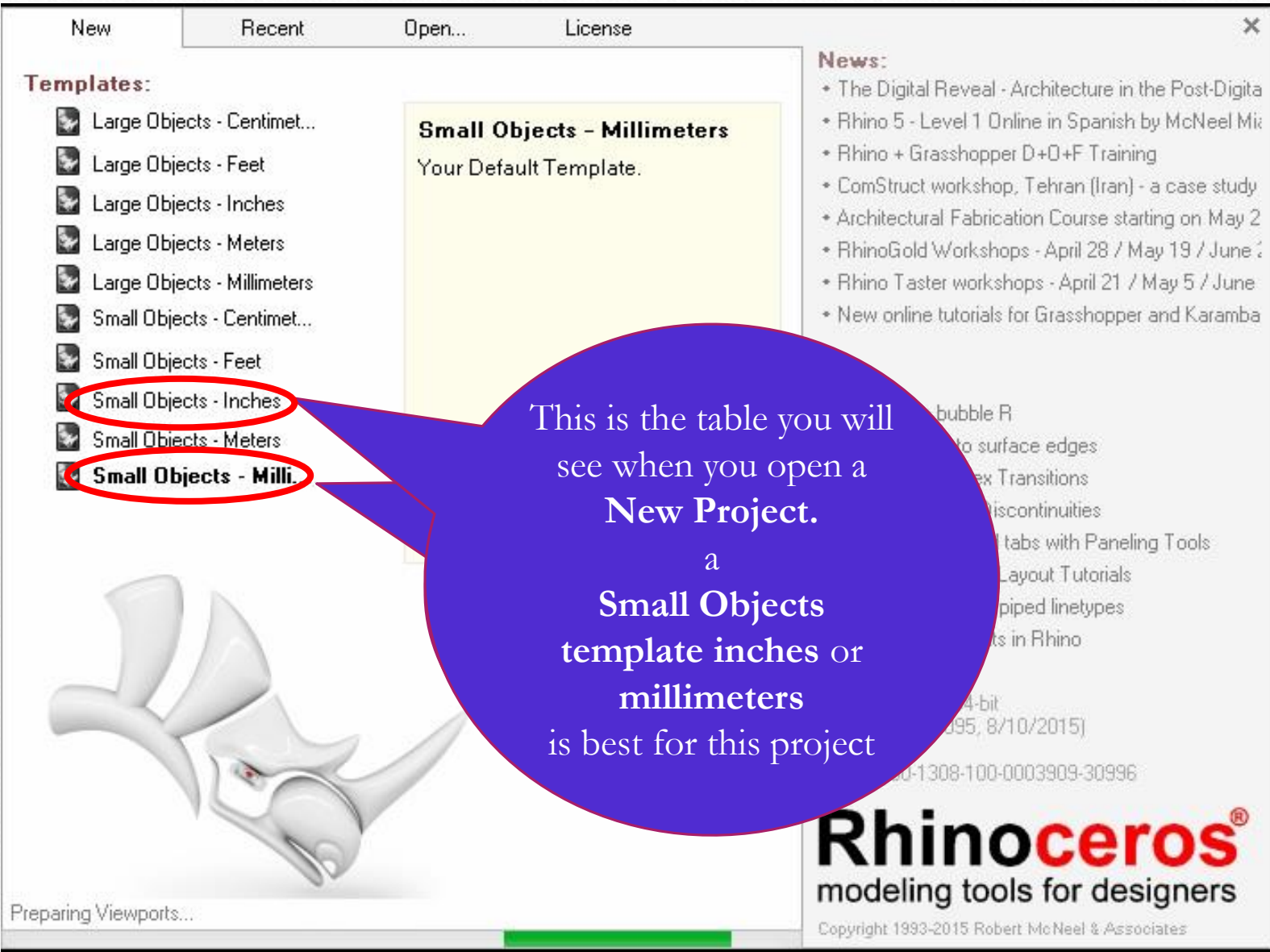


# Modeling a wagon

## **Project goals**

- Learn basic modeling in Rhino
- Introduction to tool bar and controls
- Gain a greater understanding of different modeling programs
- Learn to use x, y axis in modeling





**Templates:**

- Large Objects - Centimet...
- Large Objects - Feet
- Large Objects - Inches
- Large Objects - Meters
- Large Objects - Millimeters
- Small Objects - Centimet...
- Small Objects - Feet
- Small Objects - Inches**
- Small Objects - Meters
- Small Objects - Milli...**

**Small Objects - Millimeters**

Your Default Template.

**News:**

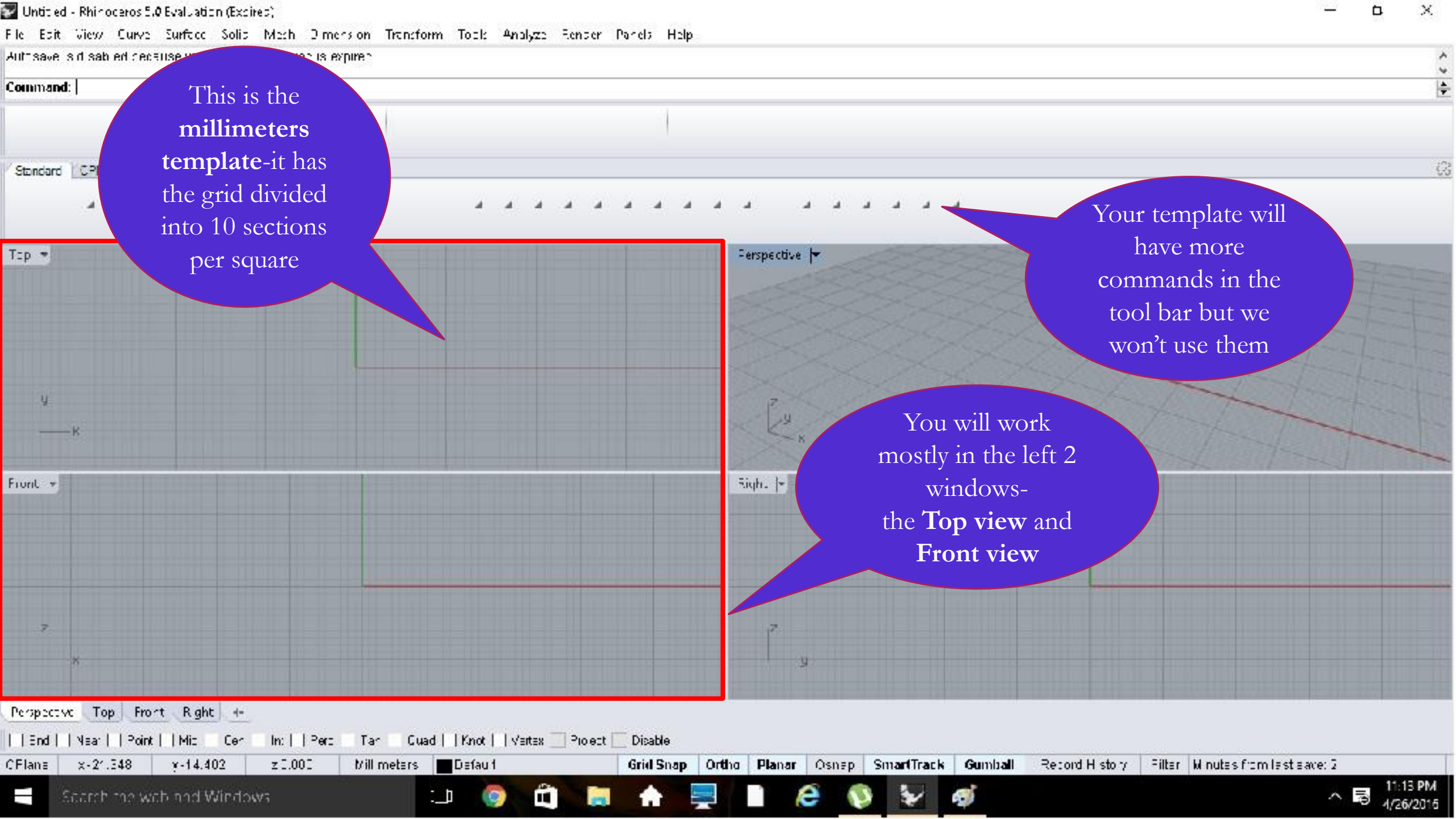
- The Digital Reveal - Architecture in the Post-Digital
- Rhino 5 - Level 1 Online in Spanish by McNeel
- Rhino + Grasshopper D+O+F Training
- ComStruct workshop, Tehran (Iran) - a case study
- Architectural Fabrication Course starting on May 2
- RhinoGold Workshops - April 28 / May 19 / June 2
- Rhino Taster workshops - April 21 / May 5 / June 2
- New online tutorials for Grasshopper and Karamba

This is the table you will see when you open a **New Project.** a **Small Objects** template inches or millimeters is best for this project

Preparing Viewports...

**Rhinoceros**<sup>®</sup>  
modeling tools for designers

Copyright 1993-2015 Robert McNeel & Associates

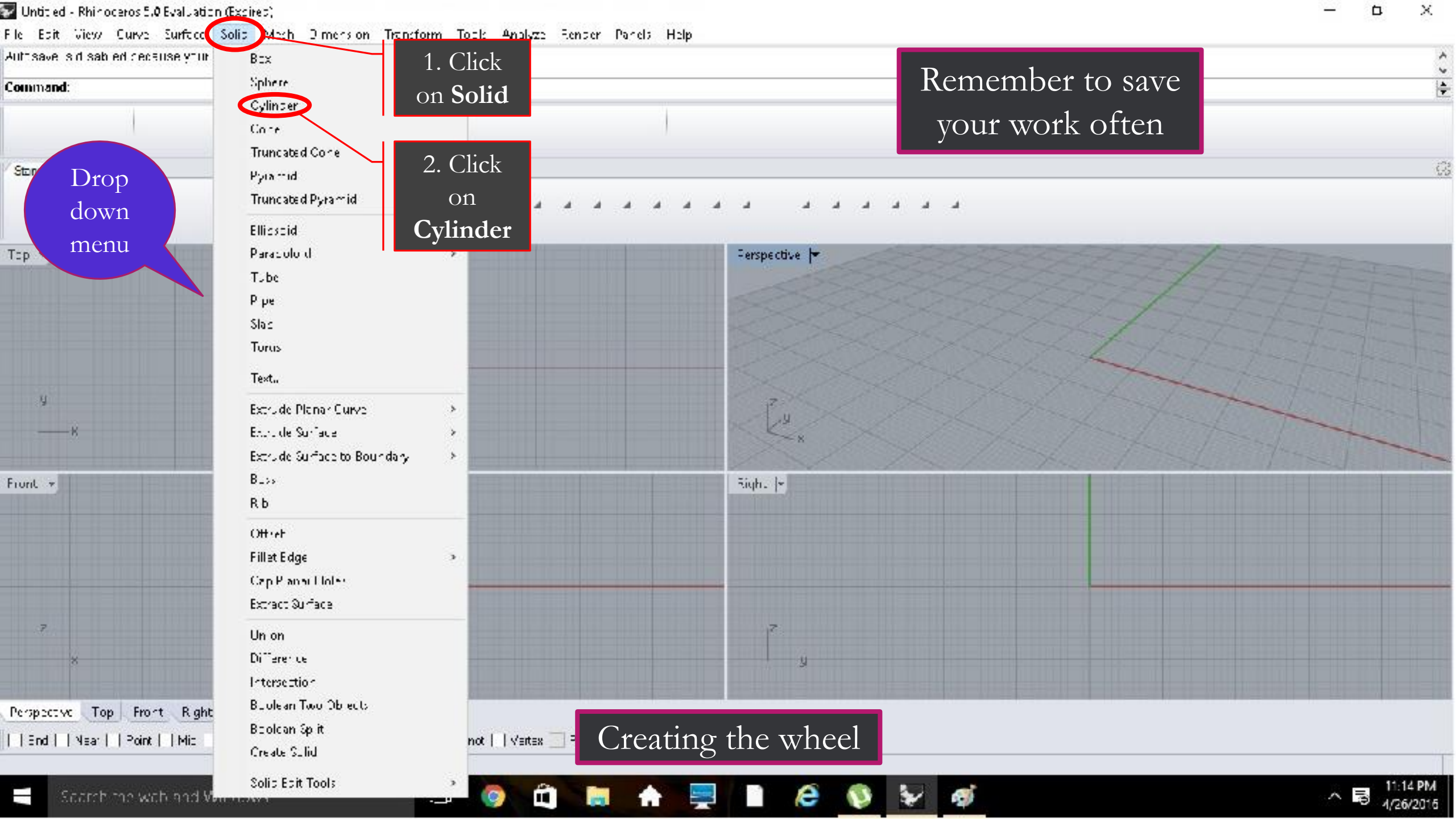


This is the millimeters template-it has the grid divided into 10 sections per square

Your template will have more commands in the tool bar but we won't use them

You will work mostly in the left 2 windows- the Top view and Front view





Solid

1. Click on Solid

2. Click on Cylinder

Drop down menu

Remember to save your work often

Creating the wheel

File Edit View Curve Surface Mesh Dimension Transform Tools Analyze Render Panels Help

Command:

