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DRAW A 3D LETTER KEYCHAIN IN AUTOCAD

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Course summary

In this course, students of the compulsory education school learn the basic commands and drawing techniques in a CAD environment. Acquiring knowledge about a typical drawing technique in a CAD software, in order to create a 3D object from a 2D design (extrude command). Learn to use elementary knowledge of geometry and mathematics connecting with drawing (Straight line, coordinate axes, the z axis).

Course facts in brief

Time: 4x45 min

Number of pupils: 55

Number of supervisors: 6

Number of groups: 4

Age of pupils: 12+

Prerequisites for students: A review at some geometrical terms and definitions (coordinate system, x,y,z coordinates etc)

Prerequisites for supervisors: Learn AutoCad simple commands in order to be able to draw a 3D letter**,** learned about “slicer” program 3D printing.

Disclaimer

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Introduction

Background

Society's and business's need for people with technical knowledge is increasing, at the same time as the interest in applying for technical education is decreasing or at least not increasing to a sufficient extent. Something should therefore be done so that more young people will choose technical both vocational and pre-school education in upper secondary school.

Purpose

The purpose of these lessons is to allow younger students in compulsory education school to come into contact with interesting technology they have not worked with before, while they are supervised by older students who attend vocational technical high school. The older students become a bit of a role models and they can more easily transfer their youthful enthusiasm, interests and attitude over technology to the younger students.

Method

The younger students are given the task of solving a technical problem, for example to program a Lego robot, construct a game in CAD and print it on a 3D printer or to mill the game in the workshop together with high school students based on the drawing they created in CAD. To succeed in this, the older students must teach and supervise the younger students the current technology. The contact between the younger and older students around concrete tasks can create conditions for both arousing and deepening interest in technology.

DRAW A 3D LETTER KEYCHAIN IN AUTOCAD

Preparations in high school

The high school students have taken AutoCad courses and especially the steps and the technique of how we can draw a 3-dimensional object using this software This object is a whistle, and they had a template for the outline shape. This simplified more the process of drawing and gives a note of a game to it. They have also learned about the limits which exist in 3D drawing when the drawing is for 3D printing.

Finally, they learned to use a"slicer" software in order to convert the 3D object to a 3D printable file and print it out.

Preparations in primary school

The only preparations in compulsory school was to find suitable dates for the courses So, after communication between the compulsory and high school there were set 2 visits in the compulsory school, in class A, (A1,A2,A3 classes) and in class B, (B1,B2, B3classes) , each class had 12-15 students. The number of the supervisor students were 2 at each class. Also, the 3D printer was carried to the compulsory school for the 3D printings.

Implementation

The high school students went to the compulsory school carried with them the 3D printer and met with the younger students' classes and with their teachers. They taught and supervised totally 55 students in various classes. In 2 classes there was the capability for the younger pupils to sit in front of a PC per pair, so they simultaneously follow every step of the high school's students in drawing the whistle using the AutoCad.

After completed the drawing, the younger pupils under the supervision of the high school's students made use of the 3D printer in order to print 3D letters.

Evaluation

When the students have attended the courses, an evaluation is made of how they experienced the CAD course and the 3printing implementation and of how their teachers felt that the course worked for the students. The purpose is to get tips on how we can improve future courses. Supervisors should also be allowed to evaluate their participation. The evaluation is done with the help of the tool Google Form.

3D MODEL DESIGN USING CAD and ready to Print it

What is a CAD program?

CAD stands for Computer-Aided Design and is the use of computers (or workstations) to help create, modify, analyze or optimize a design.

To draw various geometric objects in AutoCad, we select a command/tool and then follow a specific execution order.

We are going to draw step by step , using 7 of the most basic AutoCAD's commands ,a 3D letter with a ring ready to 3D print it and use it as a keychain.

✓OBJECTIVES

- Gain an overview of how-to use of α CAD program to draw a 3D model from the design until the part is printed.
- Use of α CAD software to draw a 3D model for printing.

✓LEARNING OUTCOMES

Knowledge

- Gain knowledge about designing with AutoCad software.
- Acquiring knowledge of the basic commands and drawing techniques in a CAD environment.
- Acquiring knowledge about a typical drawing technique in CAD software, in order to create a 3D object from a 2D design (extrude command).
- Incorporation of elementary knowledge of geometry and mathematics. (Straight line, coordinate axes, the z axis etc).

Competence

- Gain skills to be able to design a 3D letter in AutoCad with a specific step-by-step drawing technique.

✓RECOMMENDED TRAINING METHODS

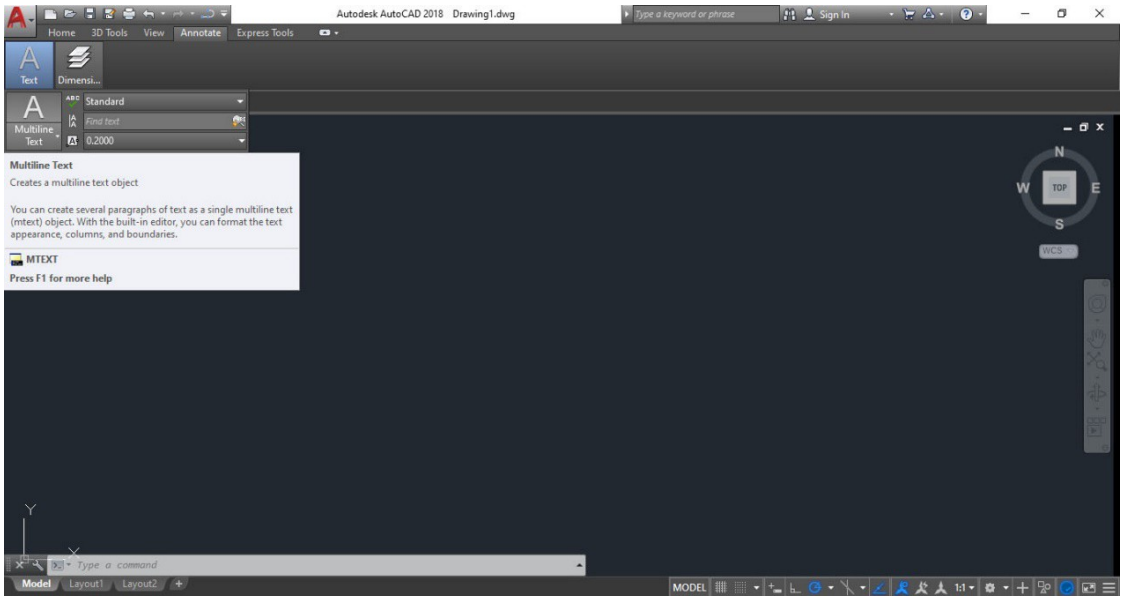
- Interactive theory.
- Examples.
- Object design.

