print the nets of each figure and construct your design.

Which three-dimensional figures did you use in your design?

Why did you choose these figures?

_____

_____

_____

In the chart below, list each three-dimensional figure that you used to create your community center. Using ModelMaker, find the volume of each figure and record it in the space provided. Paste or create the net as well. Record in table.

Three-dimensional Figure	Volume	Net

Total volume of community center structure _____cm^3

Using ModelMaker and the model of your community structure, determine the surface area of your design. (Hint: Don't count the surface area of the faces and parts of faces that cannot be seen when the building is standing upright.)

Use the space below for your calculations.

Calculations for figure 1 Total surface area for figure 1: _____cm^2	Calculations for figure 2 Total surface area for figure 2: _____cm^2
Calculations for figure 3 Total surface area for figure 3: _____cm^2	Calculations for figure 4 Total surface area for figure 4: _____cm^2

Calculations for figure 5	Calculations for figure 6
Total surface area for figure 5: _____cm^2	Total surface area for figure 6: _____cm^2
Calculations for figure 7	Calculations for figure 8
Total surface area for figure 7: _____cm^2	Total surface area for figure 8: _____cm^2

Total Surface area of figure 1: _____ cm^2 Total Surface area of figure 5 : _____ cm^2

Total Surface area of figure 2: _____cm^2 Total Surface area of figure 6 : _____ cm^2

Total Surface area of figure 3: _____cm^2 Total Surface area of figure 7 : _____ cm^2

Total Surface area of figure 4: _____cm^2 Total Surface area of figure 8 : _____ cm^2

TOTAL SURFACE AREA of EACH INDIVIDUAL SHAPE ADDED TOGETHER _____ cm^2

WHAT IS THD SURFACE AREA WHEN FUGURES ARE JOINED TOGETHER?

Computation for Surface Area Problem Solving(Subtracting Face Areas)

COMPUTATION WORKSPACE (Label each figure next to your computation)

REVISED TOTAL SURFACE AREA (When Faces touch other Faces): _____ cm^2

What changes, if any, did you make from your plan of the community structure? Why? Did the structure meet all of the specifications? Explain

_____

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Print out the screen image of your final design and paste it in the space below. Label the important features that indicate the community structure met the specifications.

Reflection

What did you learn about three-dimensional figures, surface area, and volume by completing this design challenge? _____

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What are some trade-offs or modifications that you had to make in order to be sure that your design fit all of the specifications? _____

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Exchange your design portfolio and model community center with a neighbor. Use your peer review rubric to evaluate your partner's work. When you are finished, return the model community center, design portfolio, and rubric to your neighbor. Attach the rubric that your neighbor filled out for your community center to the back of your design portfolio.