Stop

Top

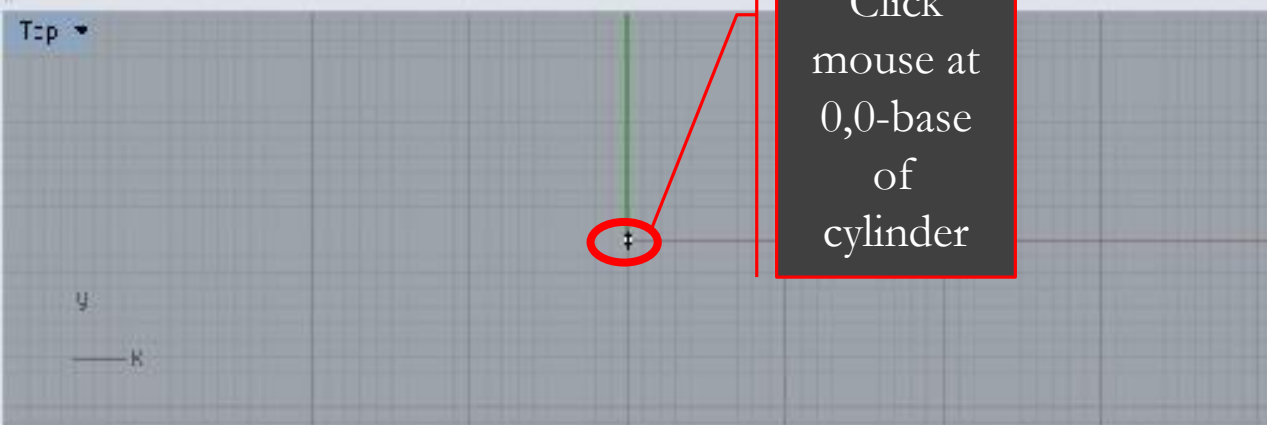
Front

Perspective

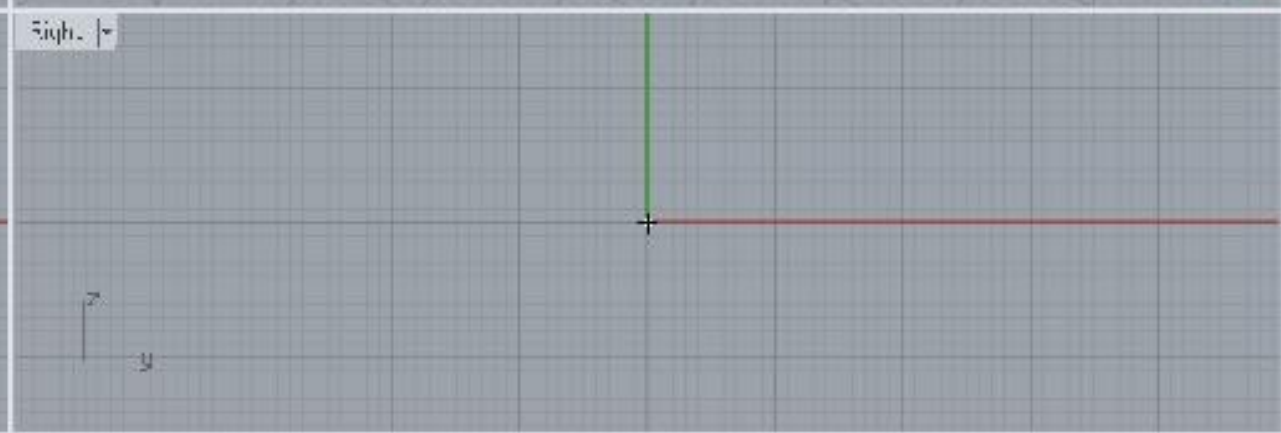
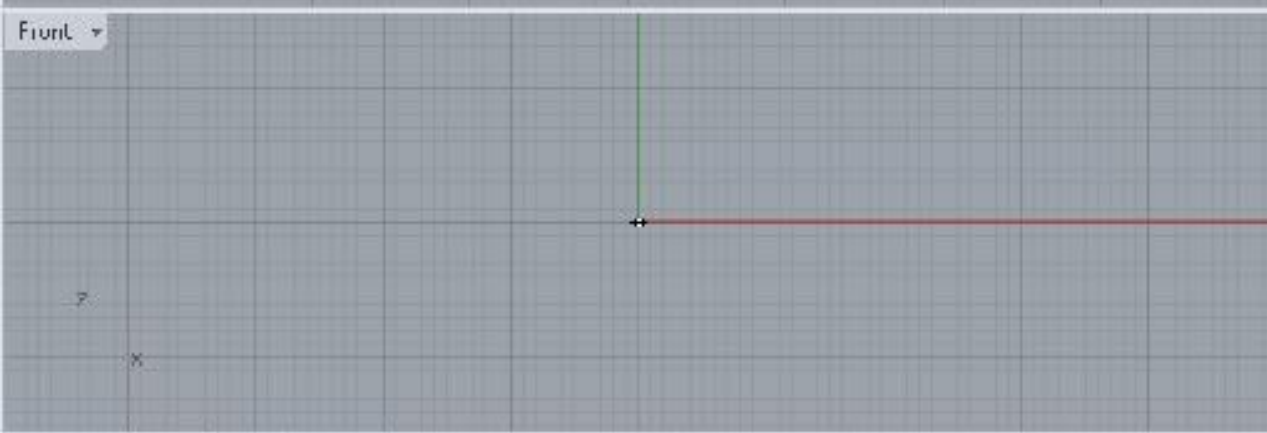
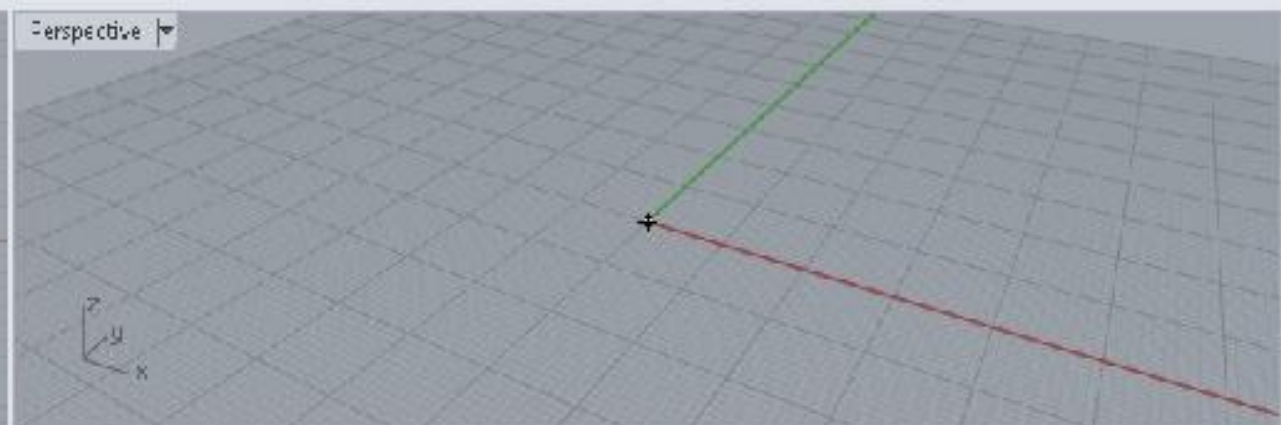
End Near Point Mic

Base of cylinder (Direct on Constraint Vertical Solid Yes 2 Point 3 Point Tangent Fit Points)

Standard C-Planes



Click mouse at 0,0-base of cylinder



Perspective Top Front Right

End | View | Point | Mid | Cen | In | Perc | Tan | Quad | Knot | Vertex | Project | Disable

C-Plane x:0.00 z:0.00 Millimeters Default Grid Snap Ortho Planar Osnap SmartTrack Gumball Record History Filter Available physical memory: 1772 MB

cmd+try (radius=1) (direction=vertical) (thickness=1in)

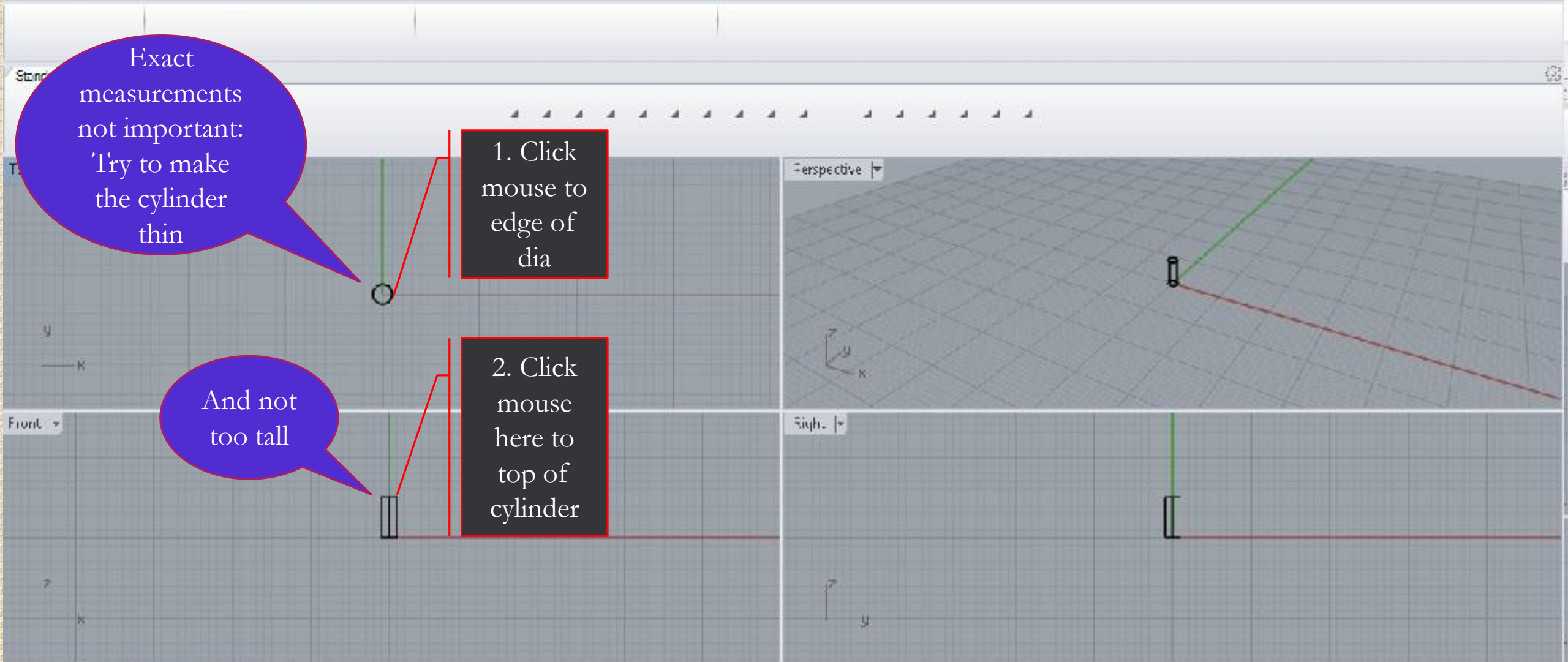
Command:

Exact measurements not important: Try to make the cylinder thin

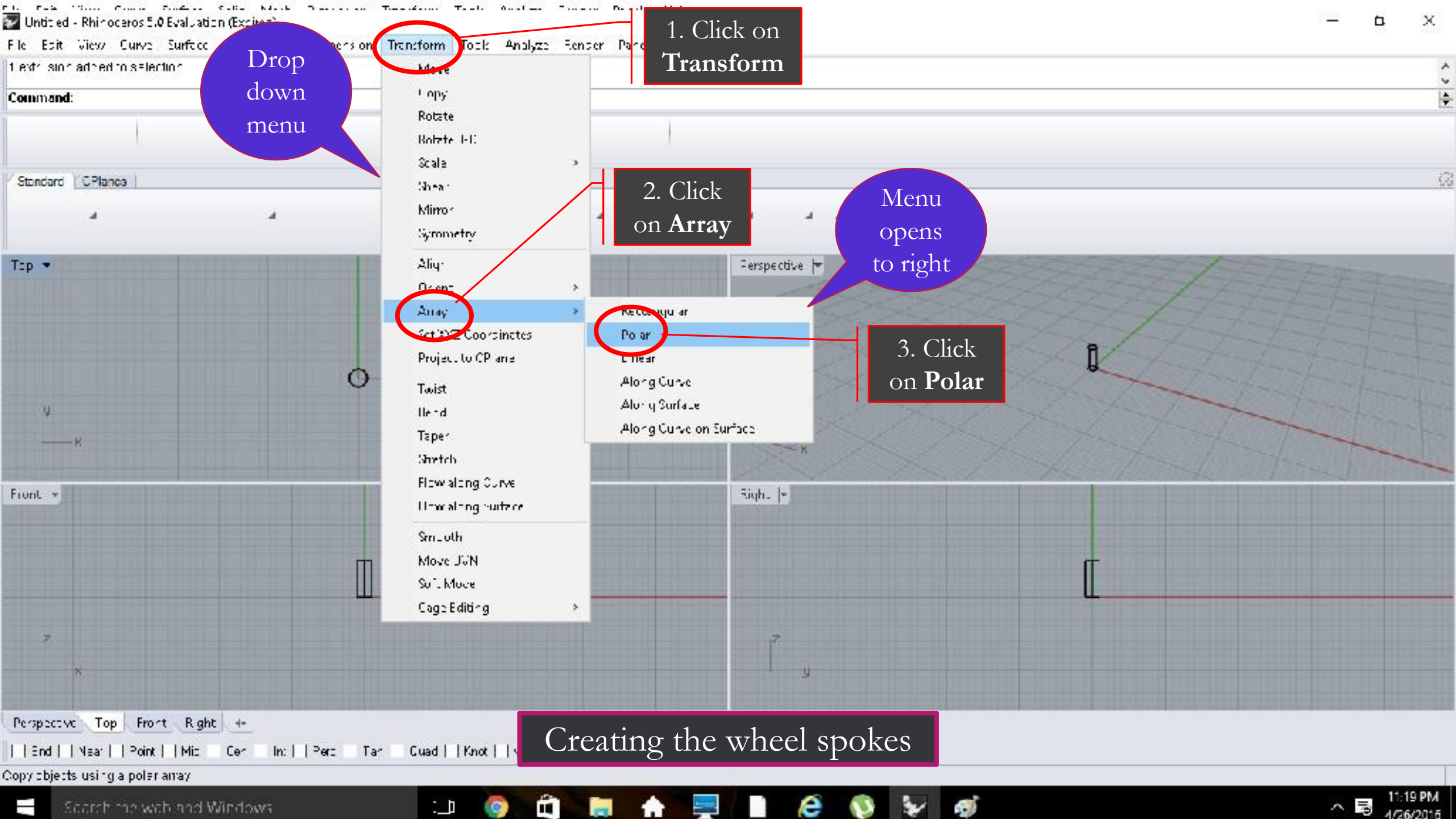
1. Click mouse to edge of dia

And not too tall

2. Click mouse here to top of cylinder







1. Click on Transform

Drop down menu

2. Click on Array

Menu opens to right

3. Click on Polar

Creating the wheel spokes

Copy objects using a polar array



Center of polar array

Standard CPlanes

Top

Perspective

Front

Right

Perspective Top Front Right

End Near Point Mid Cer In Perc Tan Quad Knot

CPlanes x:0.000 y:-1.000 z:0.000 Mill meters Default

Gumball Record History Filter CPJ Use: 1.0 %

Wheel spokes will array in a circle around the 0,0 point

1. Click at 0,0 in this window

2. Type 6 or 8

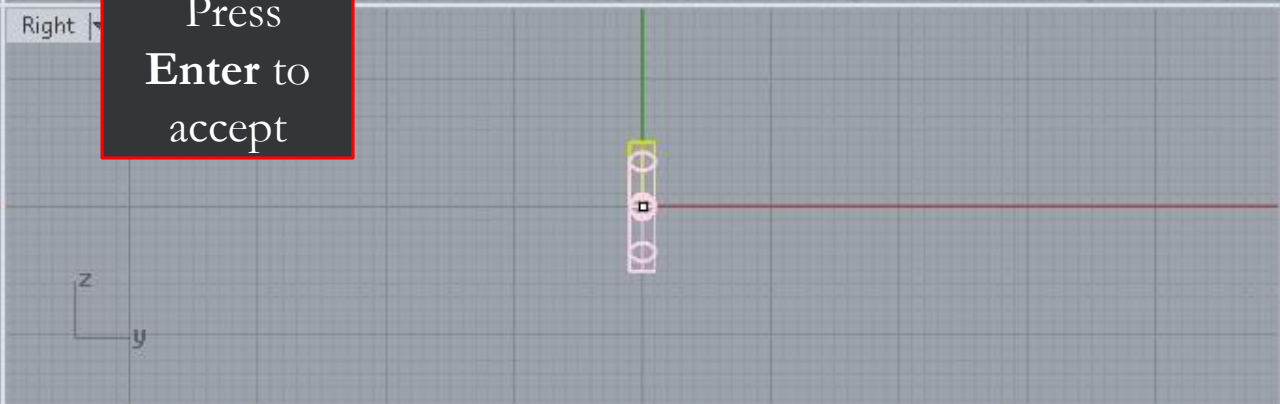
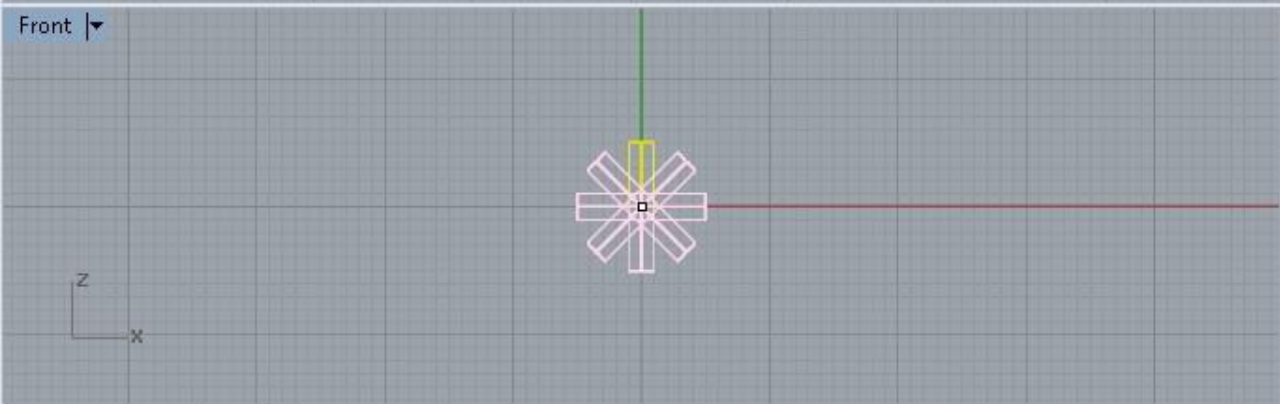
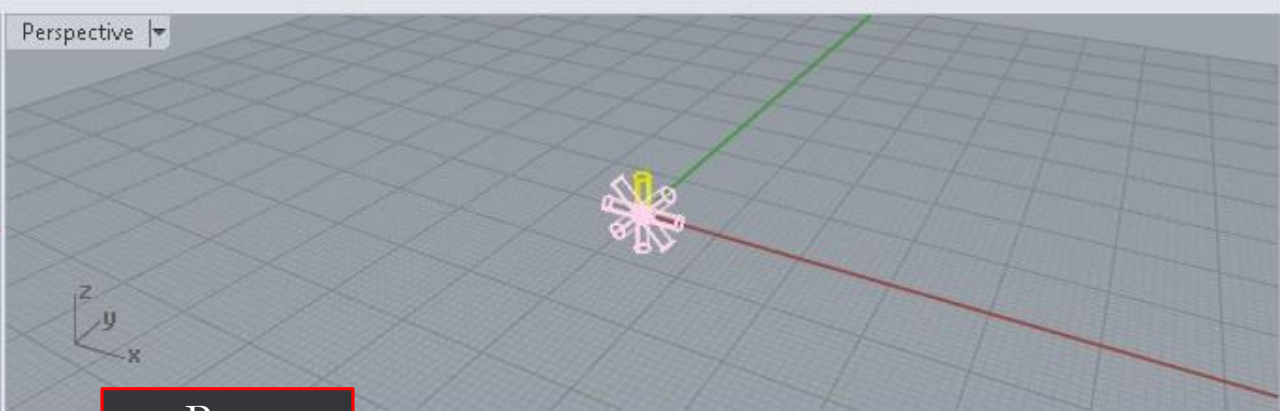
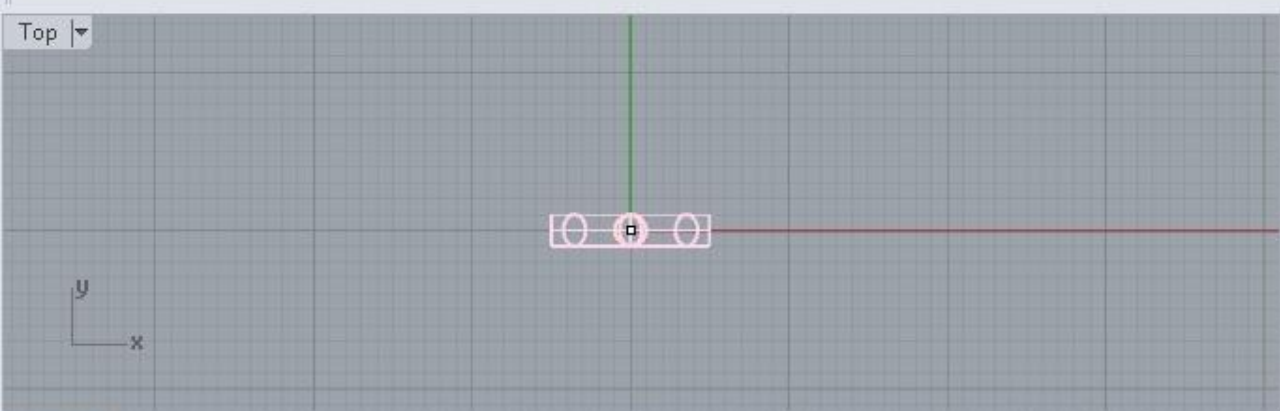
3. Press Enter

Center of wheel spokes

Angle to fill or first reference point <360> ( Preview=Yes StepAngle Rotate=Yes ZOffset=0):

**Press Enter to accept. FillAngle: 360** ([Items=8 FillAngle Rotate=Yes ZOffset=0):

Standard CPlanes



Press  
Enter to  
accept

Perspective Top Front Right

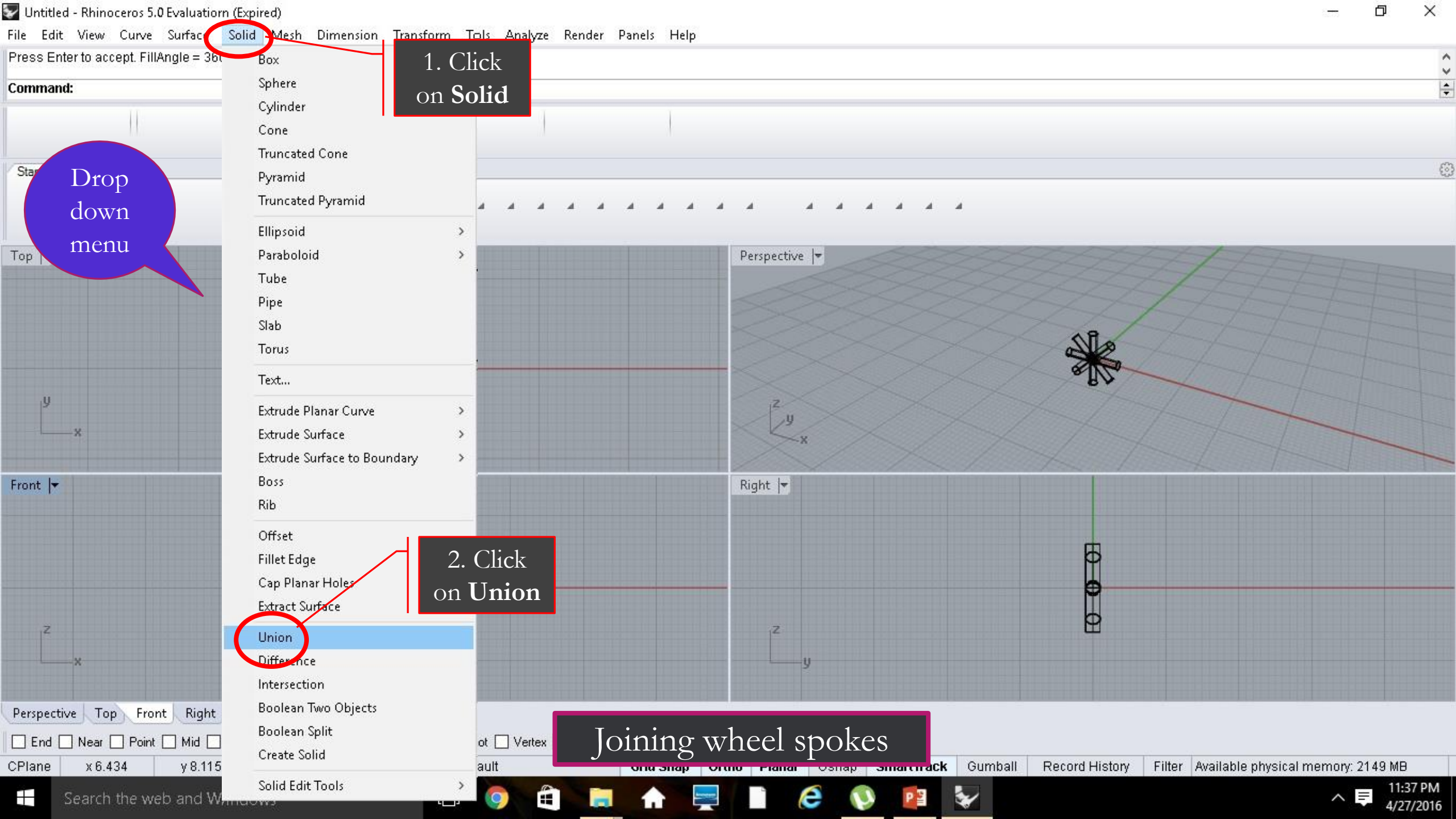
End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot  Vertex  Pr

Wheel Spokes

CPlane x 39.333 y -14.987 z 0.000 Millimeters Default

End Snap Grid Planar Osnap SmartTrack Gumball Record History Filter Minutes from last save: 12





Solid

1. Click on Solid

Drop down menu

2. Click on Union

Union

Joining wheel spokes

Select surfaces or polysurfaces to union:

Select surfaces or polysurfaces to union. Press Enter when done:

Standard CPlanes

Top

Perspective

Front

Perspective Top Front Right

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot  Vertex

CPlane x 12.721 y -15.280 z 0.000 Millimeters Default

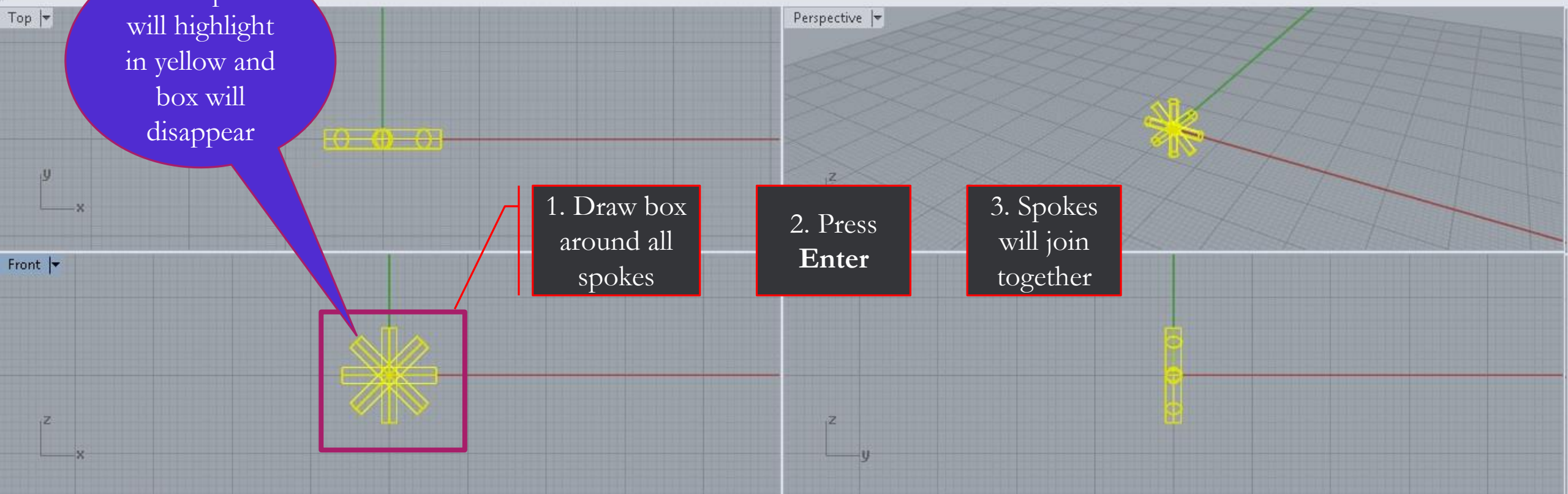
Wheel spokes will highlight in yellow and box will disappear

1. Draw box around all spokes

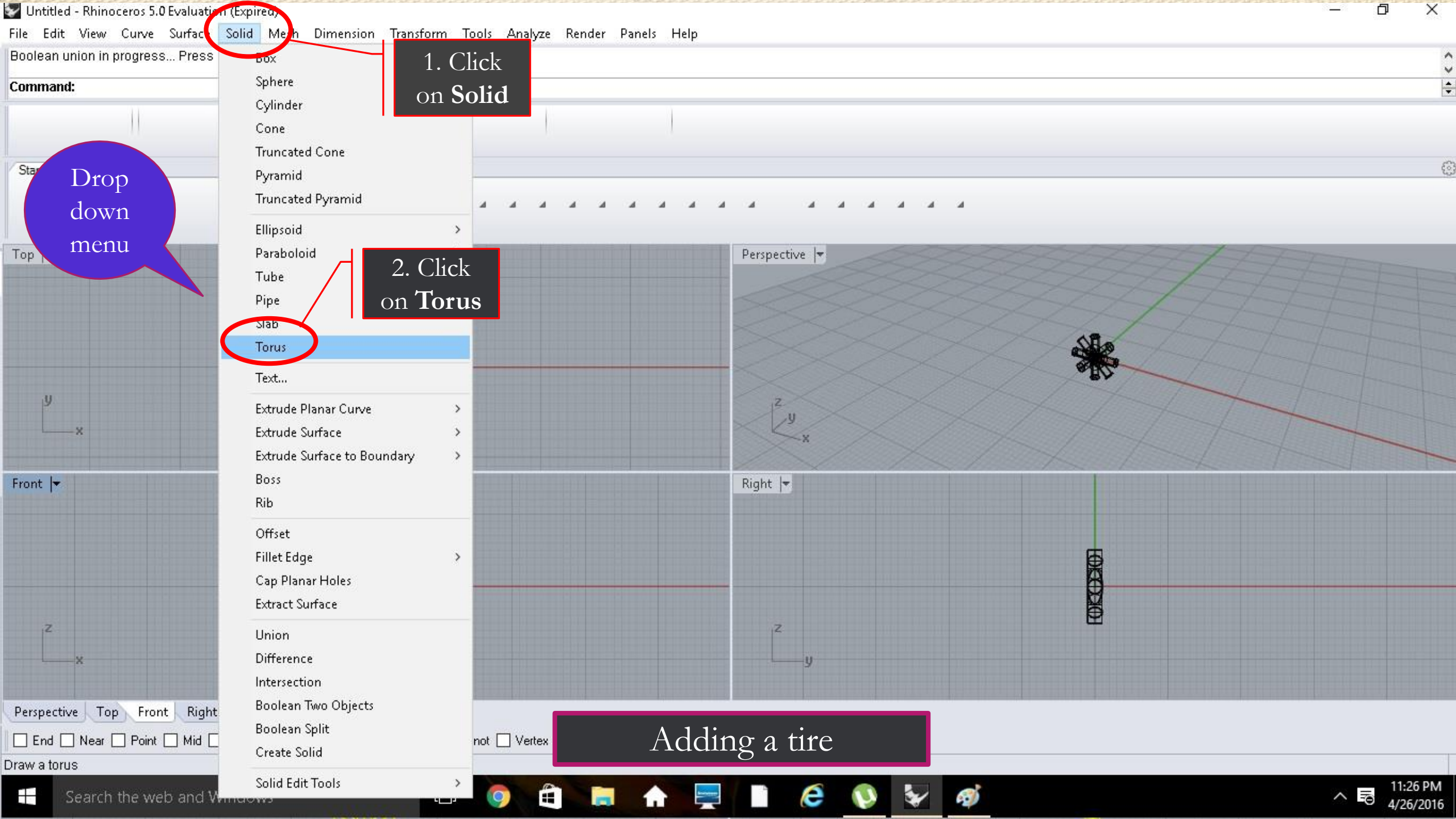
2. Press Enter

3. Spokes will join together

# Joining wheel spokes







Solid

1. Click on Solid

Drop down menu

2. Click on Torus

Torus

Adding a tire

Second radius <0.250> (Diameter FixInnerDimension=No):