DRAW A 3D LETTER KEYCHAIN IN AUTOCAD

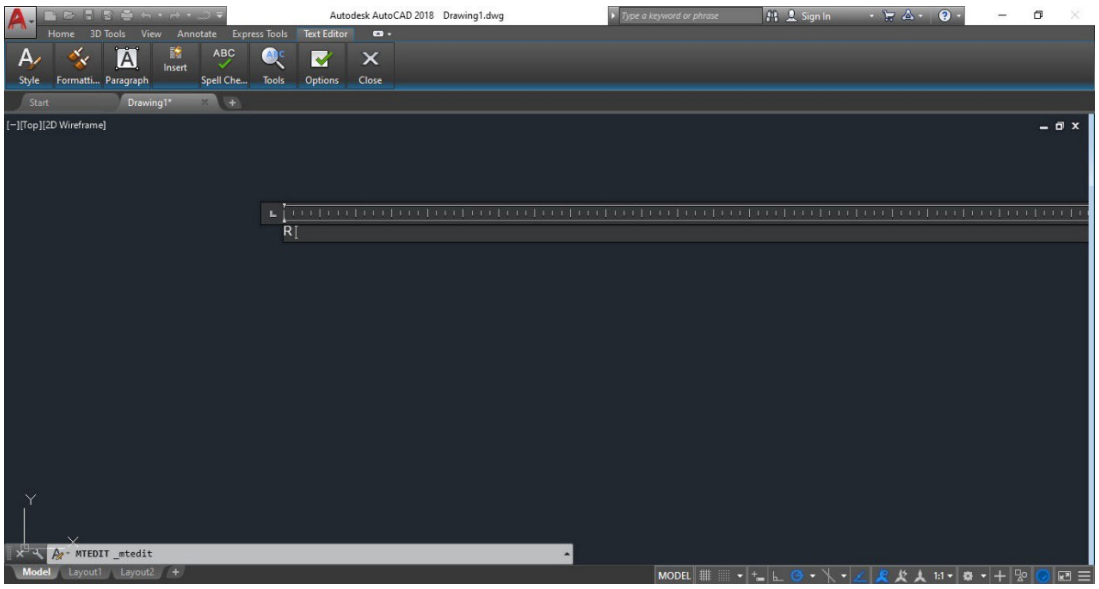
❖ **STEP 1: "MULTINE TEXT"** Command

The "**MULTINE TEXT** "command creates a multiline text object:

How to select: "**ANNOTATE"** --- "**TEXT" ----- "MULTILINE TEXT"**



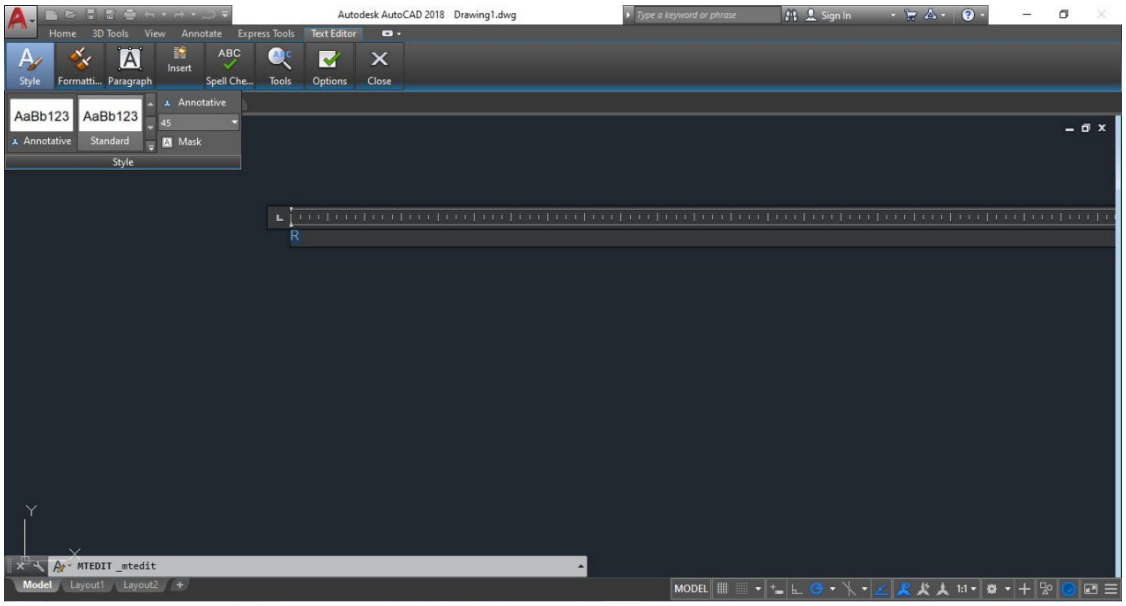
At the command prompt "**specify the 1st corner**" we "**click**" anywhere on the workplace and then the frame of the typing is created and we type the letter, for example the letter "**R**".

