The Skyline Design Challenge

An island named Willingdon has just been human-made. The president of the island is searching for young, creative, and brilliant architects who can build a city in Willingdon. Your challenge is to design an original model of a skyscraper building using three-dimensional shapes that will be placed in the new city on Willingdon. The president will need to see your plans, measurements, and a model in order to consider using your design. The skyscraper must stand up on its own and should include the use of at least 3 different three-dimensional shapes. You must complete the challenge within five class periods.

Compounded- 3 or more 3d shapes- diffrent

A Design Portfolio- The Skyline Design

Name ______________

Date 11/17/10

In this design challenge, what is the problem you need to solve? We will design a 3-D sky skaper to stand in the town of Willingdon.

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
·Create 3-d sky scraper	·oridigonal idea
to go in city of Willingdon	
·must stand on it's own	must be completed within 5
·must make mode	Class pierods
·record mesurments	·presentet must see plans, mesurments
·Must use atleest 3 3-d shapes	and a model

Name(s) ____________________ Date ___________

Explore three different three dimensional shapes on the FabLab Modelmaker. Make sure you can defend how they are similar/different.

Our first 3D shape triangler prism

Notes:

- sides not equal
- regtanglur base
- 2 triangler sides,

Our second 3D shape Cone

Notes:

- gets skinny as go up
- circle base
- 1 side

Our third 3D shape ball

Notes:

- no sides
- no vertisies
- Can't be a base for building

What are some ways that make our 3D shapes similar?

1. 2 have no edeges

2. If have sides, not equal

What are some ways that make our 3D shapes ~~similar~~ diffrent?

1. 1 side, 3 sides, and no side

2.

2 neat discoveries : 1. You can chage the color by clicking on one of the colors. icons

2. Click on icon with the arrow circling left. Click green button (on shapes corner.) Spin.

Name ________________ Due Date: Week of Nov. 17

PROJECT EXTRA Take Home Assignment

Use the internet, go to the library, or take pictures of skyscrapers. In the table below, write down the names of the geometric solids you found within the skyscrapers.

List Geometric Solids Below
·rectangular prism
·Cone
·triangular prism
·Cylinder
·Pyramid

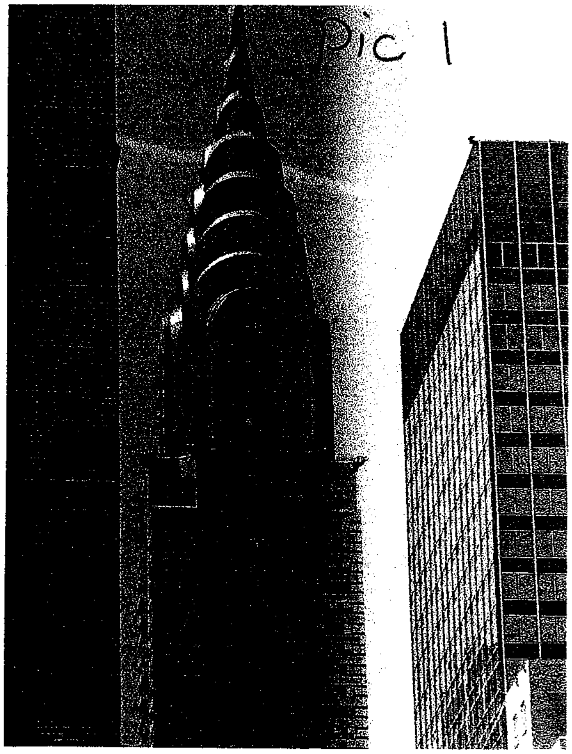
At least 5

Information (3-5 bulleted observations/facts in the space below)

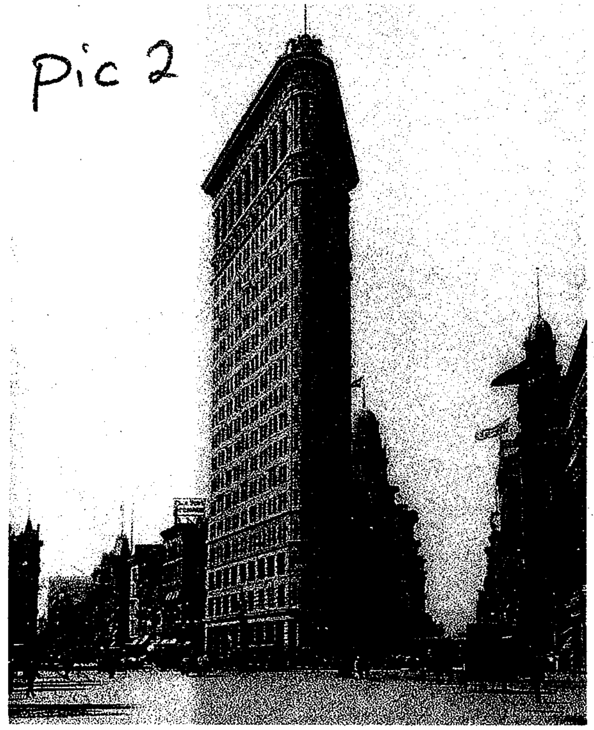
Pictures (3-5) based on my research (use back of this page)