Command:

Standard CPlanes

Top

Perspective

Front

Right

Parts have to overlap or they won't join together

1. Click mouse at 0,0

2. Click outer dia just beyond end of spokes

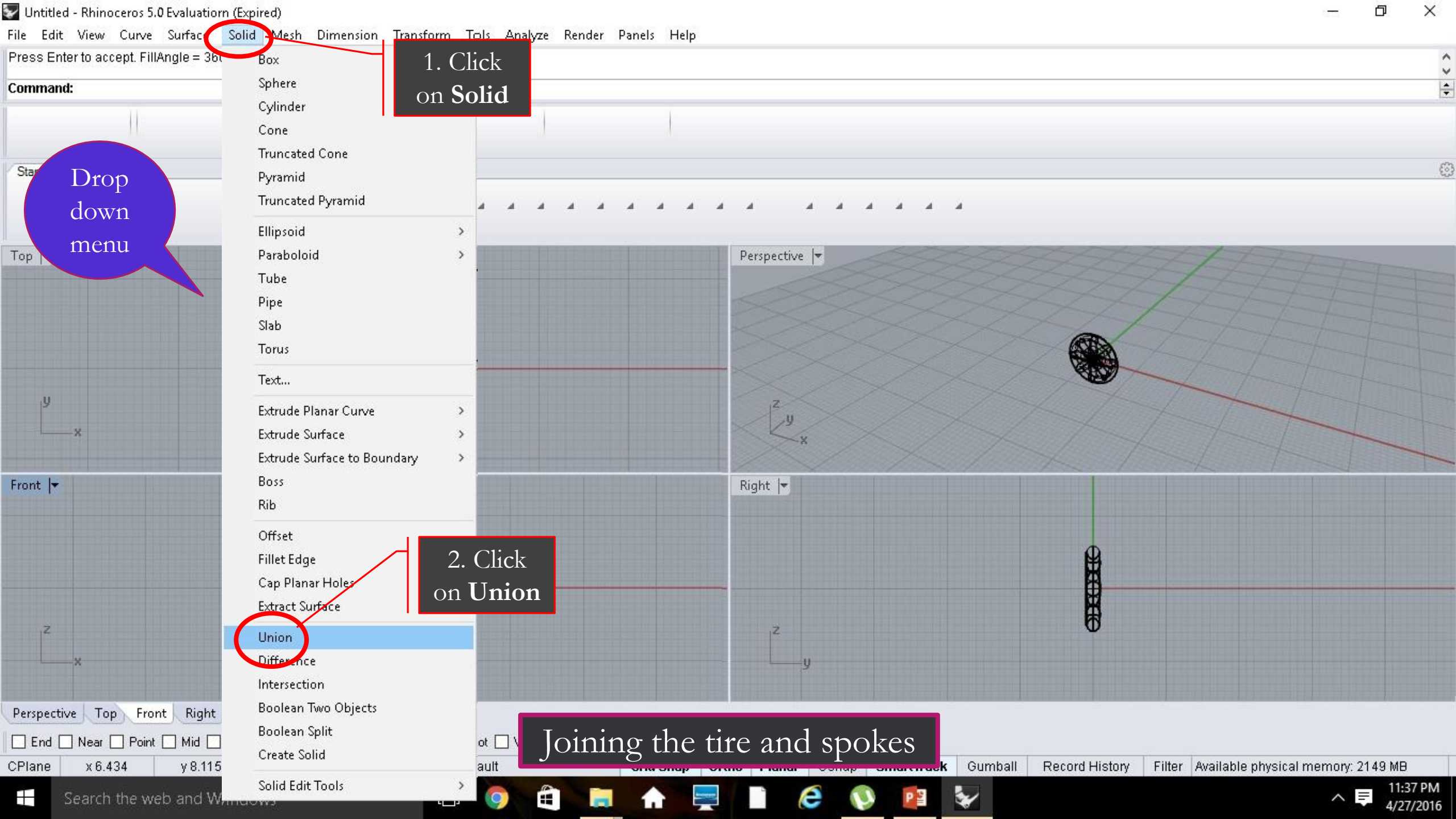
3. Click inner dia just inside outer dia.

# Adding a tire

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot  Vertex

CPlane x-0.499 y 12.851 z 0.000 Millimeters Default  Grid Snap  Grid  Planar  Osnap  Smarttrack  Gumball Record History Filter Memory use: 151 MB





1. Click on Solid

Drop down menu

2. Click on Union

Joining the tire and spokes

Select surfaces or polysurfaces to union:

Select surfaces or polysurfaces to union. Press Enter when done:

Remember to save your work often

Wheel will highlight in yellow and box will disappear

1. Draw box around the wheel

2. Press Enter

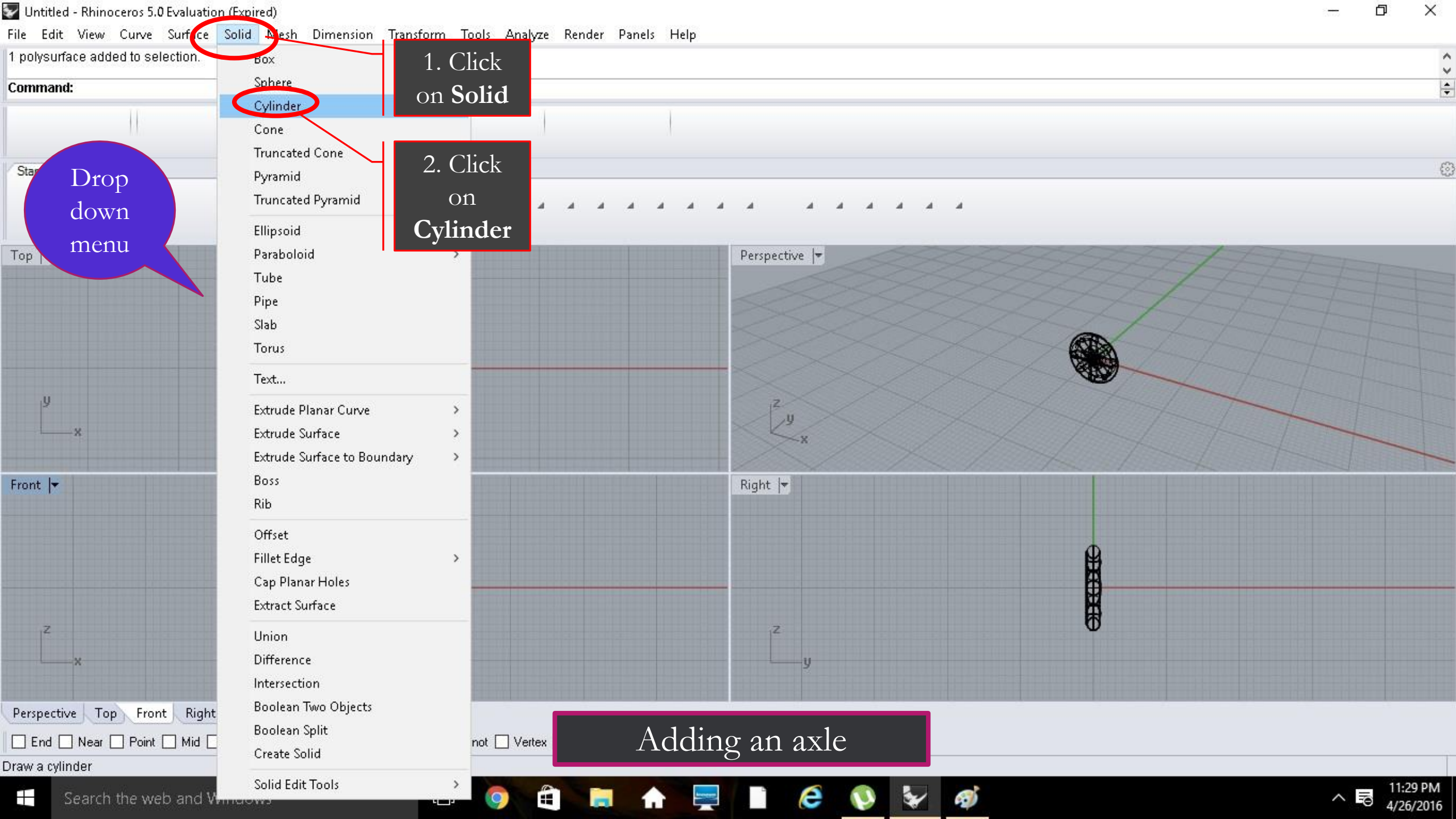
3. Wheel will join together

Joining the tire and spokes

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot

CPlane x 9.805 y -4.559 z 0.000 Millimeters Default On Snap On Grid Planar Osnap SmartTrack Gumball Record History Filter Memory use: 172 MB





Solid

1. Click on Solid

Drop down menu

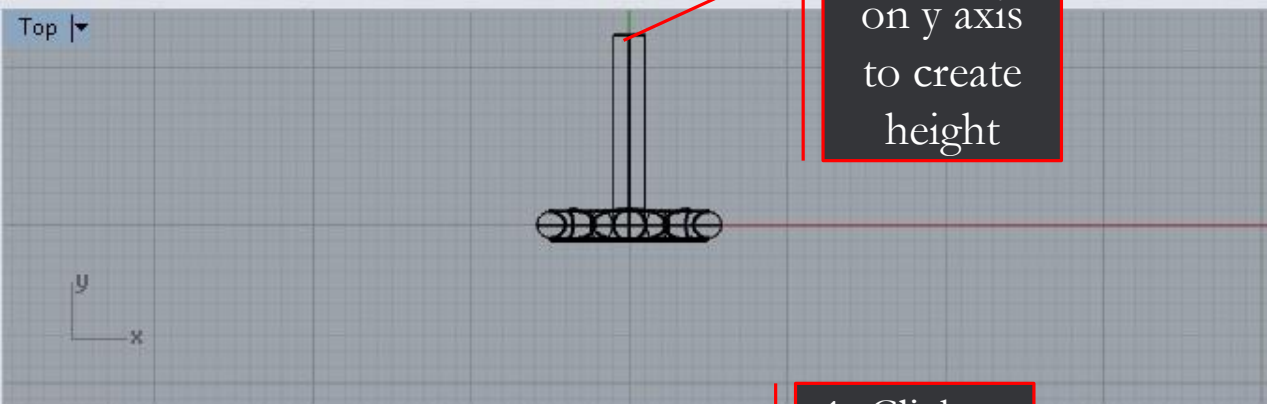
2. Click on Cylinder

Adding an axle

End of cylinder <5.000> ( DirectionConstraint=Vertical BothSides=No ):

Command: |

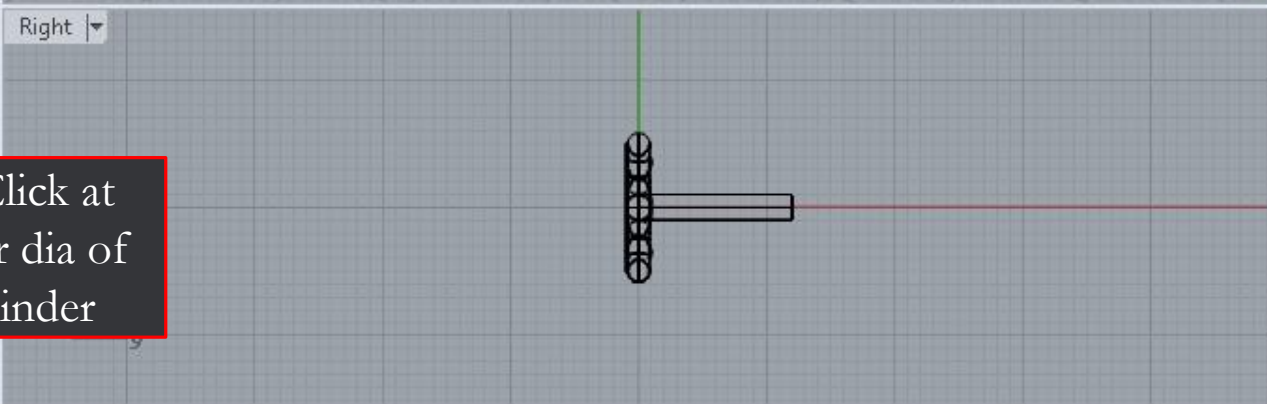
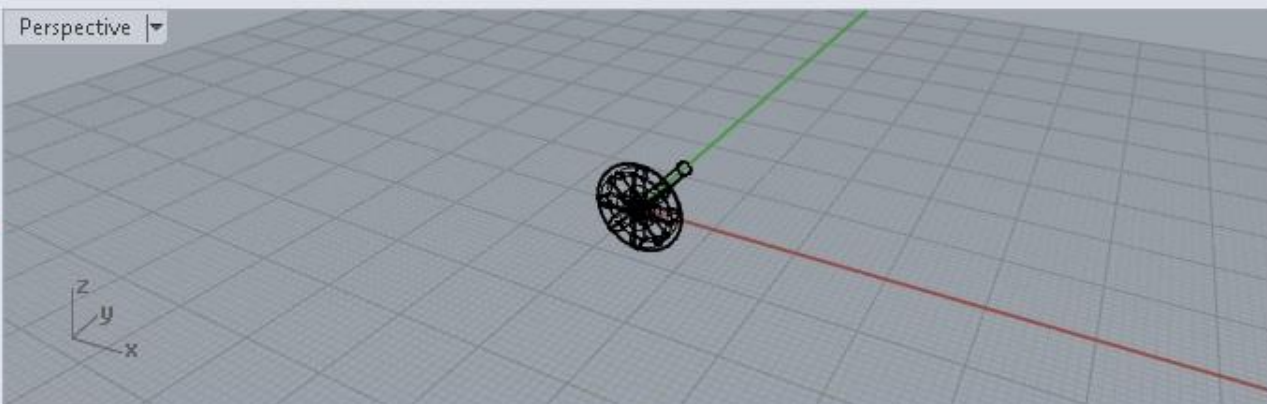
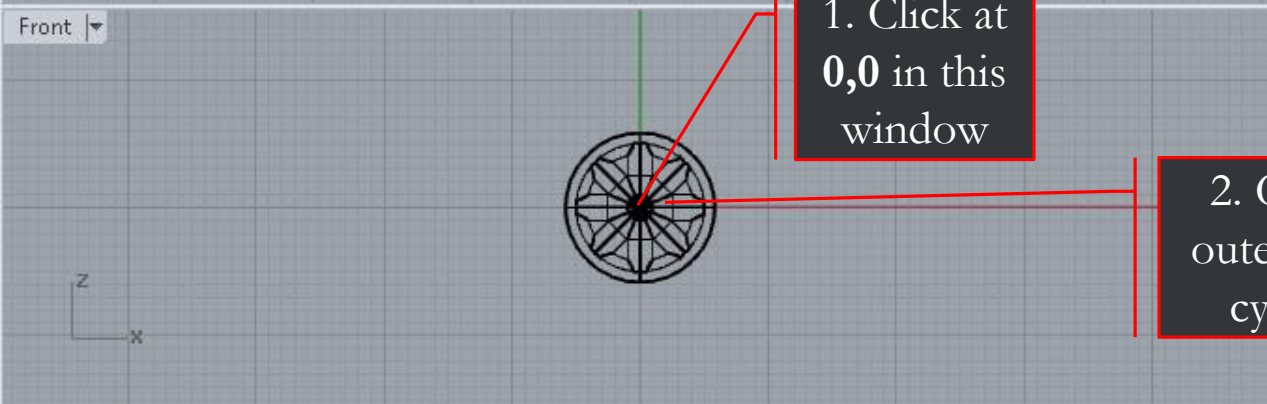
Standard CPlanes