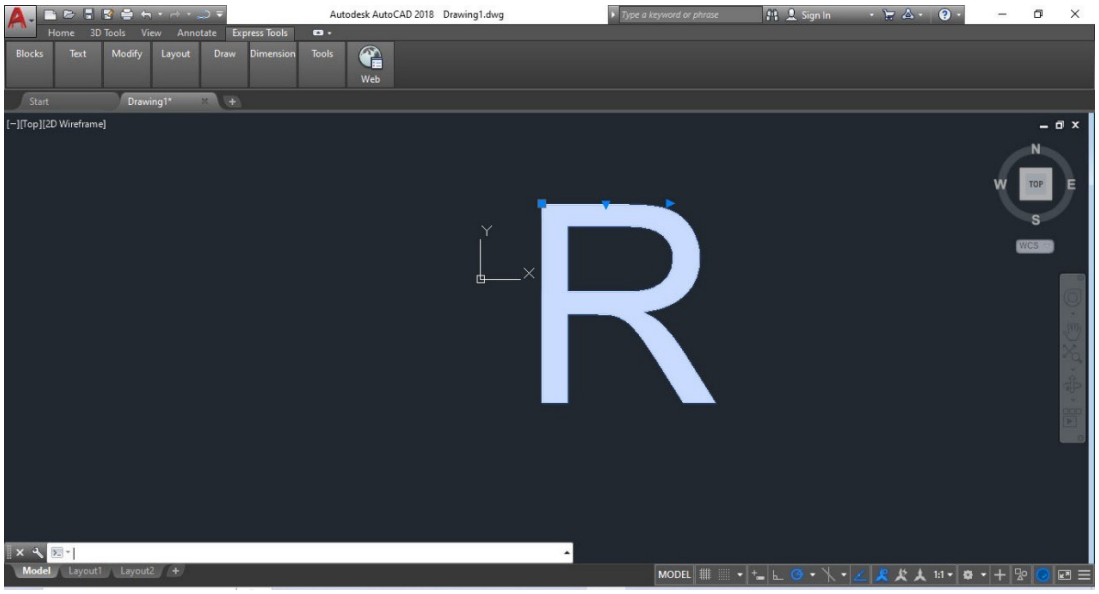


Modify the letter

a. Text height

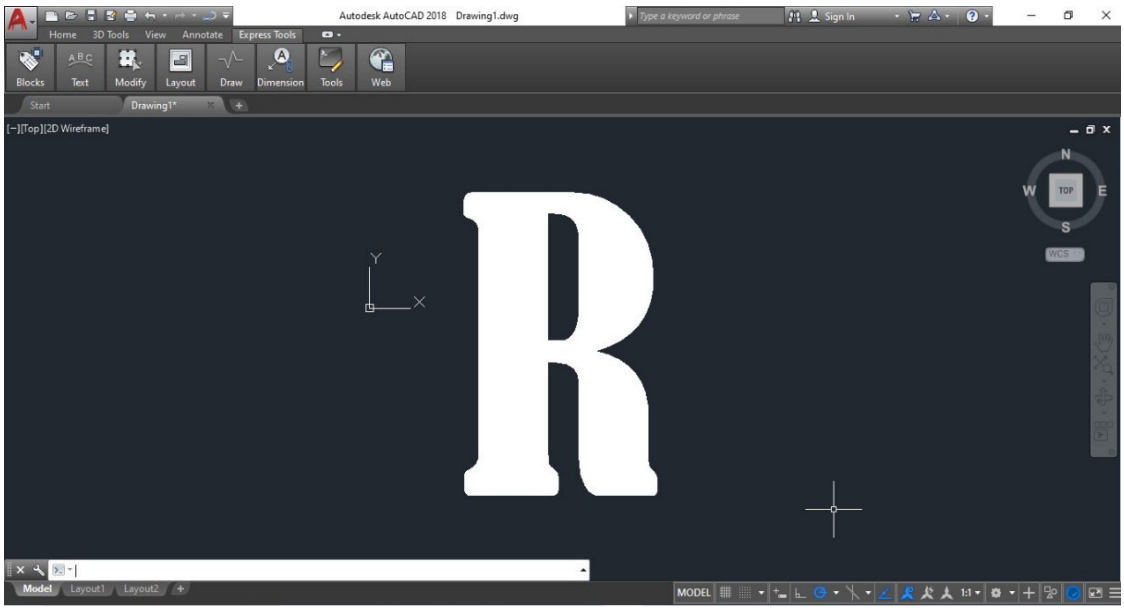
Select the letter "**R**" and from the **"Text Controls" ----- "Style" -----"Text height**" ,we give a height of 45,





b. Font type

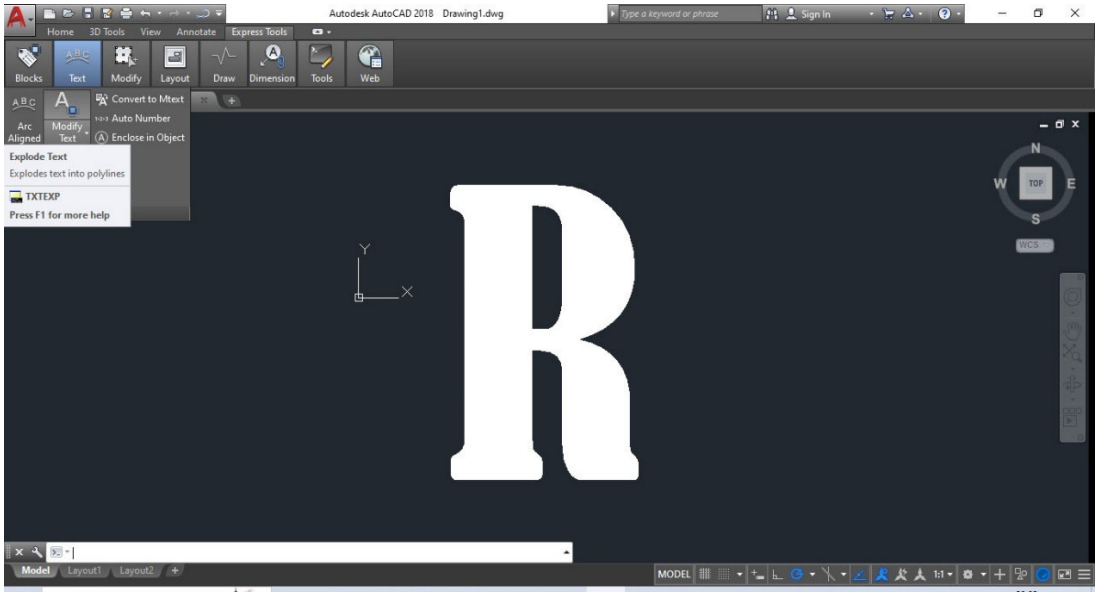
Select the letter “R” and from “**Text Editor”** ------“**Formatting”** we select a font type we like (for example Bernard MT Condensed)

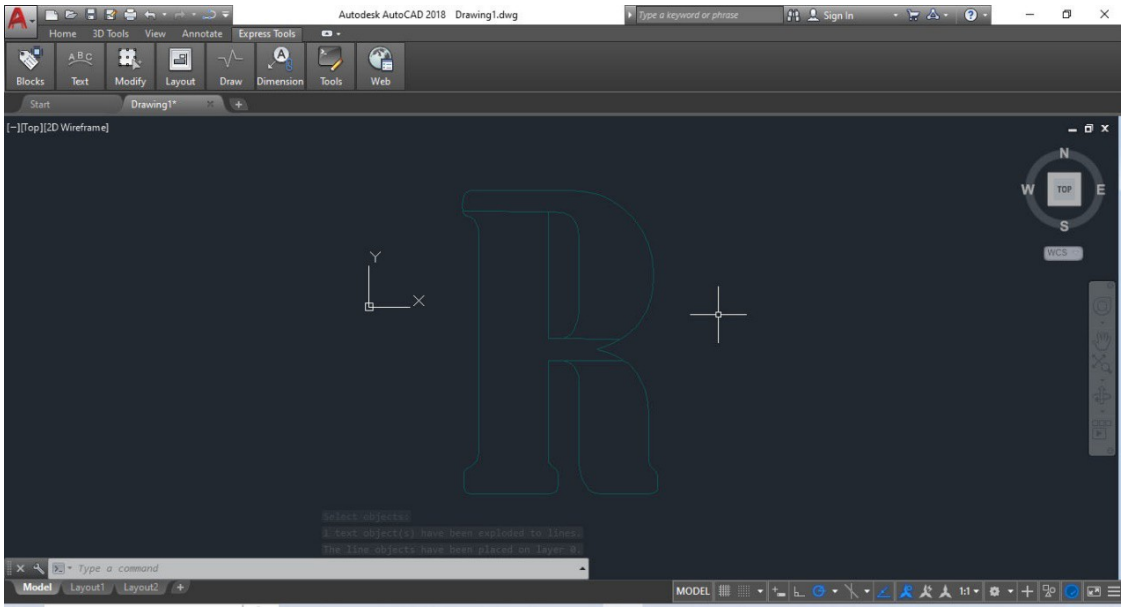


❖ **<u>STEP 2: “EXPLODE TEXT” command</u>**

The « **EXPODE TEXT** » command breaks the text into lines**:**

How to select: **“EXPRESS TOOLS” ----“TEXT” -----"MODIFY TEXT” -------- “EXPLODE TEXT”:** At the prompt **“select objects”** we **“click**” on the letter and press **“Enter”.** The text now has been transformed into lines.