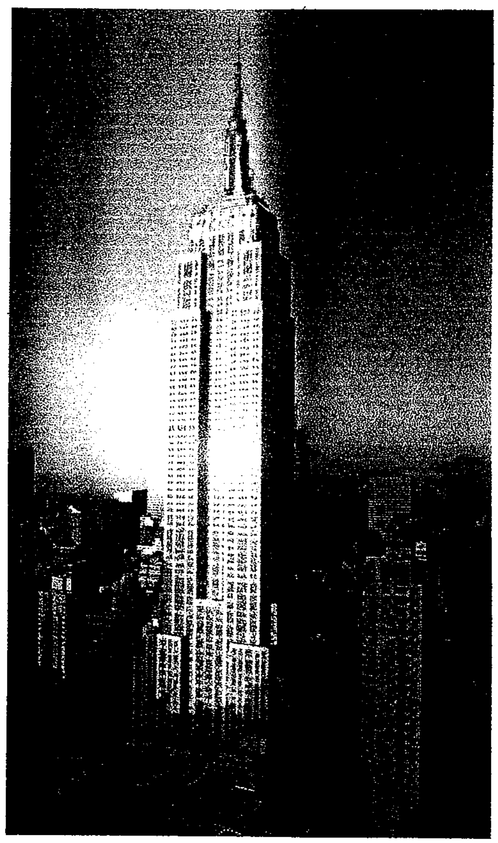
- end with point (pic 1+3)
- gets skinnier as goes up (pic 1+3)
- made up of many smaller rectangular prisms (pic 3)
- 20 stories high (pic2)
-

Pic 1



Pic 2





Geometric Solids

Type		Examples
Polyhedron	Cube	
	Rectangular prism	
	Triangular prism	
	Pyramid Square pyramid	
Cylinder		
Sphere		
Cone		

KSB 1 Formulating Ideas

Use the internet, go to the library, or take pictures of skyscrapers. In the table below, write down the names of the geometric solids you found within the skyscrapers.

List Geometric Solids Below

What makes a three-dimensional shape a three-dimensional shape?

___

___

___

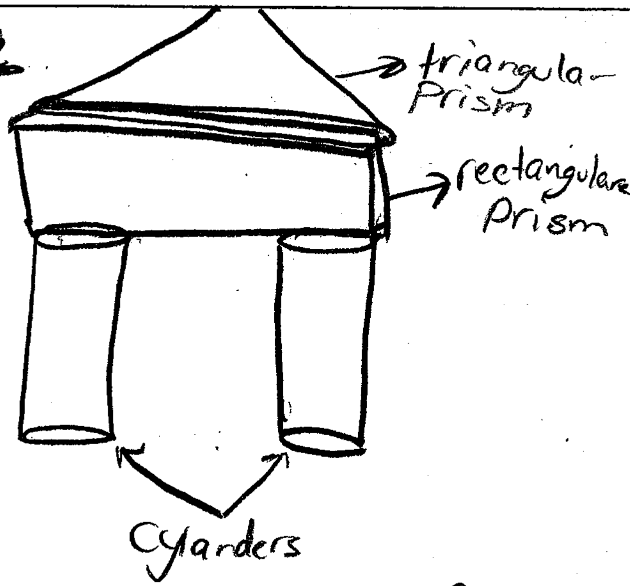
___

11/17/10

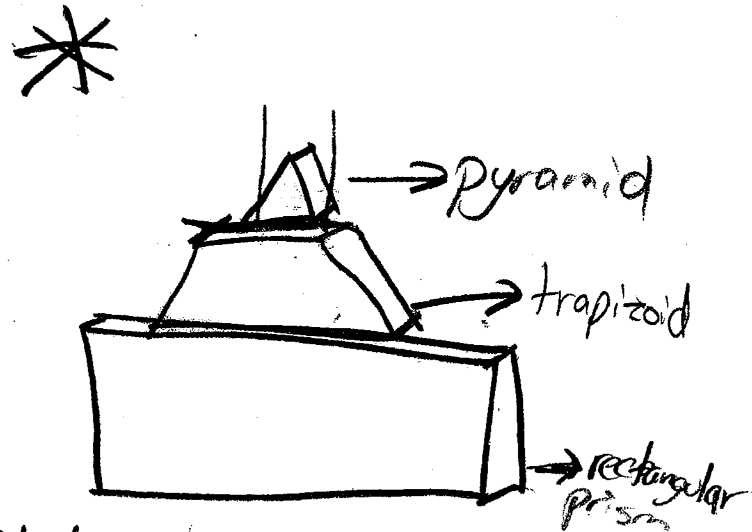
Draw two sketches of possible skyscrapers that you want to create.
Write two reasons why each sketch fulfills the specifications

Sketch 1 Indiv.