3. Click on y axis to create height

1. Click at 0,0 in this window

2. Click at outer dia of cylinder



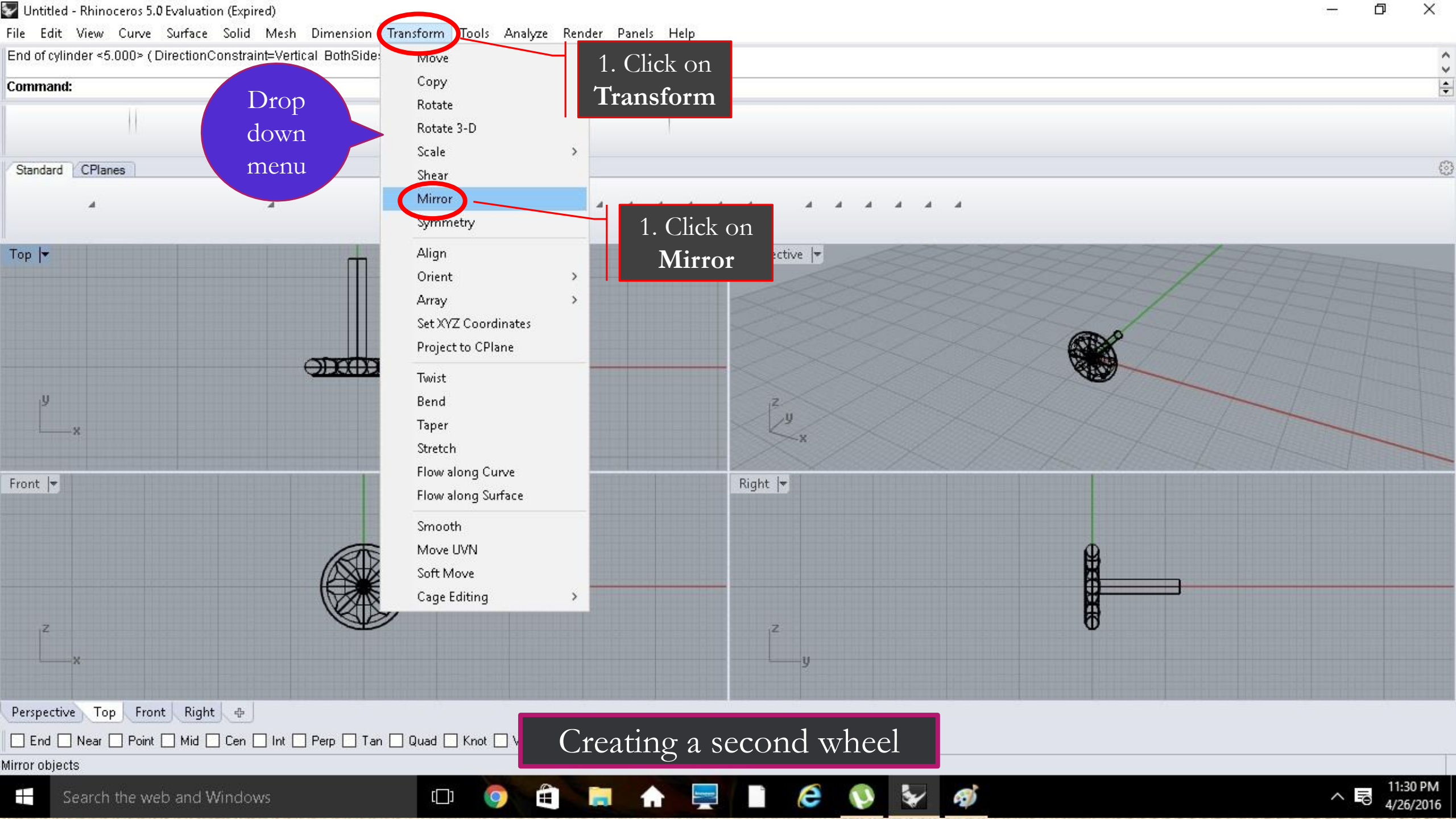
Perspective Top Front Right

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot  Vertex

CPlane x 0.000 y 12.000 z 0.000 Millimeters Default

Creating an axle





1. Click on Transform

Drop down menu

1. Click on Mirror

Creating a second wheel

Select objects to mirror. Press Enter when done:

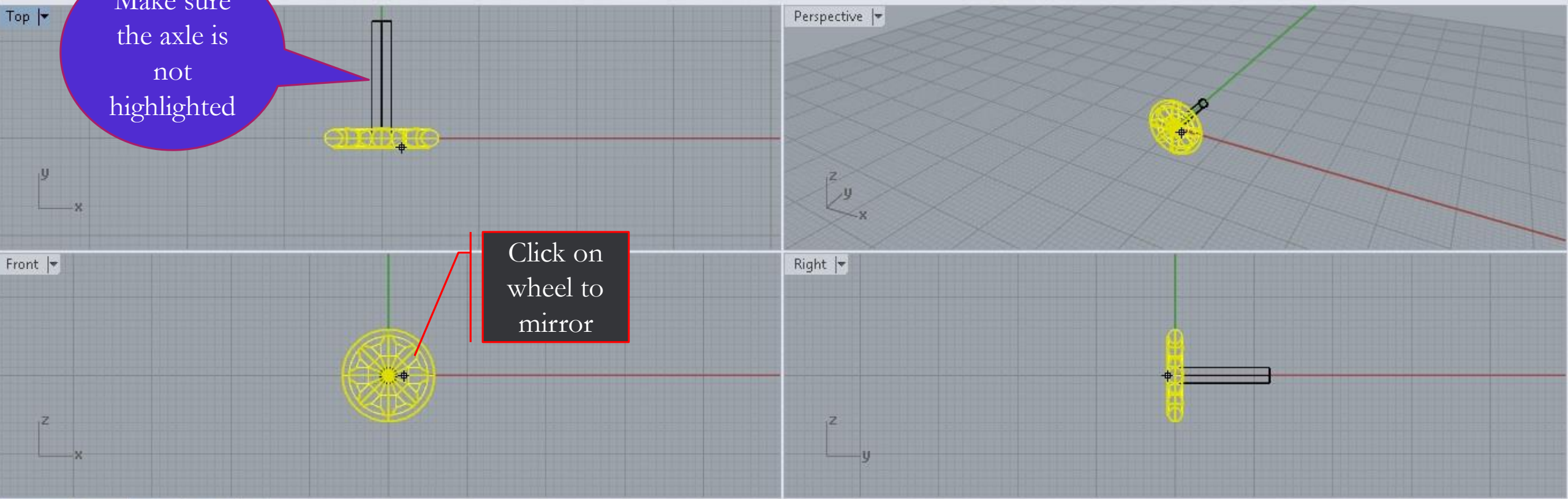
Start of mirror plane (3Point Copy=Yes XAxis YAxis):

Standard CPlanes

Make sure the axle is not highlighted

Click on wheel to mirror

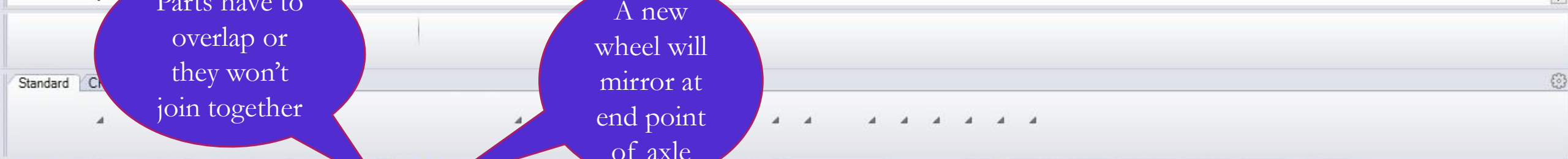
Creating a second wheel





Start of mirror plane (3Point Copy=Yes XAxis YAxis):

End of mirror plane:

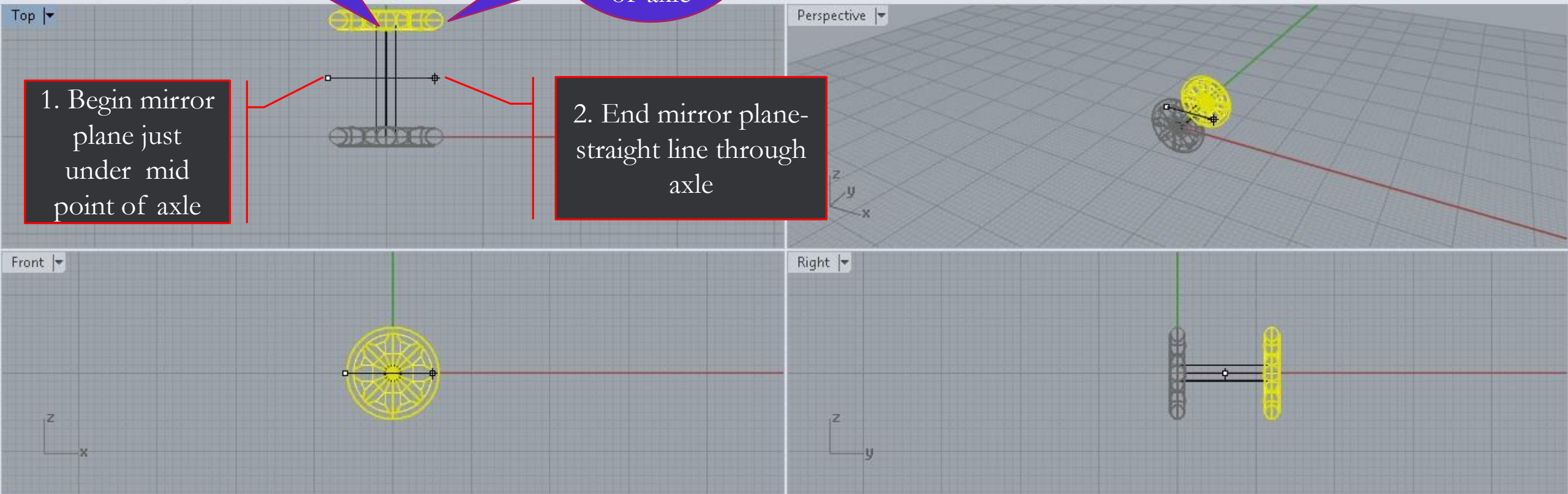


Parts have to overlap or they won't join together

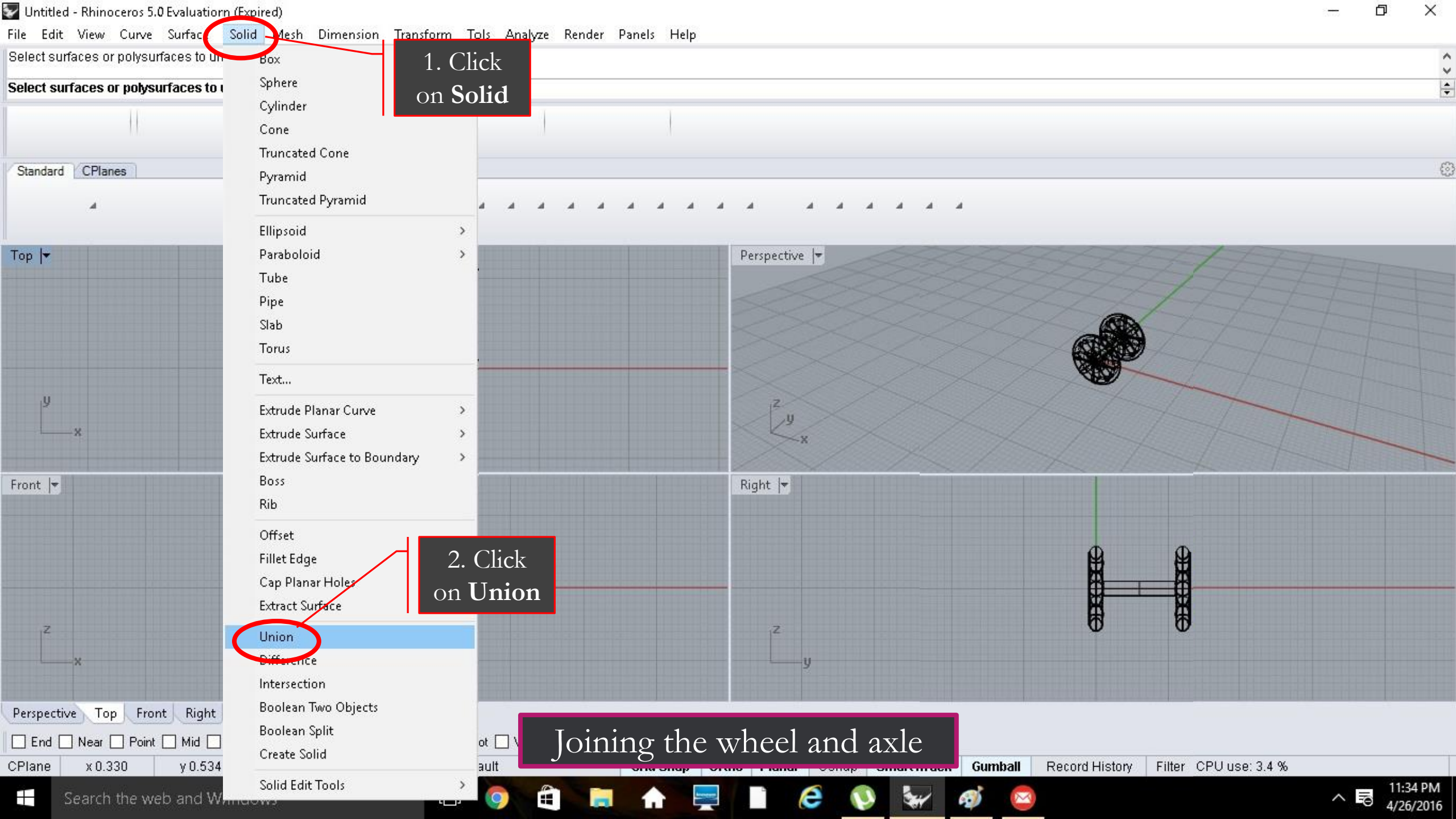
A new wheel will mirror at end point of axle