Extension Questions

1. How does the base area of an extruded figure relate to the volume of the extruded figure?

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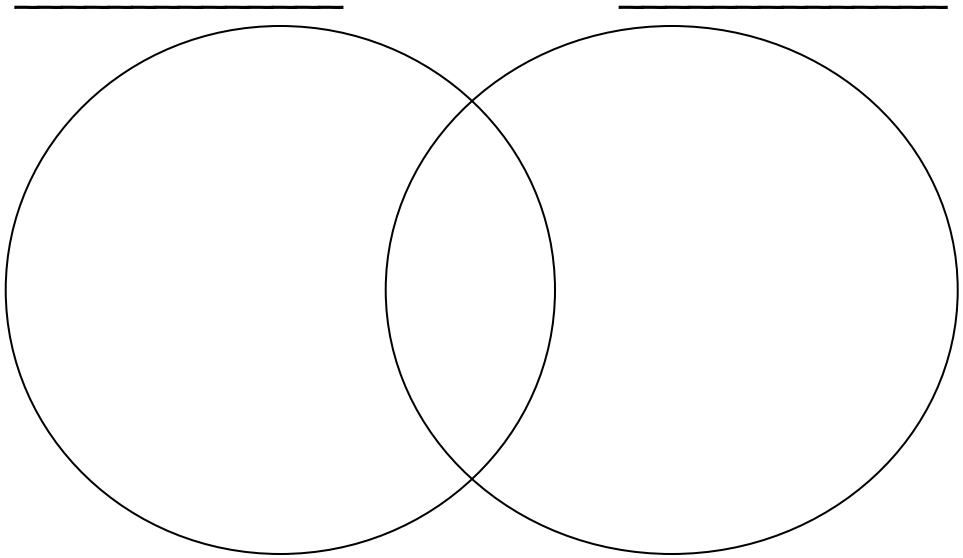
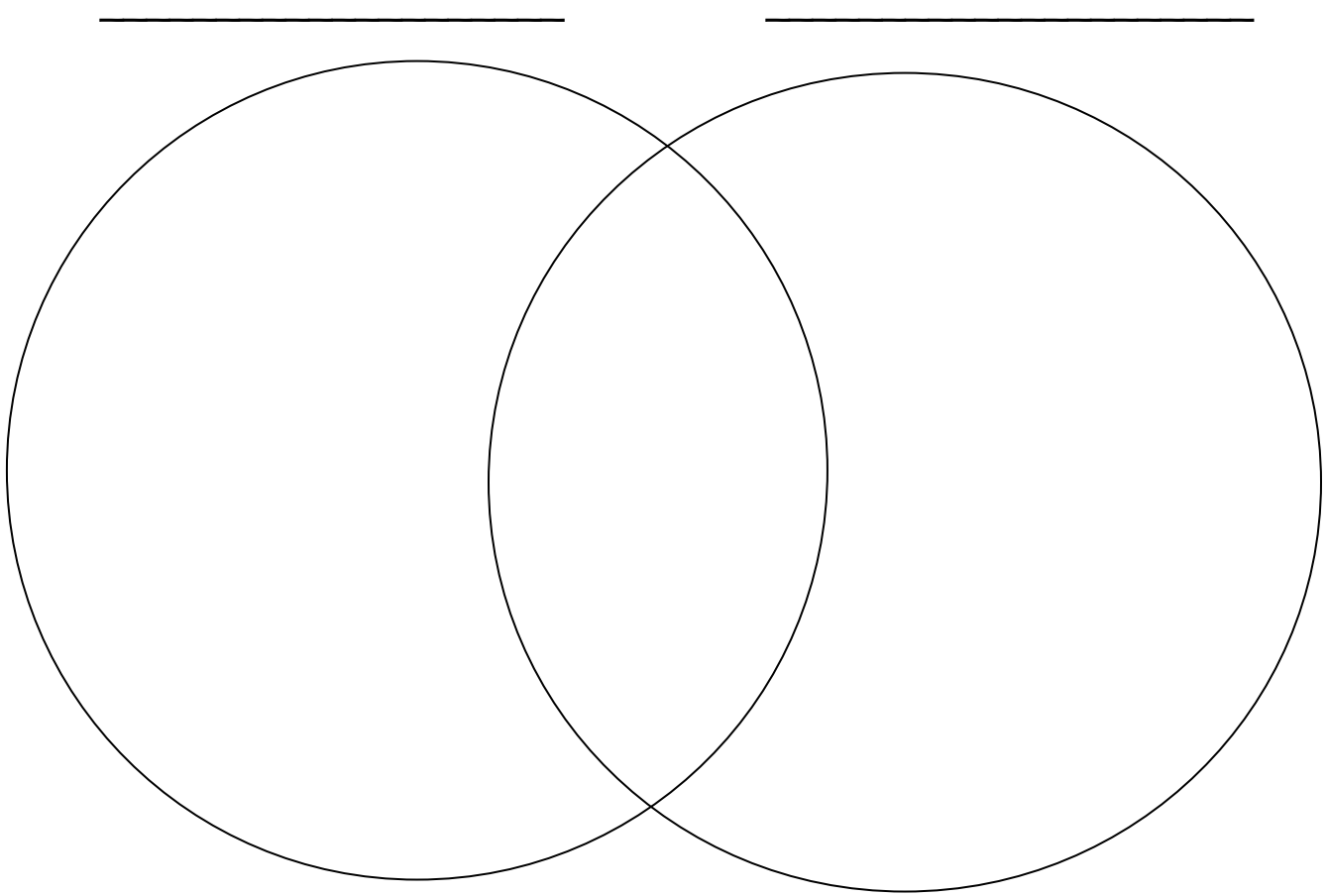
2. Use the Venn diagram below to note the similarities and differences of a cone and a pyramid.