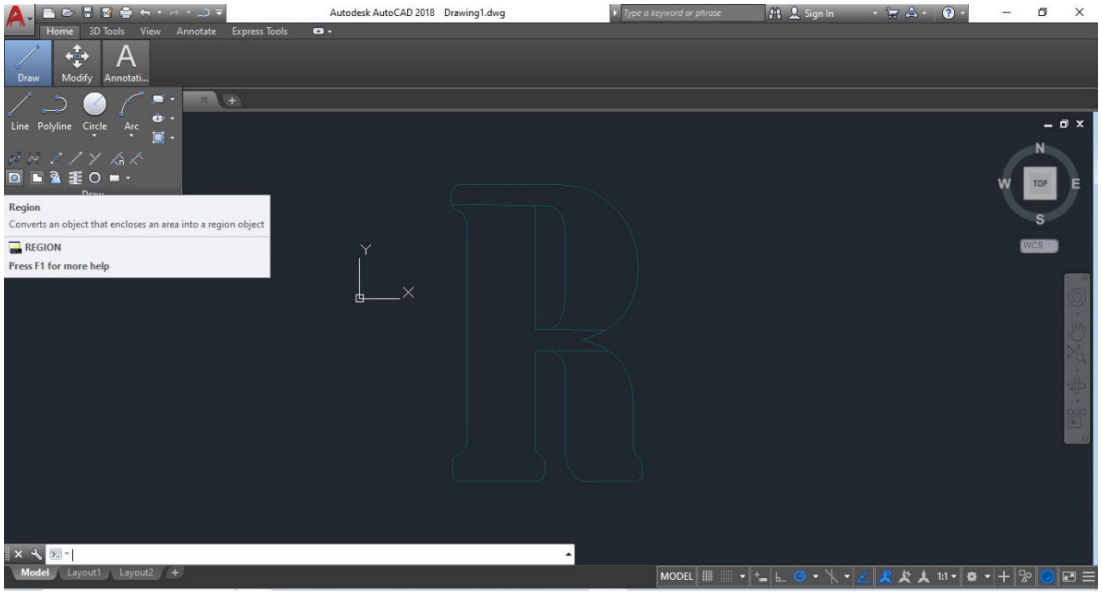




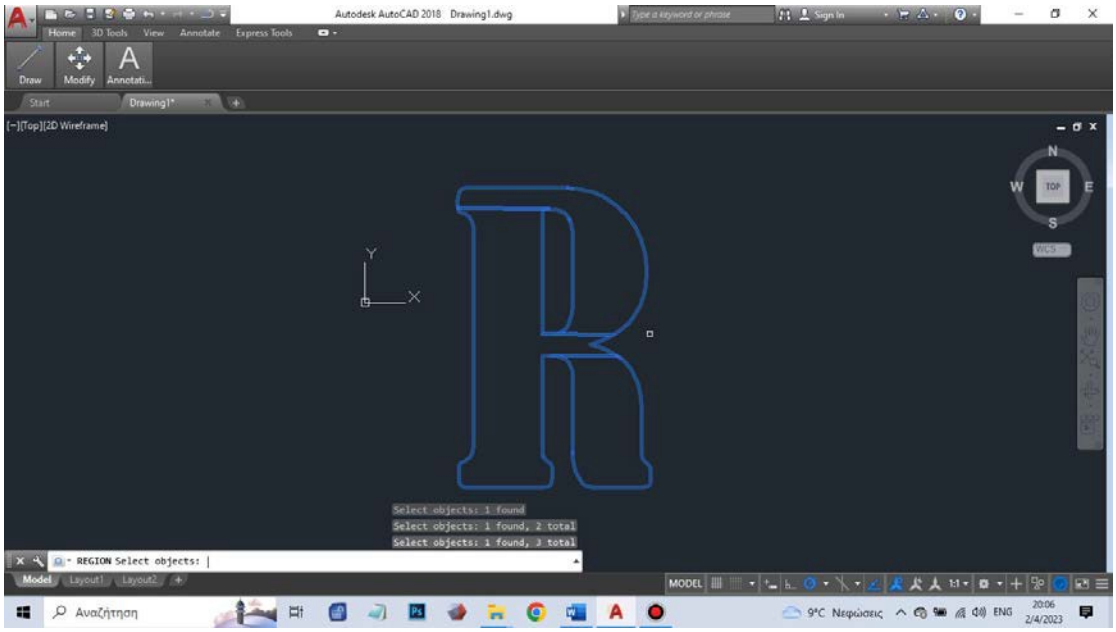
❖ **STEP 3: "REGION" command**

The "**REGION"** command converts objects that enclose an area into a 2D region object

How to select: "**HOME"** ---"**DRAW**" ---"**REGION**": At the command prompt "**Select objects**" we select all the lines of the letter "R" and we press "**Enter".**



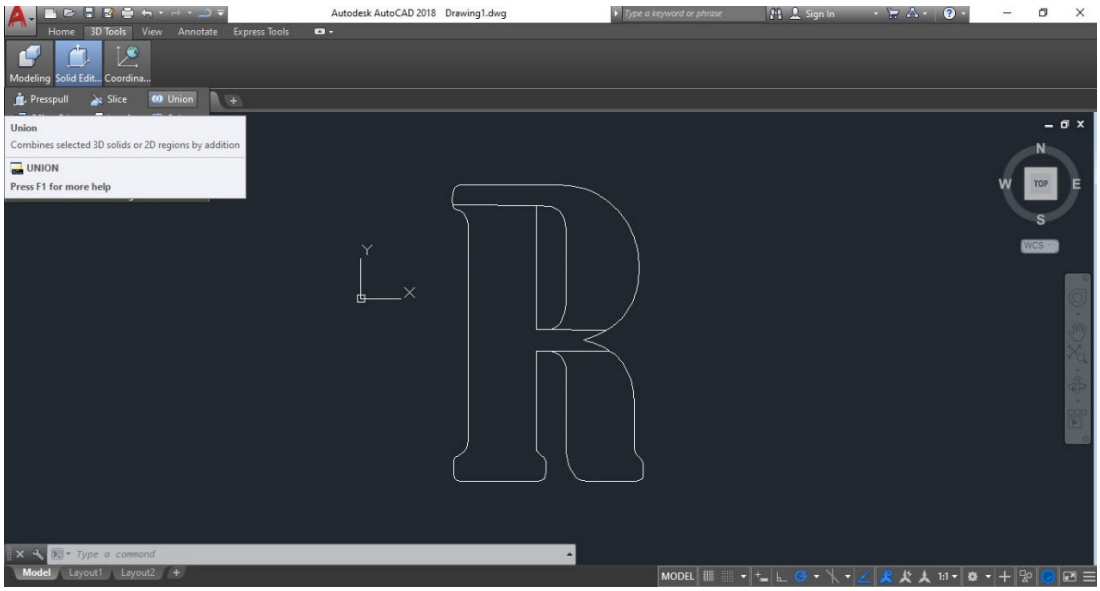
Now the letter is converted into 2D regions.