1. Begin mirror plane just under mid point of axle

2. End mirror plane- straight line through axle



Creating a second wheel



1. Click on Solid

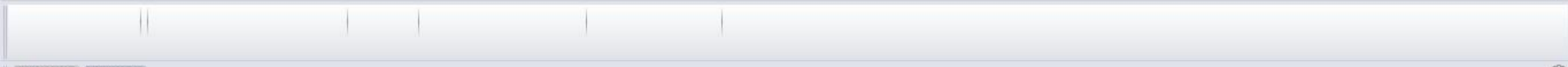
2. Click on Union

Joining the wheel and axle



Select surfaces or polysurfaces to union. Press Enter when done:

Select surfaces or polysurfaces to union. Press Enter when done:



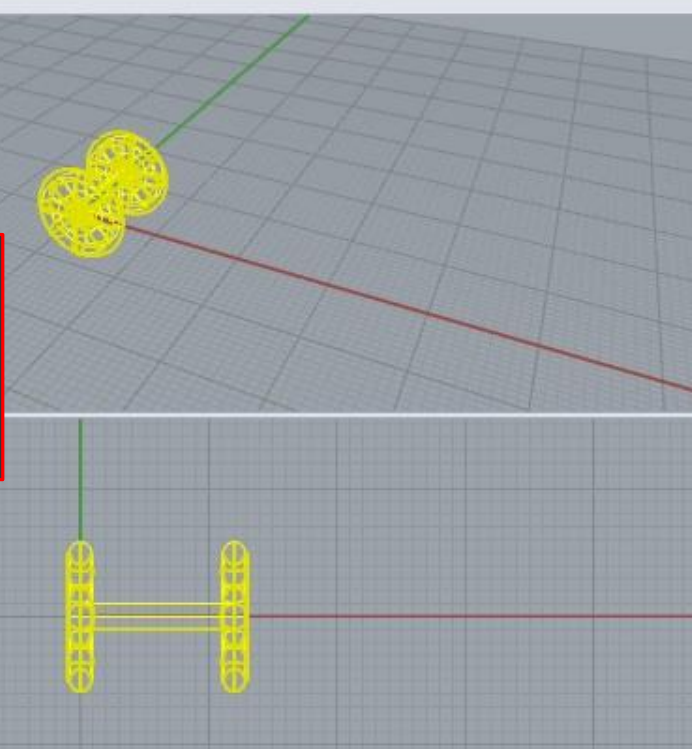
Wheels and axle will highlight in yellow and box will disappear



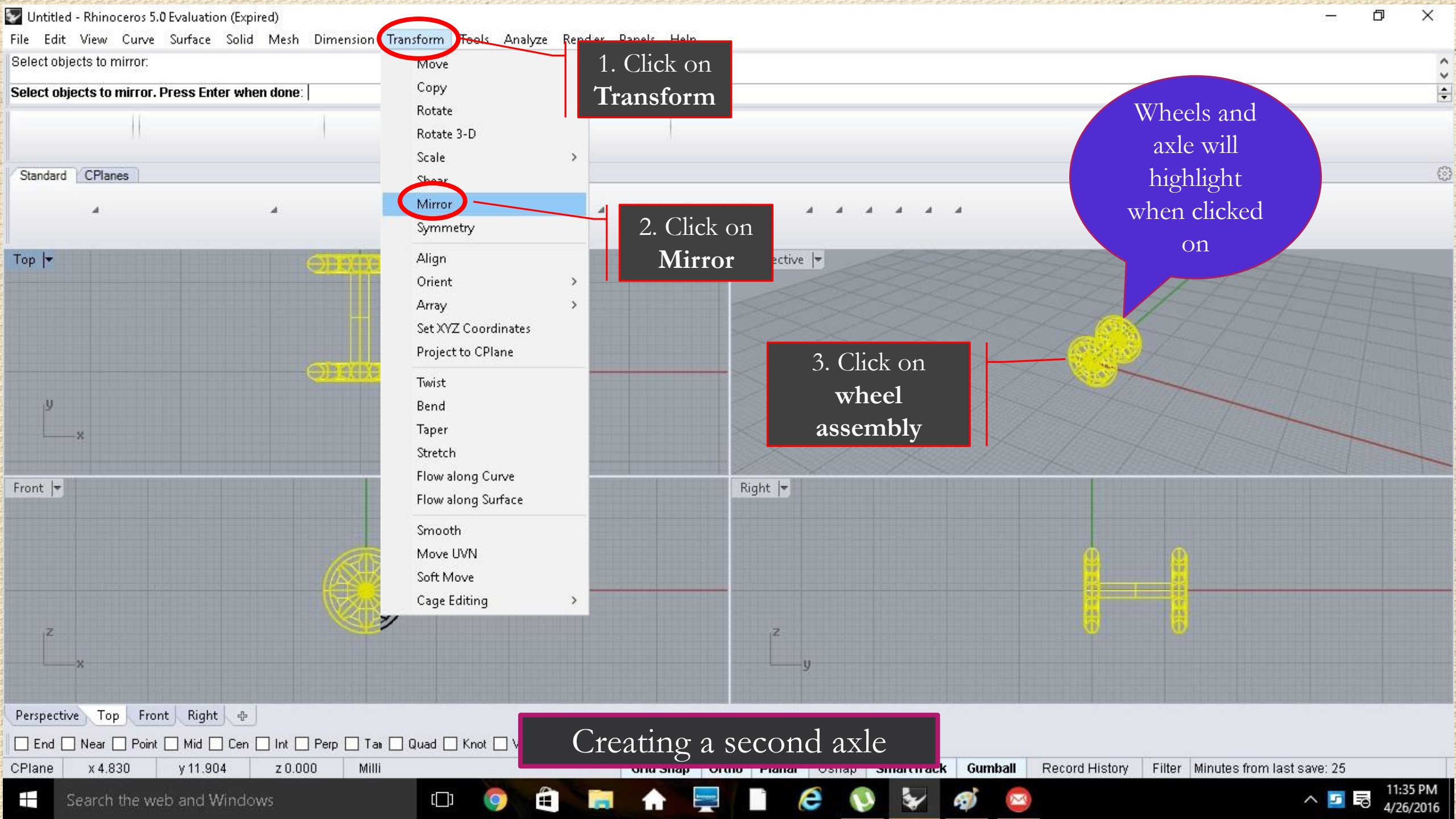
1. Draw box around the wheels and axle

2. Press Enter

3. Wheels and axle will join together



# Joining the wheel and axle



1. Click on Transform

2. Click on Mirror

3. Click on wheel assembly

Wheels and axle will highlight when clicked on

Creating a second axle



Select objects to mirror:

Select objects to mirror. Press Enter when done

Standard CPlanes

Top

y x

Front

z x

Perspective Top Front Right

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot  V

CPlane x 4.830 y 11.904 z 0.000 Millimeters Default

Creating a second axle

Begin Mirror line  
1/2 length  
between axles

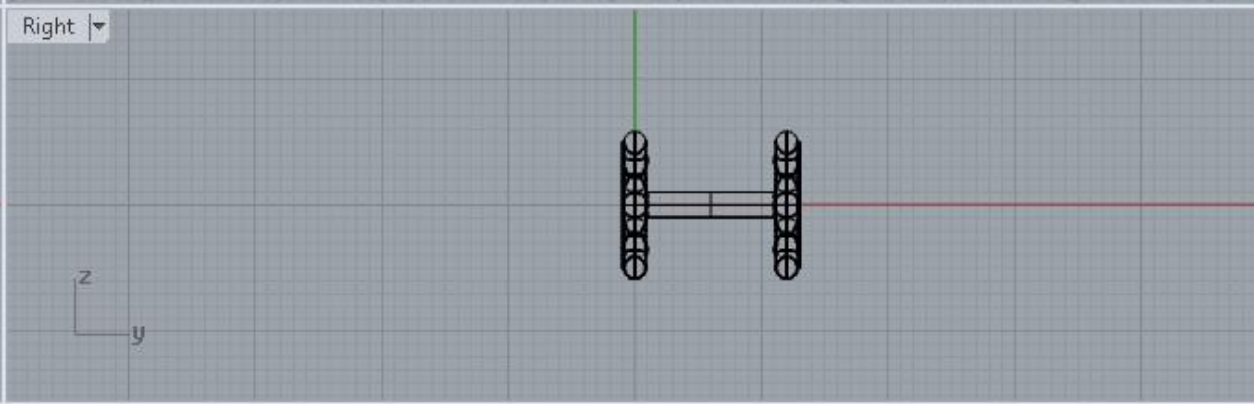
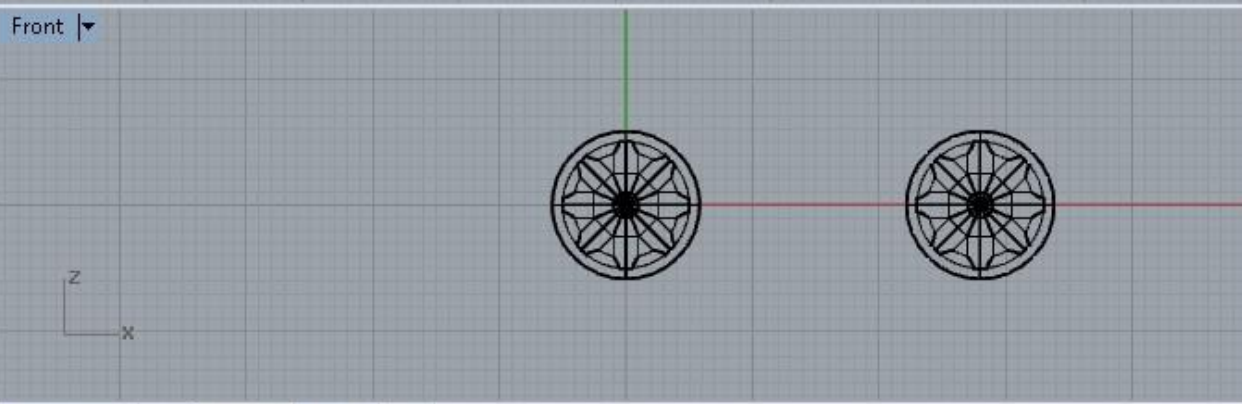
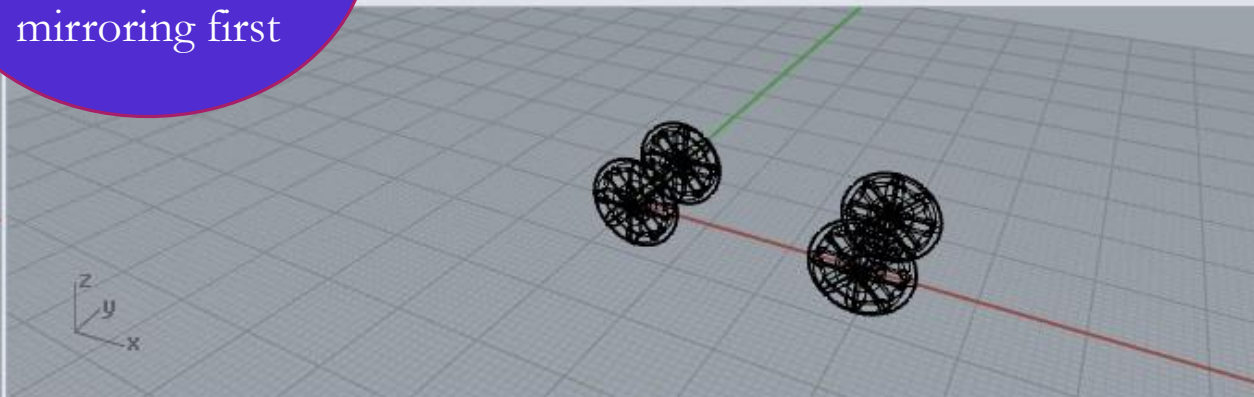
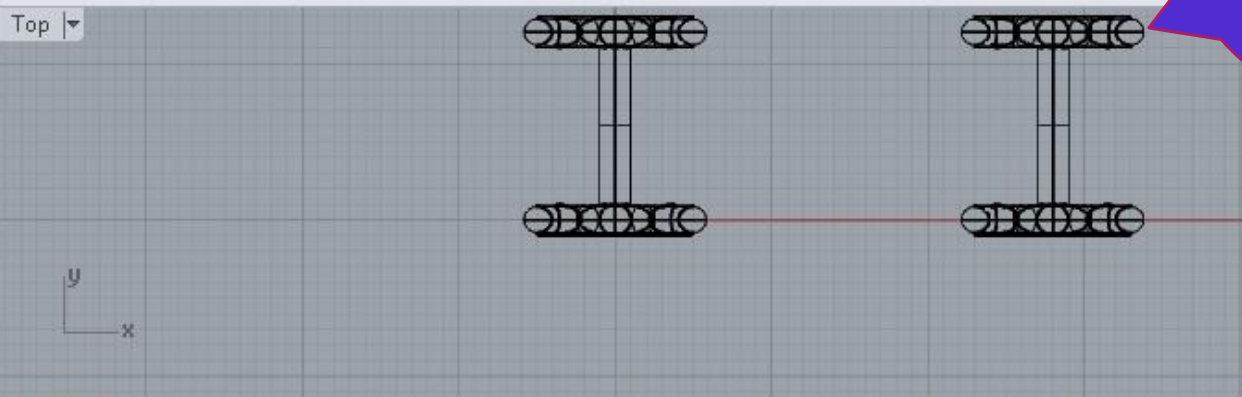
2. End Mirror line-  
straight line parallel  
to axle

End of mirror plane ( Copy=Yes ):

Command:



Second wheel axle will appear mirroring first



Perspective Top Front Right

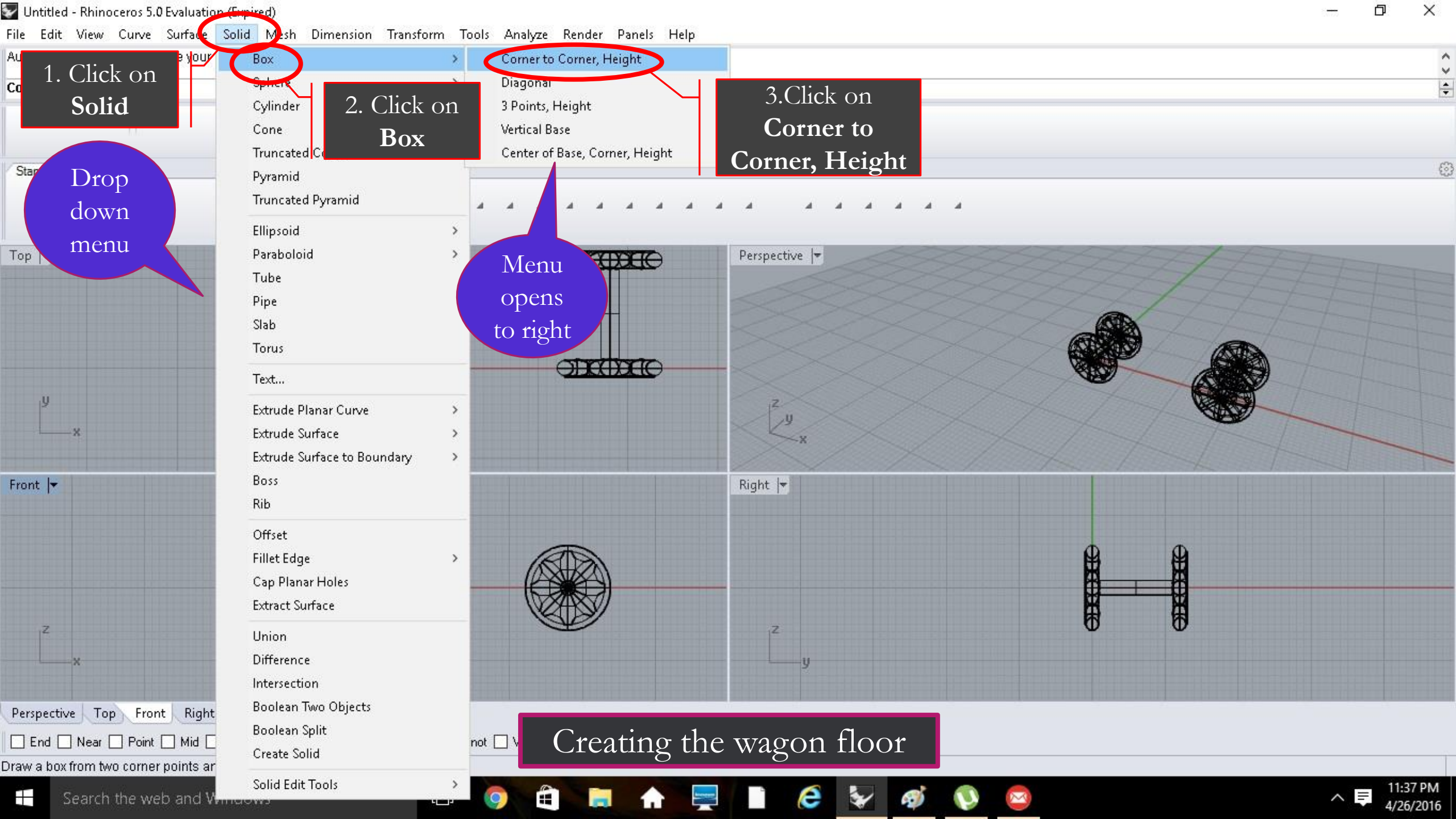
End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot