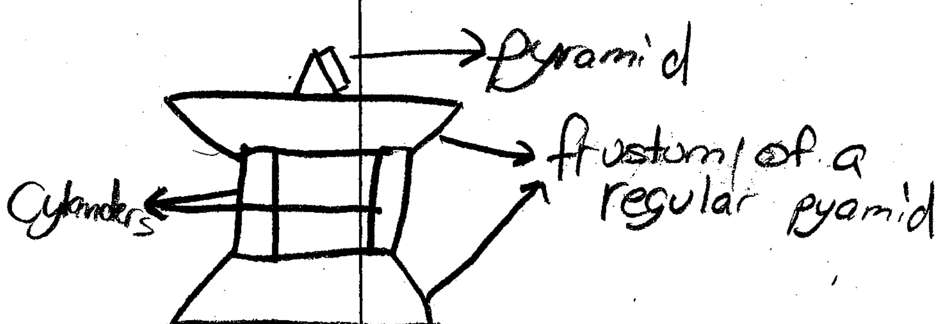
Cable



Sketch 2 Indiv.



Group Sketch



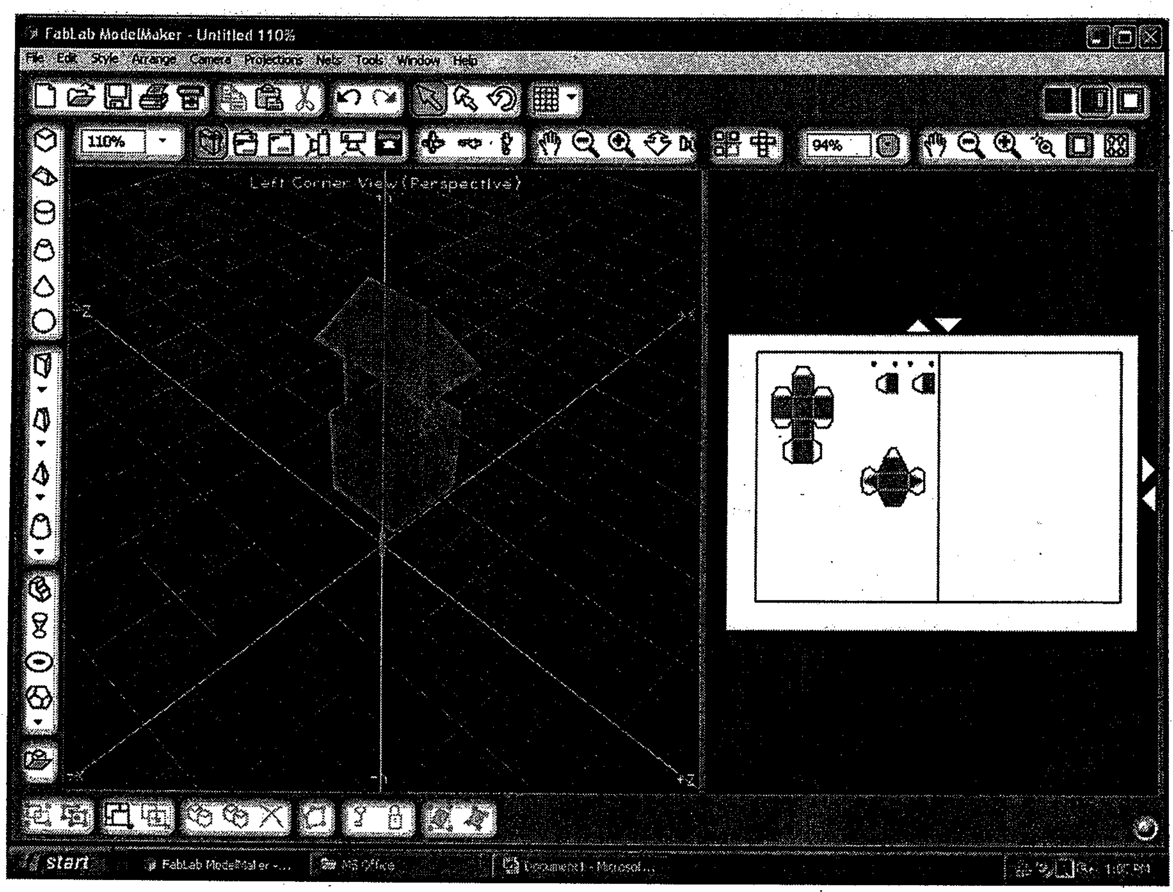
* = favorite sketch

Reason 1:

Reason 2:

Reason 1:

Reason 2:


FabLab ModelMaker - Untitled 110%
File Edit Style Arrange Camera Projections Nets Tools Window Help
110%
94%
Left Corner View (Perspective)
start

Here Comes The Tough Part

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

The president of Willingdon has added some requirements for the model skyscraper that you're creating. Not only must the skyscraper must stand up on its own and use at least 3 three-dimensional figures, the president has requested that the skyscraper must also have a volume between $150cm^3$ and $250cm^3$. The president also asked that the surface area of your model skyscraper be between $170cm^2$ and $350\ cm^2$. In addition, you may only use a glue stick to assemble your model skyscraper. You still have 4 class periods to complete the challenge.

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

Specifications	Constraints
• volume be between 150 cm³ 250	• glue stick cm 150 cm³ - 250 cm³
• surface area between 170 cm 350	• original idea cm
• Create 3d sky scraper	170 350
• must stand on own	glue
• must make mode	
• record mesurment	
• Must use at least 3 3-d shape	

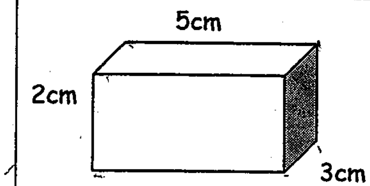
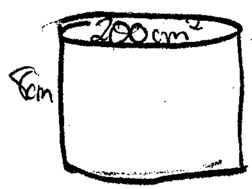
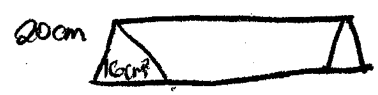
KSB 2- Surface Area Toughtest Part 8888

Draw each shape in the example box below. Label each shape with measurements (in centimeters) that you create. Find the area for each shape using the formulas given.

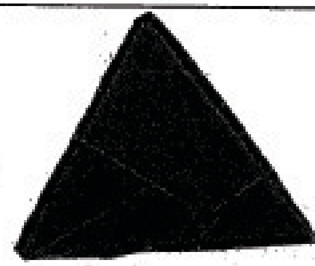
Shape And Formula for Surface Area	Example (Place your sketch and calculations here)	Properties of Each Shape (Ex: What makes a circle a circle?)
Parallelogram (square, rectangle) A= Base x Height	5 centimeters 3 centimeters A= Base x Height A= 5cm x 3cm A= $15cm^2$	
Triangle A= (Base x Height) ÷ 2	8, 3, 4cm A△ = $\frac{1}{2}$ of Base × Height = (Base × Height) ÷ 2 A = 32 ÷ 2 A = 16	
Circle r= radius r^2= r x r π= 3.14 A= πr^2	πr^2 radius Diamiter 15 π = 3.14 r = 8 r^2 = 64 A = 64 × 3.14 A = 200.96 cm^2 8cm 16cm	

KSB 3- Volume

a. 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. Find the volume for each three-dimensional shape using the formulas given below.

3D Figure And Formula For Volume	Example	Properties of 3D Figure (Ex: What makes a cylinder a cylinder?)
Rectangular prism (including cube) V= Area of Base x Height	 V= Area of Base x Height V= $15cm^2$ x 2cm V= $30cm^3$	•rectanglar + square faces •oppisite faces are same area •8 vertisies •6 faces •all right angles
Cylinder V= Area of Base x Height	 V = Area x Height V = $200cm^2$ x 8cm V of C = $1,600cm^3$	•2 faces •
Triangular Prism V= Area of Base x Height	 V = Area x Height V = 16 x 20 V of t = $320cm^3$	•5 fases •6 vertixs •oppisite sides equal 9 edges

12/1

3D Figure	Example	Properties of 3D Figure
Cone V= (Area of base x Height) ÷ 3	 V=15.88cm³ B.A.=8.82cm H=5.40cm	• 1 face • 1 vertex • will roll
Square Base Pyramid V= (Area of Base x Height) ÷ 3	 V=36.46cm³ B.A.=17.64cm² H.=6.20cm	• 5 faces • 5 vertexes • not roll
Triangle Base Pyramid V= (Area of Base x Height) ÷ 3	 V=65.99cm³ B.A.=29.11cm² H.=6.80cm	• 4 faces • 4 vertexs • not roll

Which three-dimensional figure included in the chart would roll from one side of a table to the other the best? Why? The cone because it doesn't have any edges stopping it.