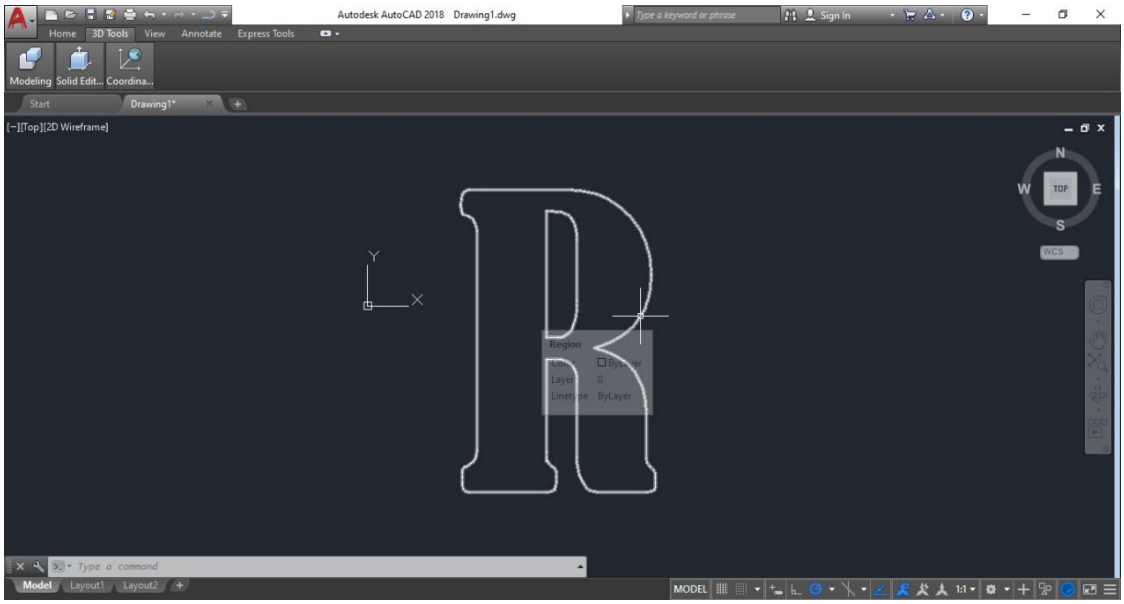
- **<u>STEP 4: "UNION" command</u>**

The **"UNION"** command combines two or more 3D solids, surfaces, or **2D regions** into a single, composite 3D solid, surface, or region:

How to select: "**3D TOOLS**" ---"**SOLID EDITING**" ----"**UNION**":



At the prompt “**Select objects**”, we select all the 2D regions and press “Enter”. Now our object converted into a single region.