CPlane x 14.000 y 12.000 z 0.000 Millimeters Default

Creating a second axle

Gumball Record History Filter Minutes from last save: 25





1. Click on Solid

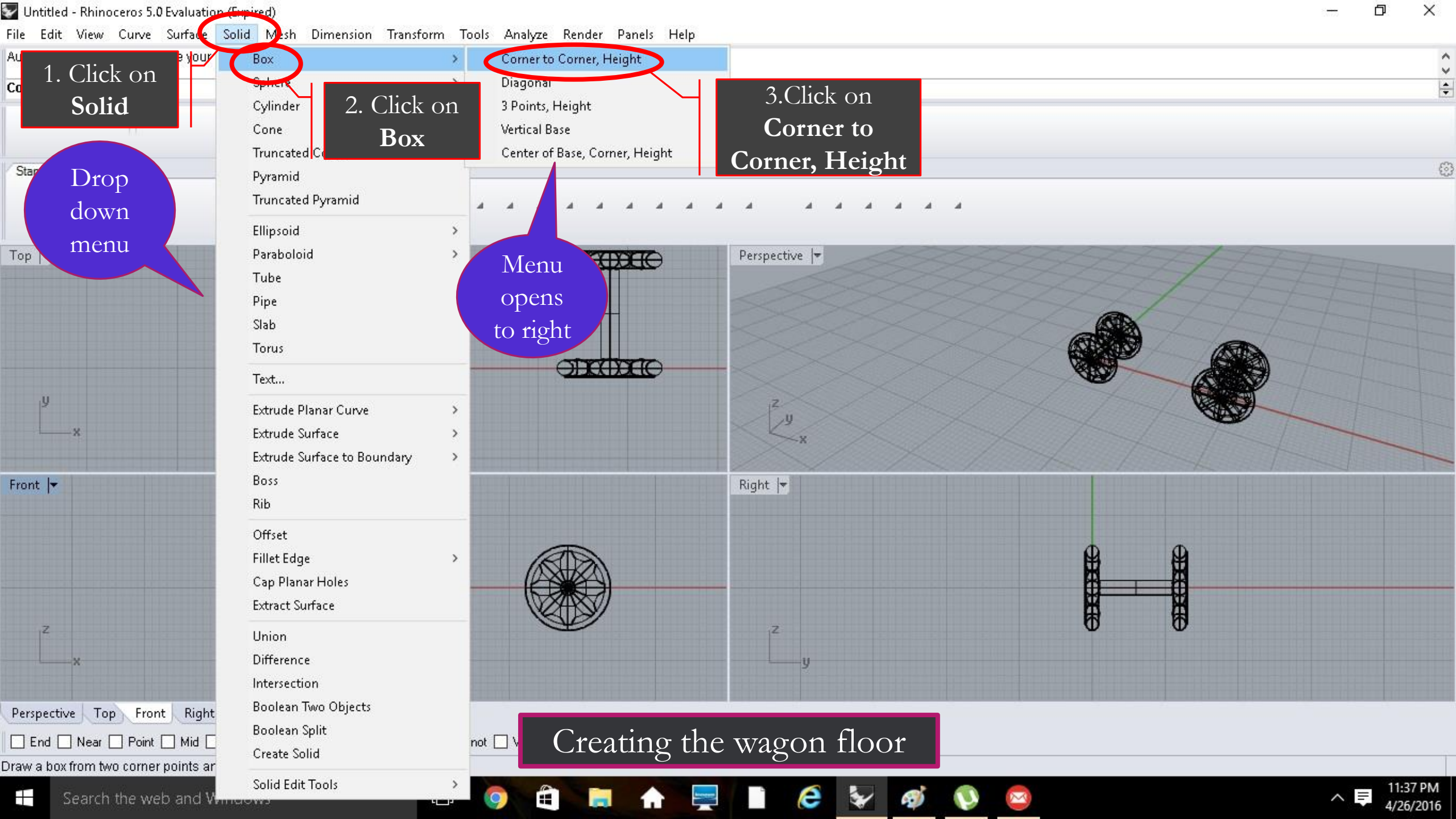
2. Click on Box

3. Click on Corner to Corner, Height

Drop down menu

Menu opens to right

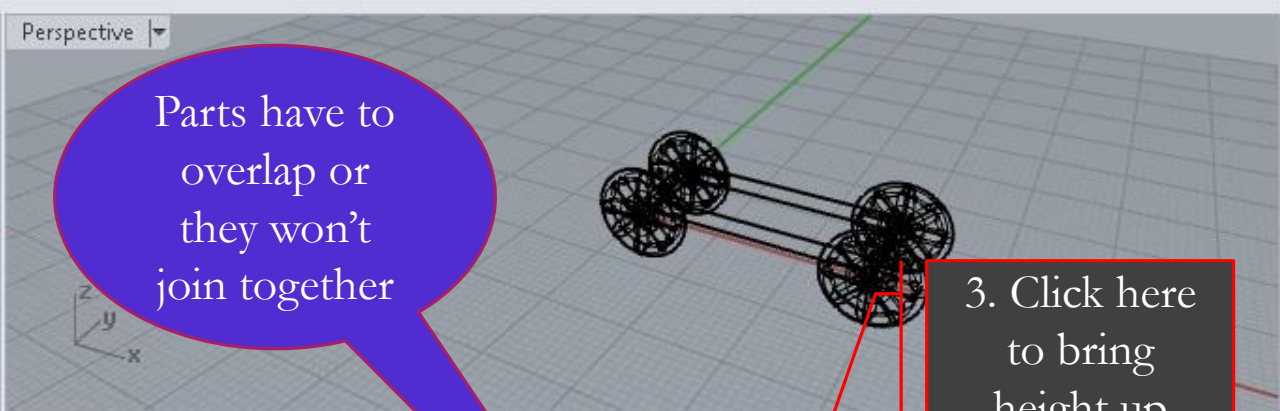
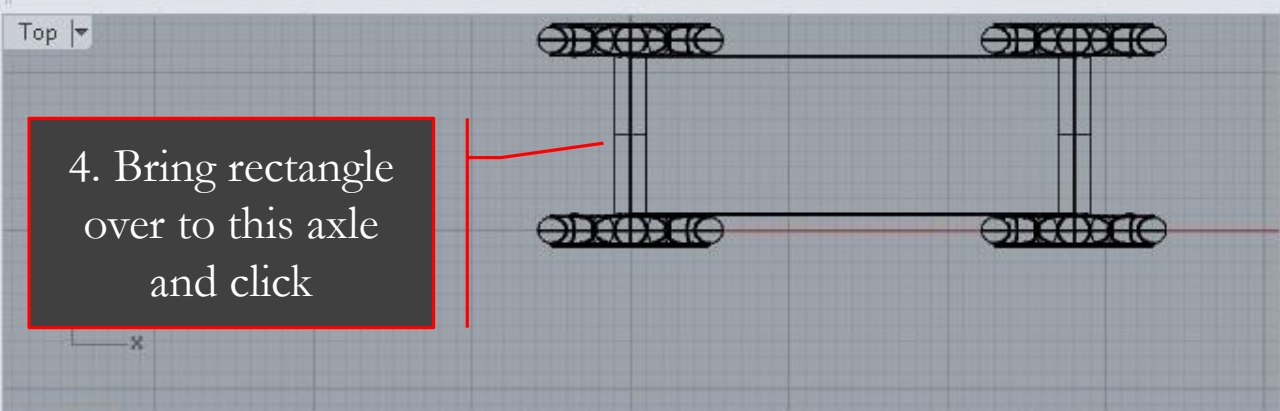
Creating the wagon floor



Height. Press Enter to use width:

Command:

Standard CPlanes



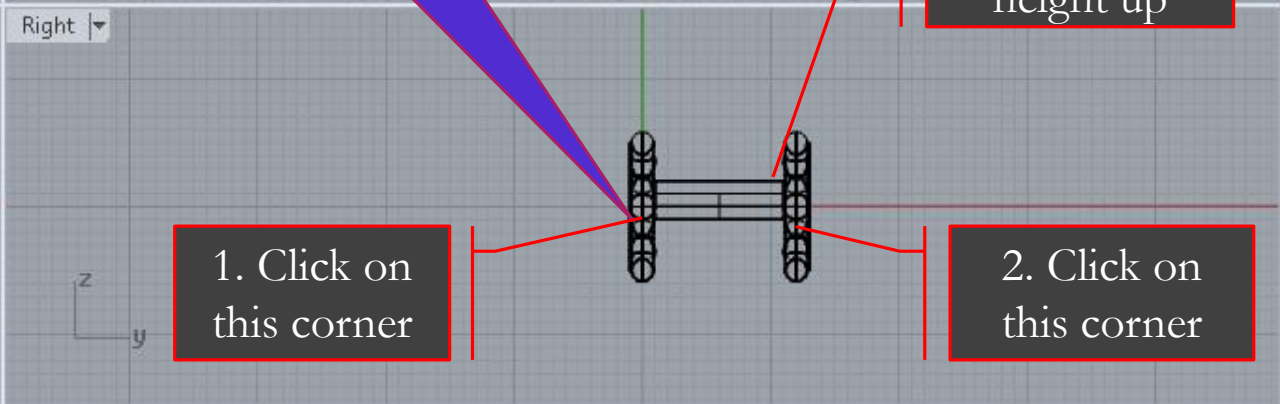
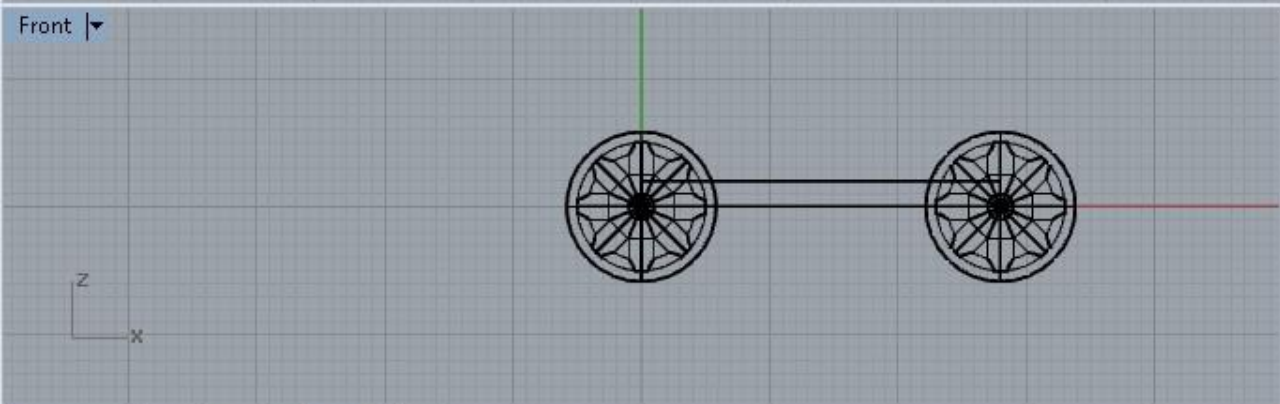
4. Bring rectangle over to this axle and click