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

Teacher's Signature ____________

12/1

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 on the screen and attach it to the back of this page.

Three-dimensional Figure	Volume
Rectangular Prism	30 cm^3
Cone	15.88 cm^3
Cylinder	16.001 cm^3
Triangular Prism	320 cm^3
Square Base Pyramid	36.46 cm^3
Triangle Base Pyramid	65.99 cm^3

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 a mistake? no

Which figures had a mistake? none

Where did you find the mistake? (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?)

I didn't

Revised Optimum Skyscraper Design

Using Model Maker, create a revised design of the skyscraper that meets the new requests of the president 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.

STOP! Your teacher must approve your skyscraper 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?

I used two cylanders, a frustem of a regular pyramid, and a cone.

Why did you choose these figures?

We thought it would look good and appropriate for our building idea which is a technology musem.

In the chart below, list each three-dimensional figure that you used to create your skyscraper. Using ModelMaker, find the volume of each figure and record it in the space provided.

Hard!

Three-dimensional Figure	Volume	Surface Are
Cylander (2)	8.84	27.76
frustem of a regular pyramid	75.53	124.62
Cone	62.72	96.59

Total surface area 263.51 cm²

Total volume of skyscraper 155.93 cm³

Surface area work!

botton shape - 124.62
middle shapes - 27.76
27.76
top shape - 96.59
276.73
- 3.28
273.35

Cylander - base 1.64
× 2
3.28
× 2
6.56

273.35
- 3.28
270.07
- 6.56
263.51

Using ModelMaker and the model of your skyscraper, 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	Calculations for figure 2
cylinder surface area- 27.76 cm² volume- 8.84 cm³	Cylinder surface area- 27.76 cm² volume- 8.84 cm³

Calculations for figure 3	Calculations for figure 4
Cone surface area- 96.59 cm² volume- 62.72	Frostem of a regular pyramid surface area- 124.62 volume- 75.53