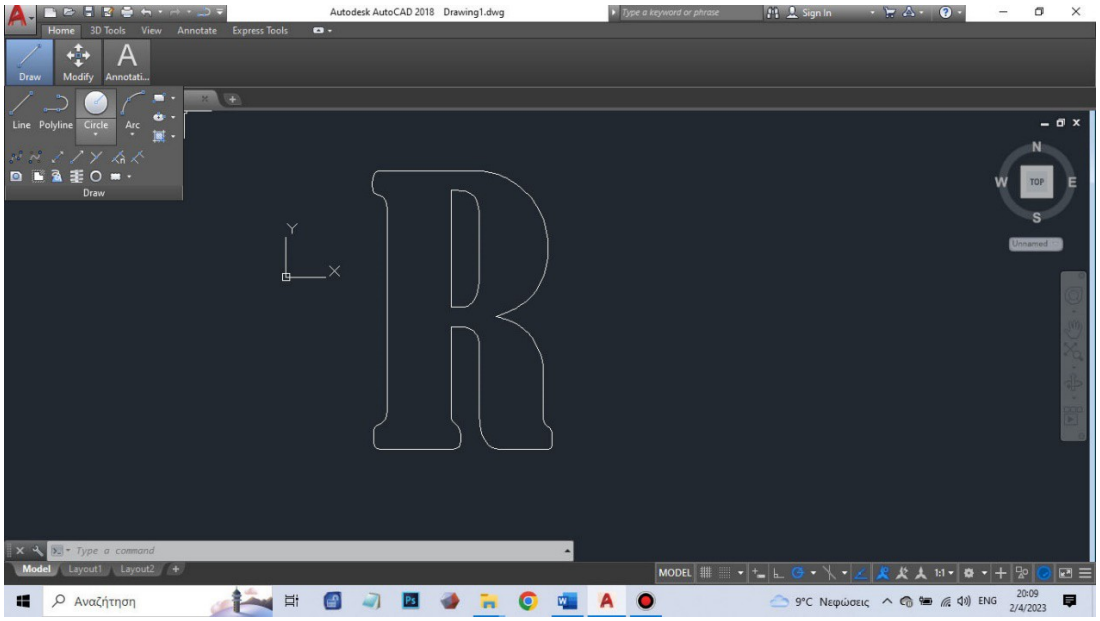


❖ **<u>STEP 5: “CIRCLE “command (creating the ring of the letter keychain)</u>**

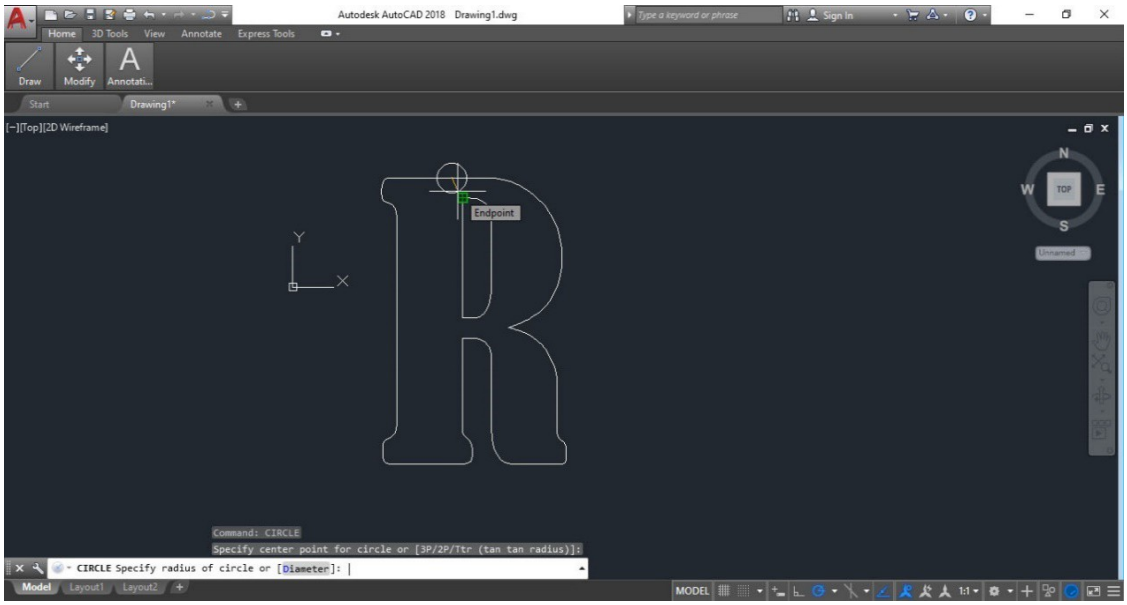
The ring of the keychain is a 3D cylinder with a hole in the middle where a small ring or chain of metal passing through to which several keys can be attached.

So, first we draw 2 circles, D1=5mm, D2=2mm:

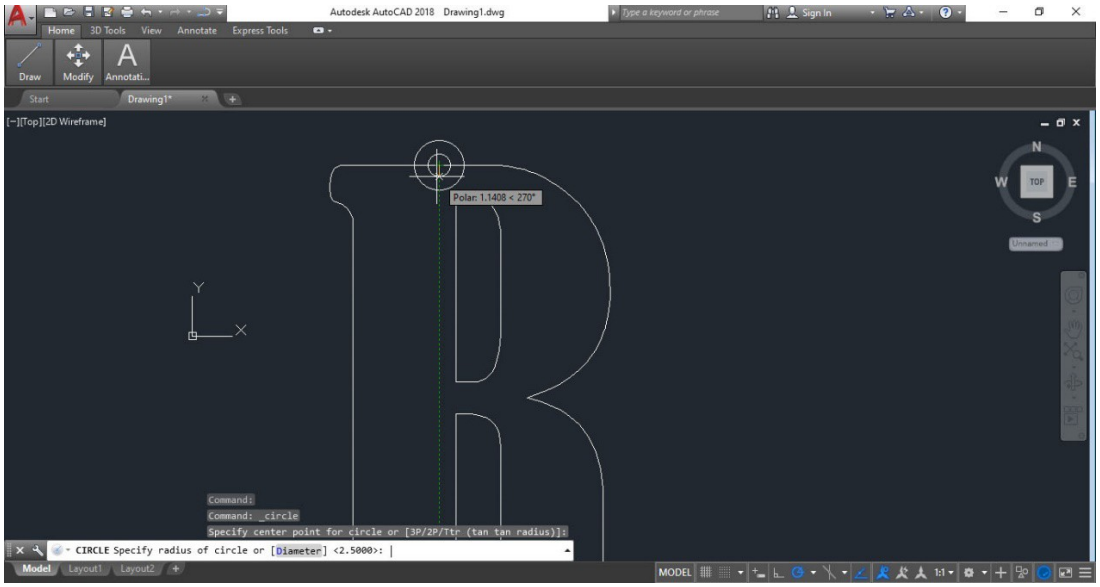
How to select: “**HOME” ----“DRAW” ---“CIRCLE”**:



At the prompt “**Specify center point of circle**” we “**click**” somewhere on the middle of upper side of the letter and at the prompt” **Specify radius of circle**” we input 2.5 and press “**Enter**” for the first circle.