Parts have to overlap or they won't join together

1. Click on this corner

3. Click here to bring height up

2. Click on this corner



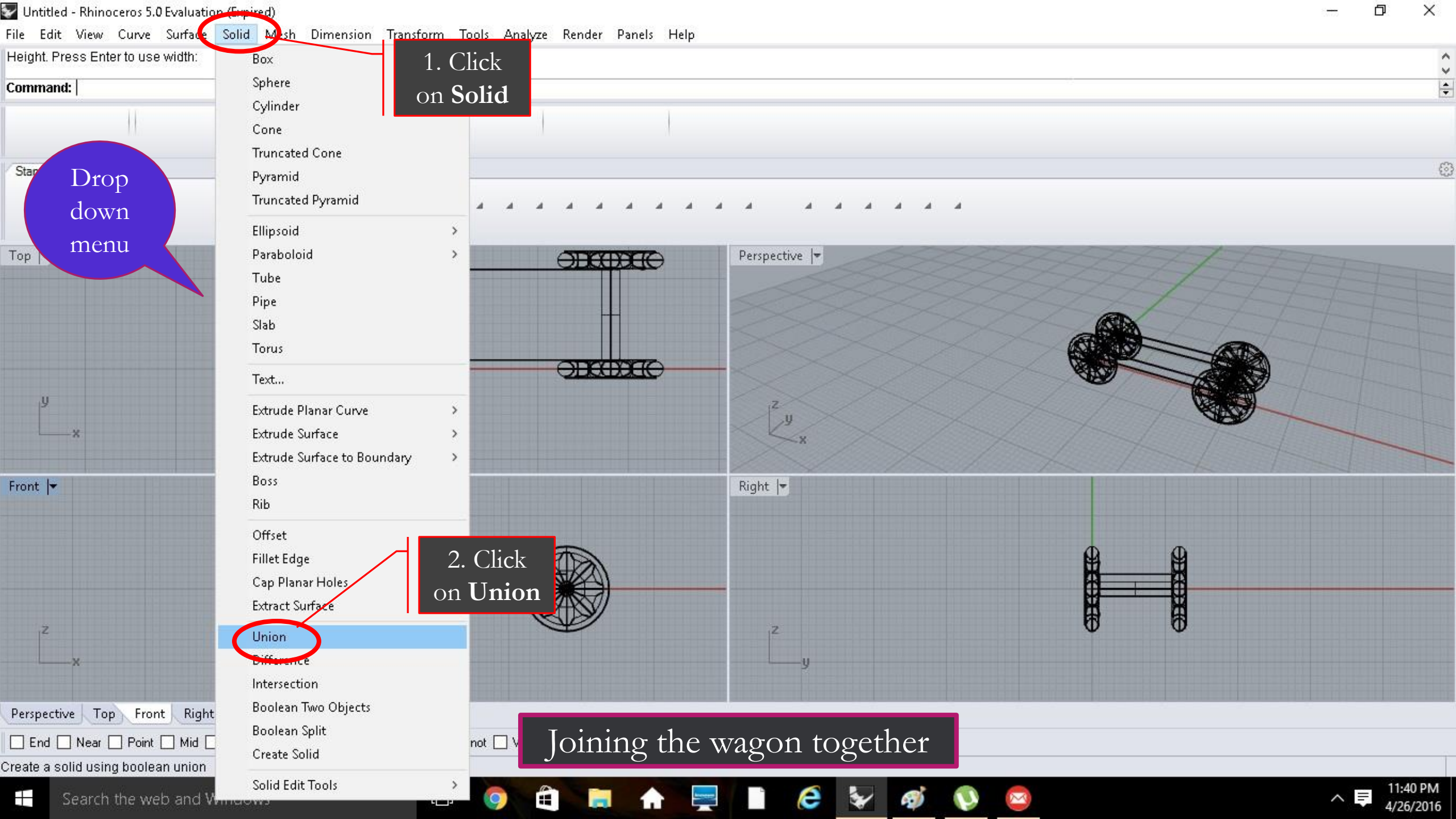
Perspective Top Front Right

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot

CPlane x 4.949 y 12.970 z 0.000 Millimeters Default

# Creating the wagon floor





1. Click on Solid

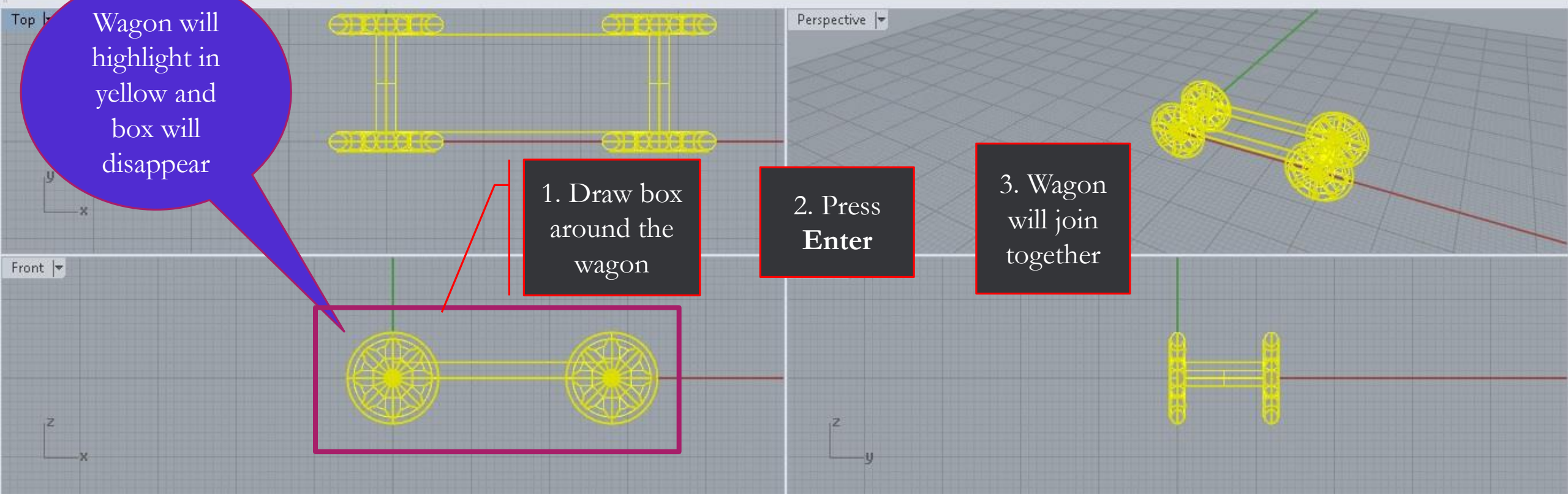
Drop down menu

2. Click on Union

Joining the wagon together

Select surfaces or polysurfaces to union. Press Enter when done:  
Select surfaces or polysurfaces to union. Press Enter when done:

Standard CPlanes



Wagon will highlight in yellow and box will disappear

1. Draw box around the wagon

2. Press Enter

3. Wagon will join together

Joining the tire and spokes



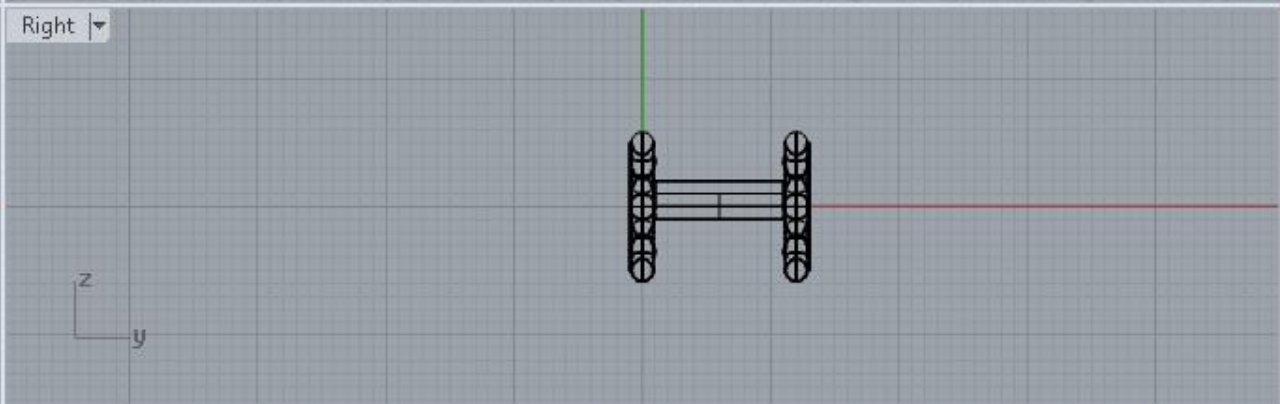
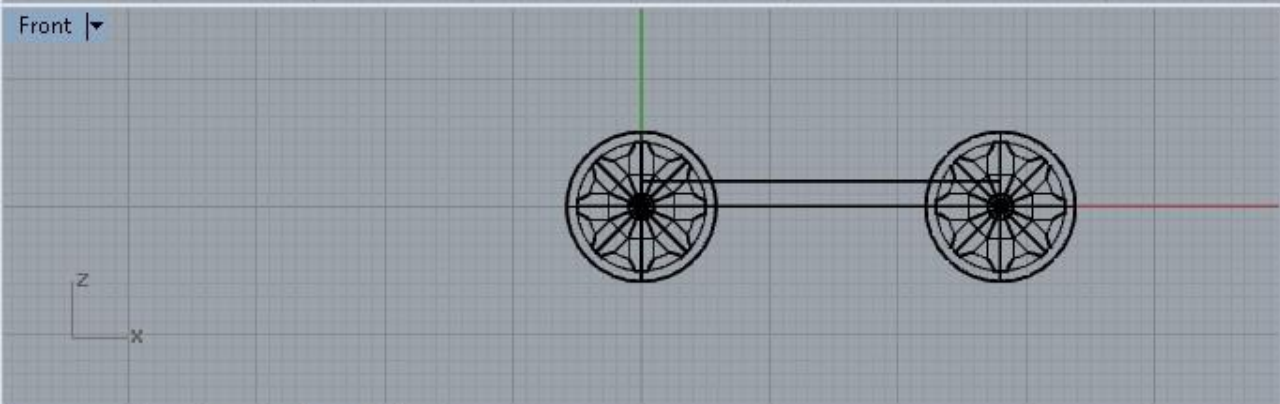
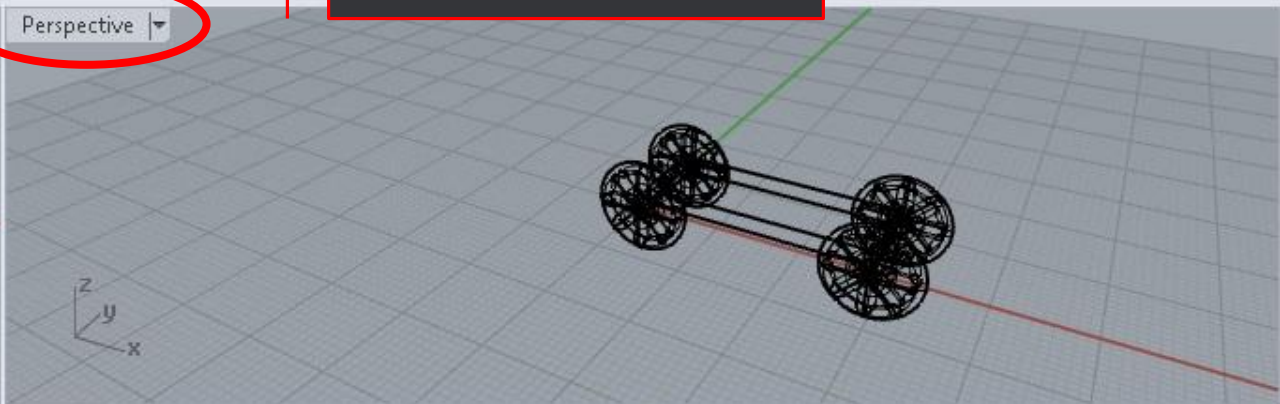
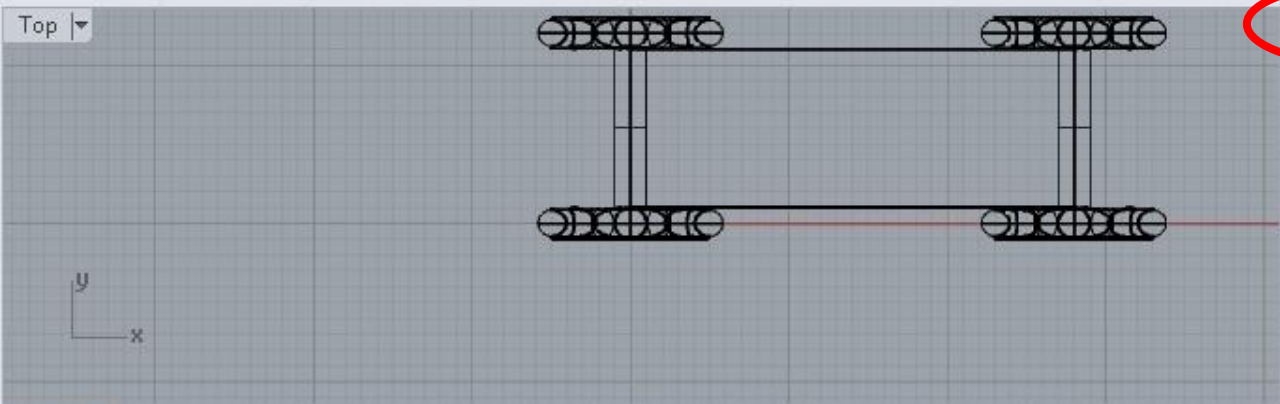
Height. Press Enter to use width:

Command:

2. Click on **Render**

1. Click on this window and be sure the **Perspective** tab is highlighted in blue

Perspective

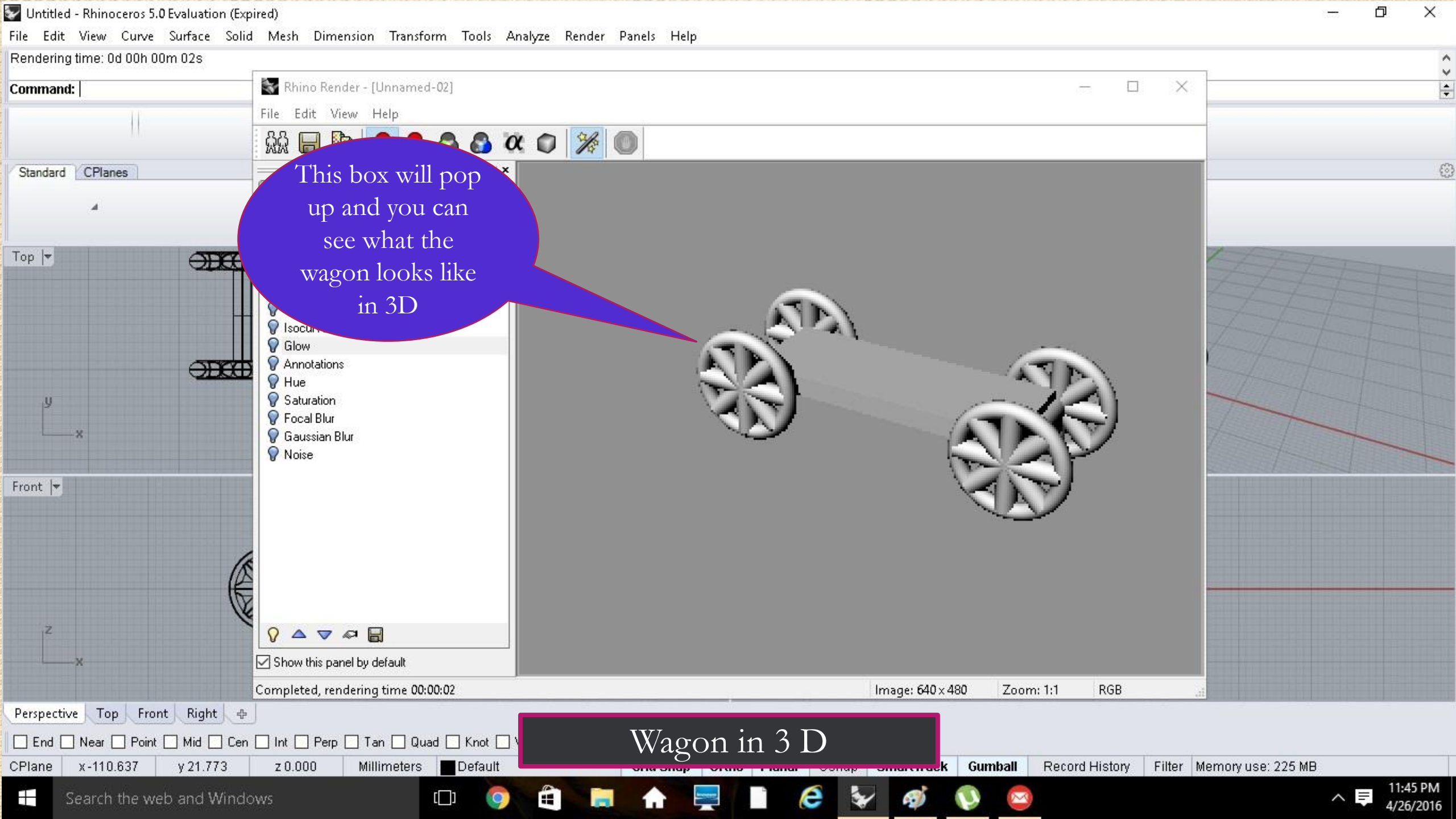


Perspective Top Front Right

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot

CPlane x 4.949 y 12.970 z 0.000 Millimeters Default

Rendering the wagon in 3D



This box will pop up and you can see what the wagon looks like in 3D

Wagon in 3 D



*Congratulations!*