Surface area of figure 1: 27.76 cm² cm²

Surface area of figure 2: 27.76 cm² cm²

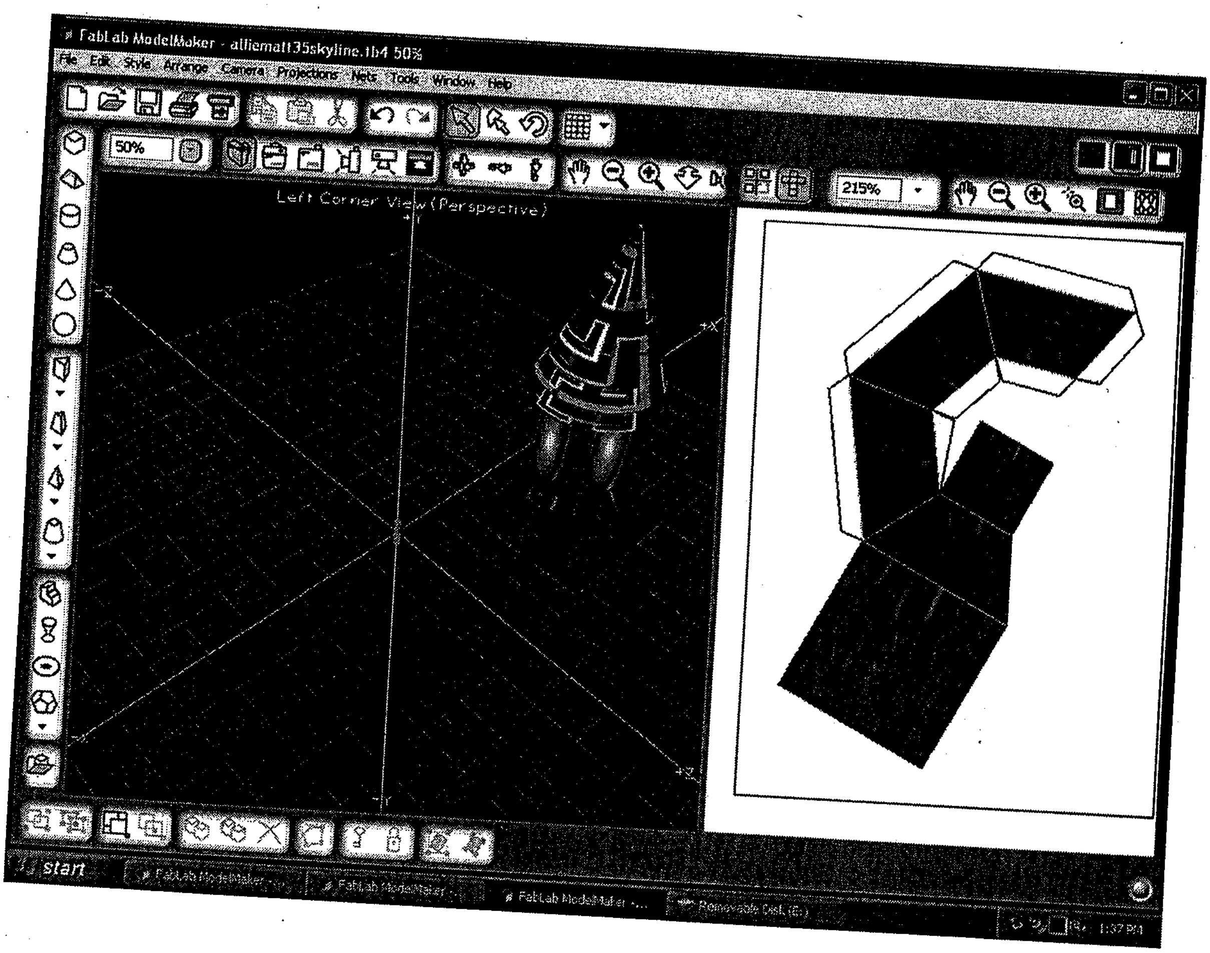
Surface area of figure 3: 96.59 cm² cm²

Surface area of figure 4: 124.62 cm²

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

When we got the sencond specs and constraths, we relizzed that our volume and surface area were over the limit. We had to change our shapes so it would meet it the correct size.

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



Reflection

What did you learn about three-dimensional figures, surface area, and volume by completing this design challenge? I learned how to caculate the volume and surface area of many three-dimensional figures, such as cones, cylanders, and regular pyramids. I also learned that the equation to find surface areas and volumes are diffrent for diffrent figures. For example, the equation for finding the volume of a cylander, you multiply the area by the hieght.

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? We had to change are first shape we created on sky line completely, because it was way to big. Both the surface area and the volume went way out of the specs. Also, our top shape was bigger than our bottom shape, so it probably would've not stood on it's own.

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

54.21 − 12.32 = 41.89   37.59 − 7.19 = 30.20

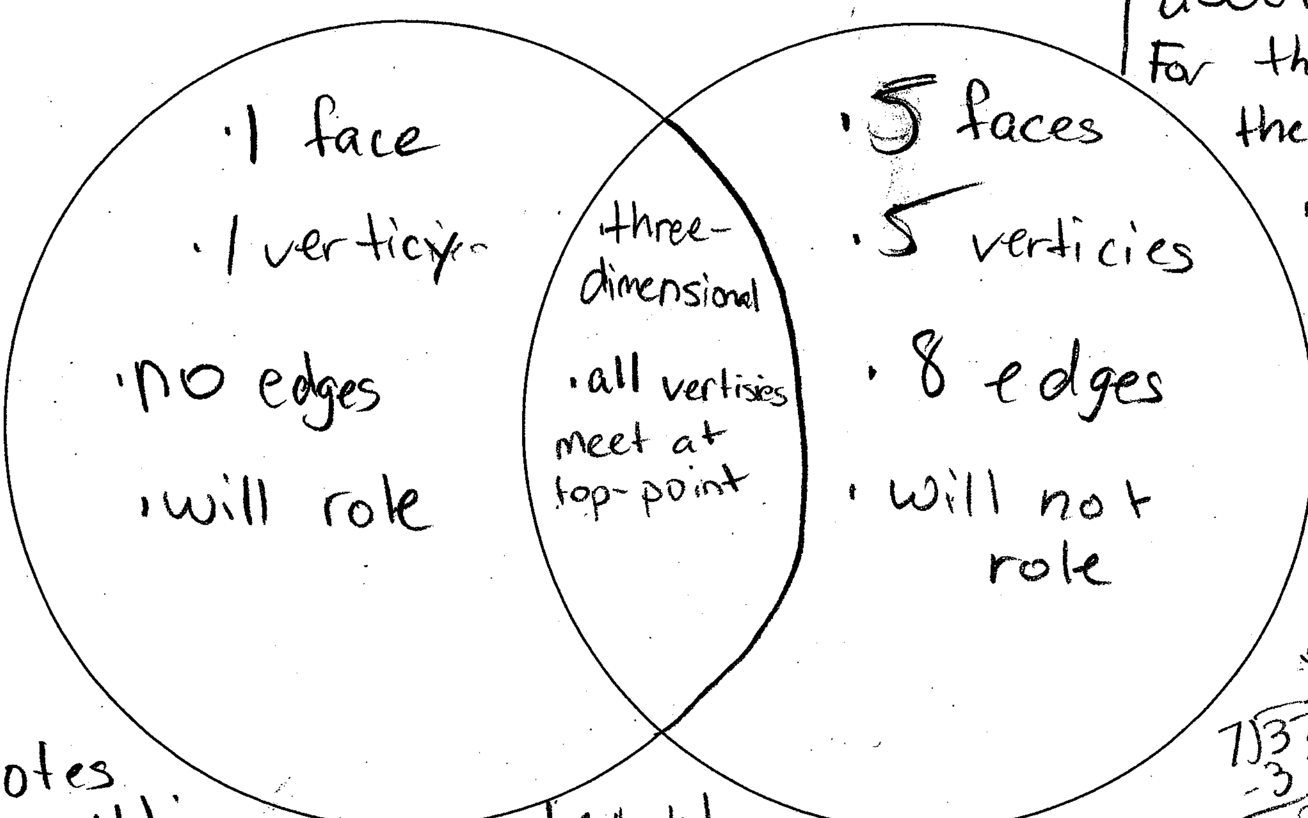
Notes for question 1:
Cube: V: 54.21 cm³, BA: 12.32 cm²
Cylander: V: 37.39 cm³, 7.19 cm²
Wedge: V: 22.80 cm³, 22.80