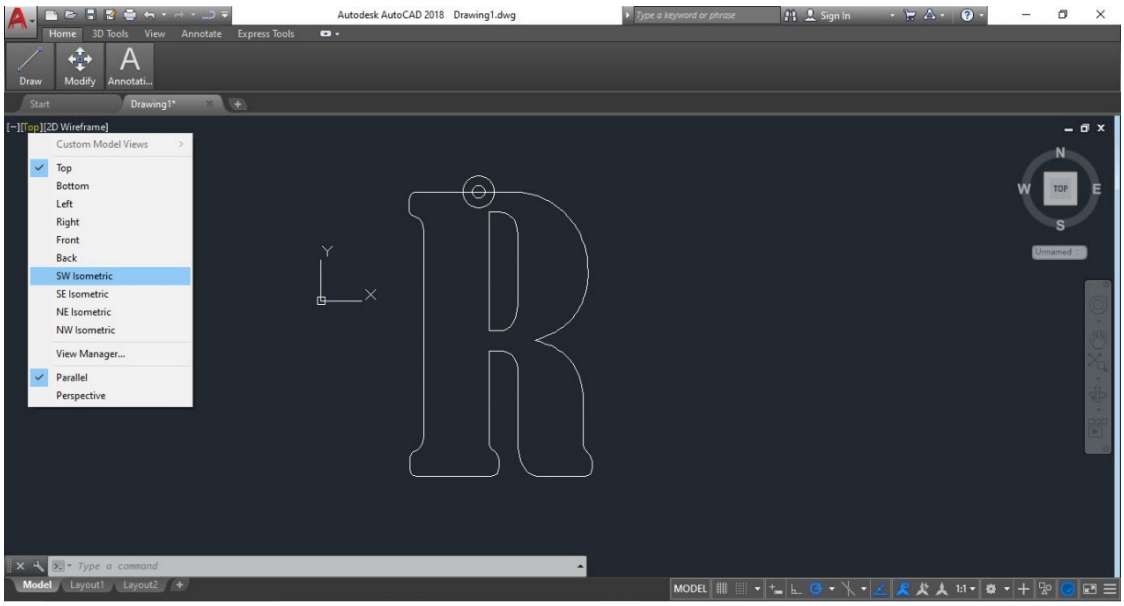


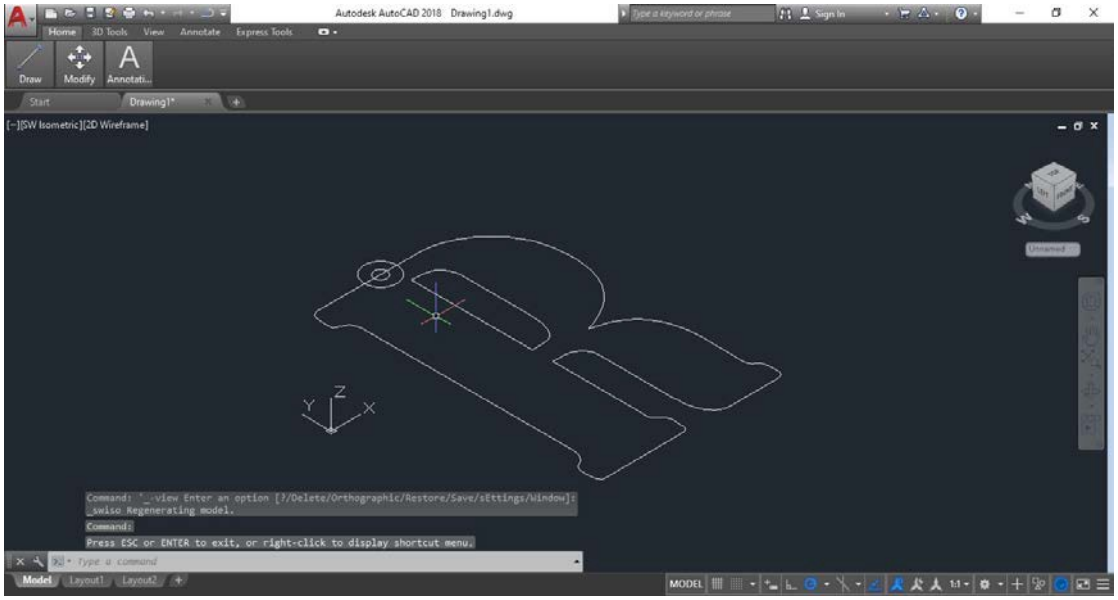
Following the same steps as above, we draw the second circle which has the same center with the first circle and a radius= 1mm.



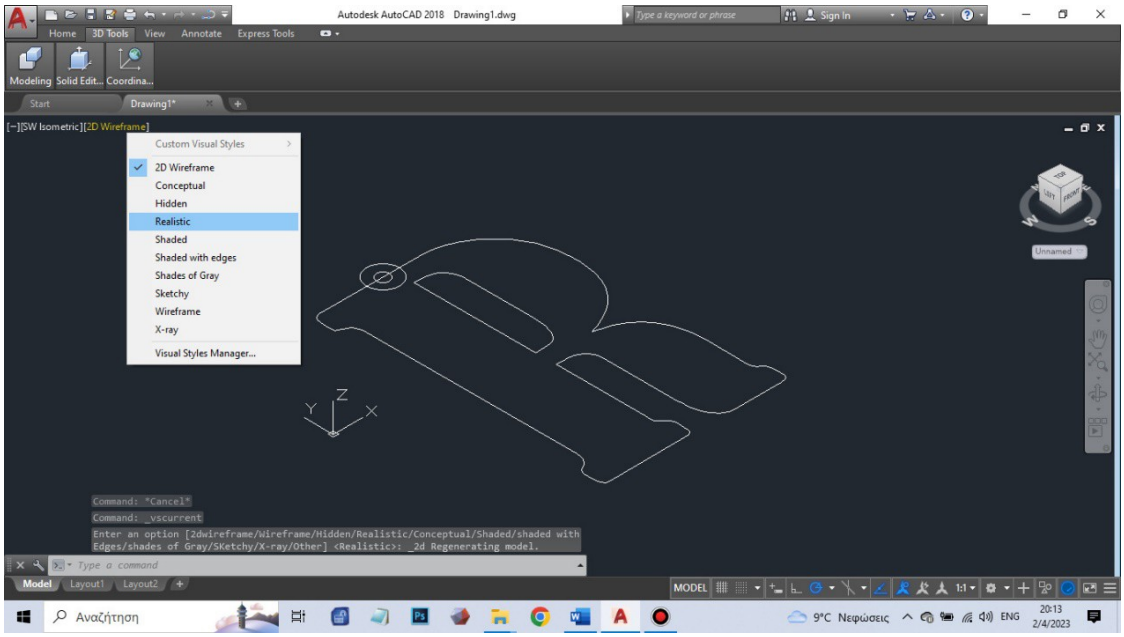
Changing the view:

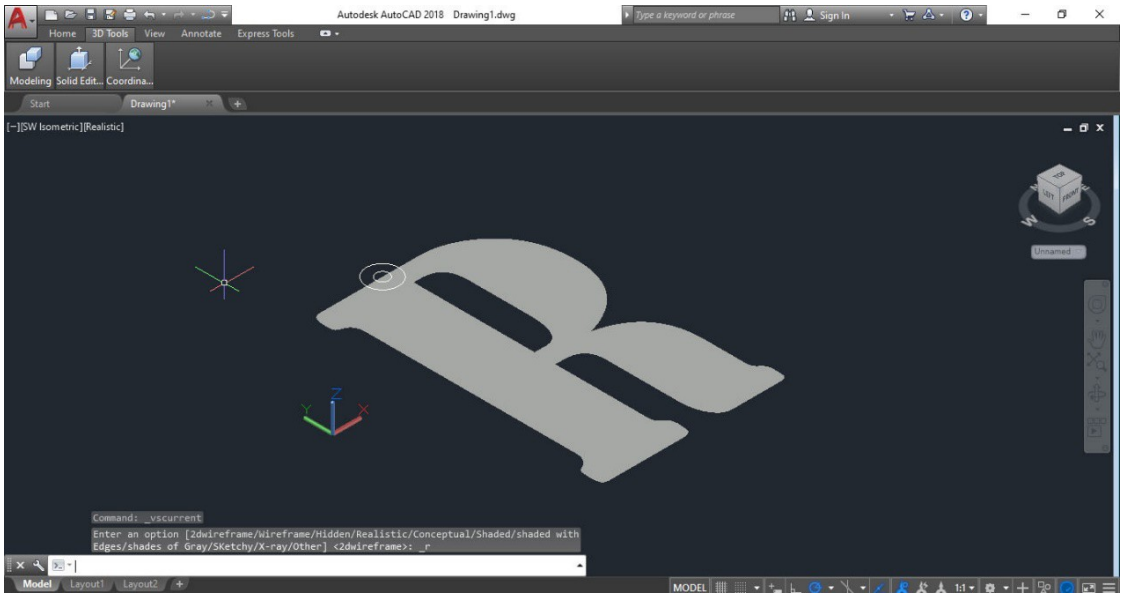
From the menu "**VIEW CONTROLS"** instead of «**top view**» we select an «**Isometric view»** to change the angle of the view of the object.