3. Use the Venn diagram below to compare and contrast 2 three-dimensional shapes of your choice.



4. If the mayor of Willingdon required your unique design to include at least one three-dimensional figure placed inside another, how would you approach this? What are some things that you might think about? _____

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Sketch one possible design for this requirement.

Daily Learning Log

Day_____

This is what I did today:_____

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_____

This is what I learned:_____

_____

_____

This is a picture of what I learned:

This was my best math for today:

Daily Learning Log

Day_____

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This is what I learned:_____

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_____

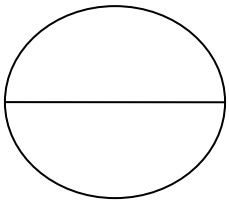
This is a picture of what I learned:

This was my best math for today:

KSB

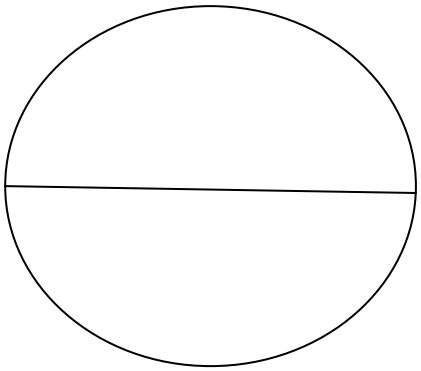
Examine the circles below. Use a string to find the length of the diameter of each circle. Cut each piece of string the diameter's length. About how many times does the string diameter go around the circumference? Work with a partner, to find out about how many times the diameter (string) goes around each circle. Record your answer under each circle.

Circle A



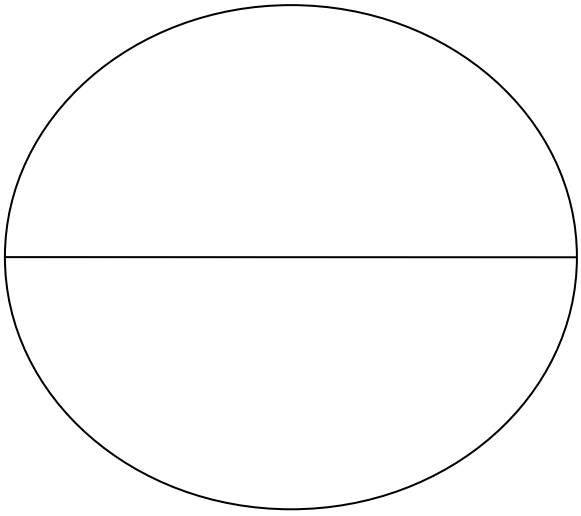
_____

Circle B



_____

Circle C



_____

Did you find a pattern between the diameter of each circle and the number of times it went around the circumference? What is the pattern?

_____

_____

KSB

Both you and your partner are to go on a 3D Scavenger Hunt. Find the following objects that are 3D shapes like the ones listed below. Fill in the table below with at least two classroom objects for each 3D shape listed.

Explain how they match.

3D SHAPE	CLASSROOM OBJECTS	HOW THEY MATCH
Cylinder		
Rectangular Solid		
Cone		
Triangular Solid		

Shape	Cost
Rectangular Prism	$12.00
Cylinder	$11.75
Cone	$10.50
Triangular Prism	$10.00
Triangular Pyramid	$9.50
Square Pyramid	$9.25
Sphere	$9.00
Taurus	$9.00
Other:	$8.50