Extension Questions

1. How does the base area of an extruded figure relate to the volume of the extruded figure? Does the way to find the relationship change for diffrent figures. For the wedge, the volume and the base area were the same. For the cube, the volume was 41.89 cm larger than the surface area. For the cylander, the volome was 30.20 cm bigger. If you divid the volume by the base area for the cylander, it's about $5\frac{2}{7}$. For the cube, the quotient is about $3\frac{2}{3}$. For the wedge, the quotient is one.

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

Cone   Square Pyramid



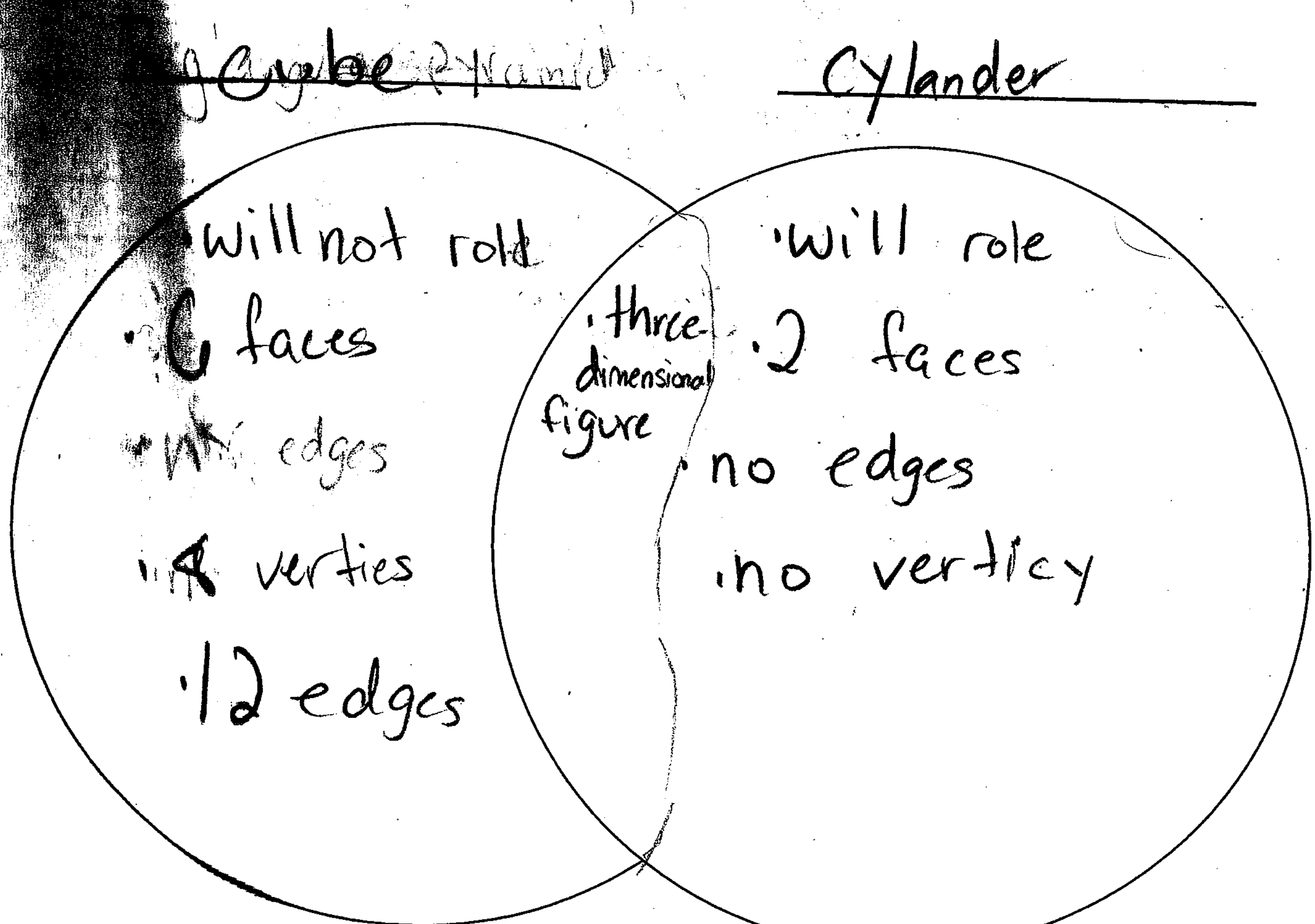
Notes for #1:

	cube	cylander	wedge
V	54.21 cm³	37.39 cm³	22.80cm³
BA	12.32 cm²	7.19cm²	22.80cm²

same

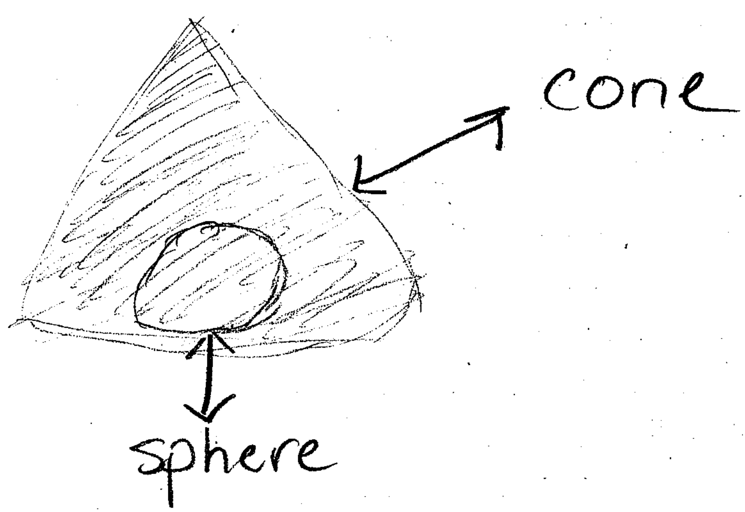
12 ⟌ 45.4 = $3\frac{2}{3}$ 7 ⟌ 37 = $5\frac{2}{7}$ 7.19 ⟌ 37.39

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



4. If the president 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? I would put a sphere through cone. I would make the cone larger than the shere. I would do this because I could first build the ball, and than easly place the shere in the cone as I fold it. Also, if I make the shere smaller than the cone, it will give the shere more place to move, making it easly put in a cone.

Sketch one possible design for this requirement.



Day_____

This is what I did today:____________________________________

This is what I learned:____________________________________

Day_____

This is what I did today:____________________________________

This is what I learned:____________________________________

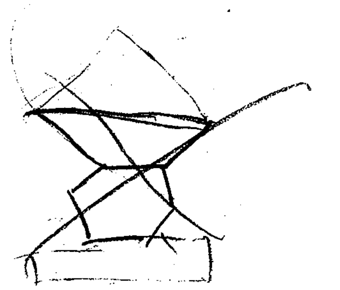
Day_____

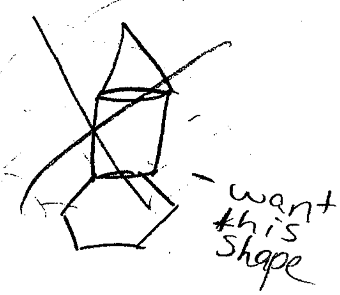
This is what I did today:____________________________________

This is what I learned:____________________________________

11/13/10

idea - office building + toursist attraction
- small cylander or cone at top
- tall / big
- skinny
- hexagon
- combine all ideas





idea - simalar to the cristlar
- war company building
- really unusal shape - tourist attraction
- cone + cylander

Notes

```
  8.84
+ 8.84
 17.68
+75.53
 93.21
```

```
  150.00
- 93.21
  56.79
```

```
  221.21
+ 85.52
  276.73
```

```
   96.59
+ 124.62
  221.211
```

```
  27.76
+ 27.76
  55.52
```