Changing the "**Visual Style**": From the "**Visual Style Control**" menu we select "**Realistic**" instead of "**2D Wireframe**"

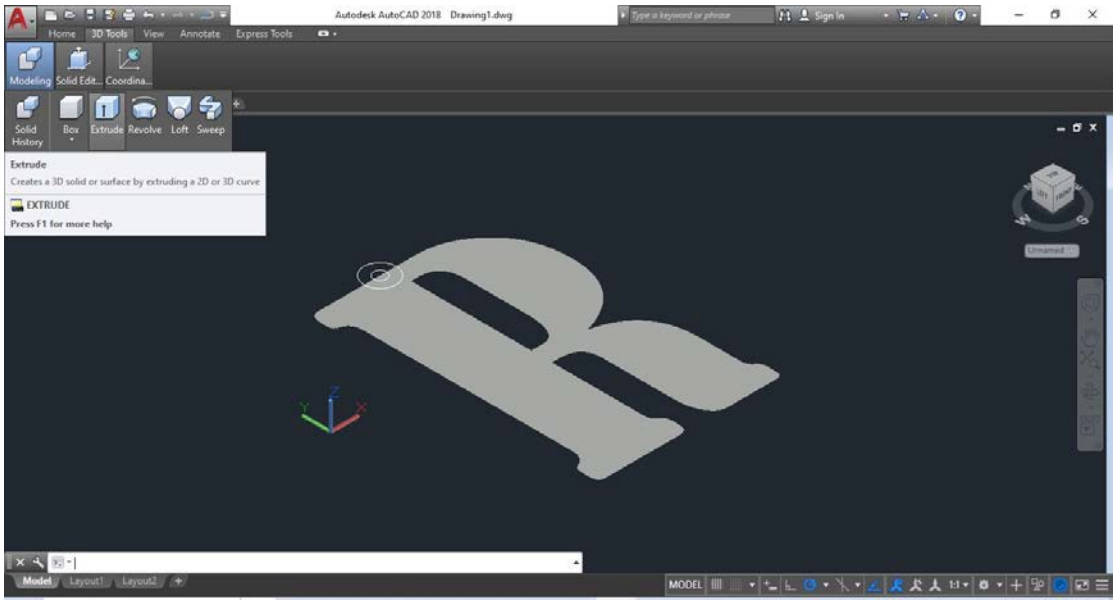




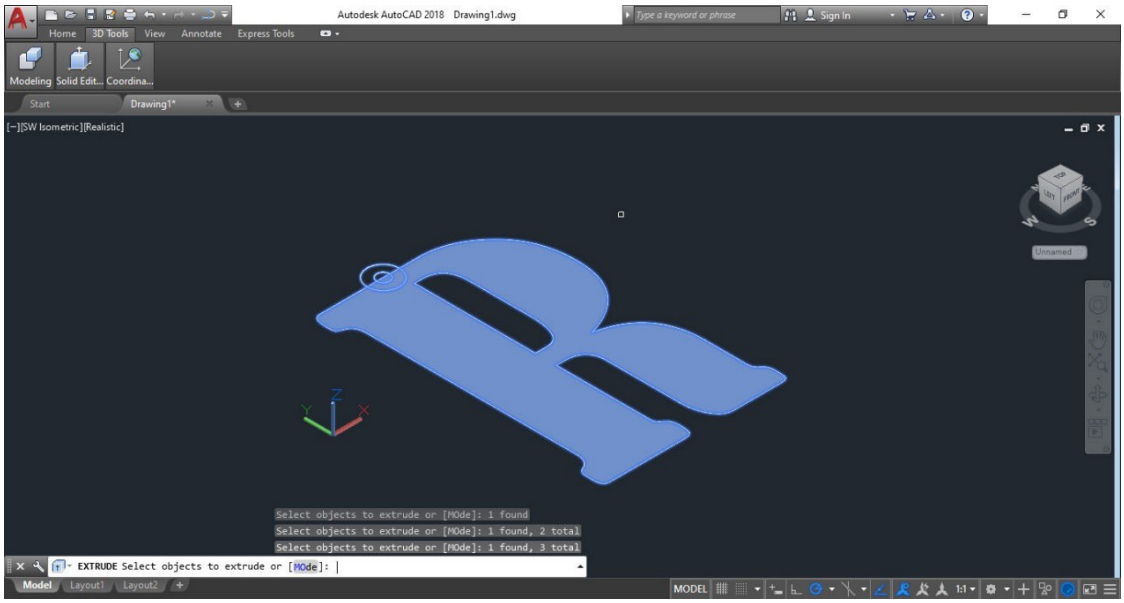
- **<u>STEP 6: "EXTRUDE"</u>** <u>command</u>

This command generally is used by most CAD programs to convert a 2D object into a 3D one. The "**EXTRUDE**" command creates a 3D solid from an object that encloses an area, or a 3D surface from an object with open ends:

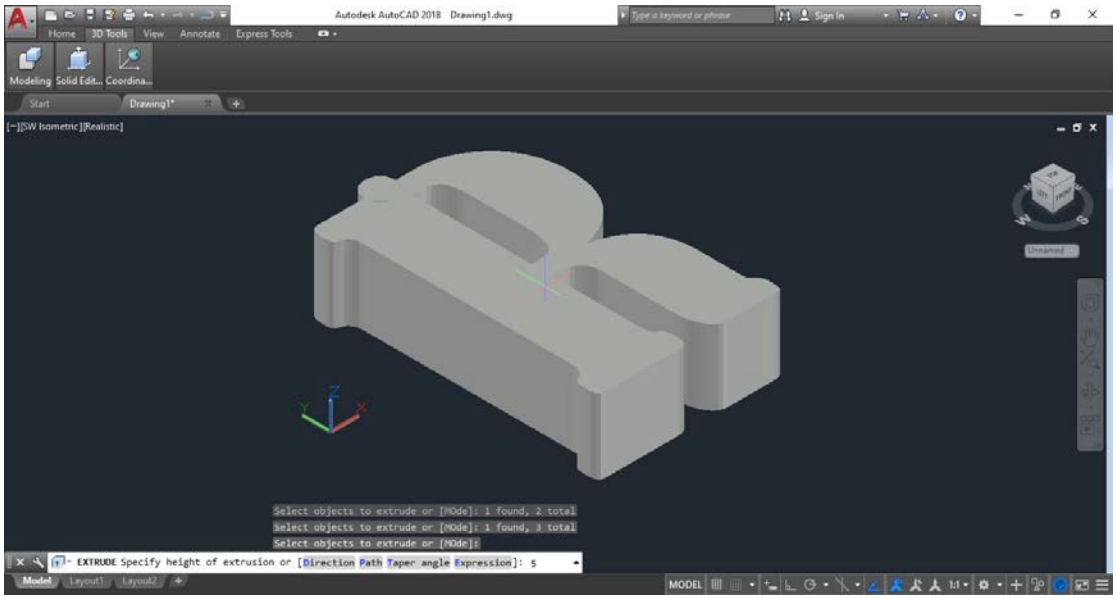
How to select: "**3D TOOLS**" ---"**MODELING**" ----- "**EXTRUDE**".



At the prompt "**Select objects"** we **"click"** on the letter and the 2 circles and press **"Enter".**



At the prompt "**Specify height of extrusion**" we input 5 and we press "**Enter**".

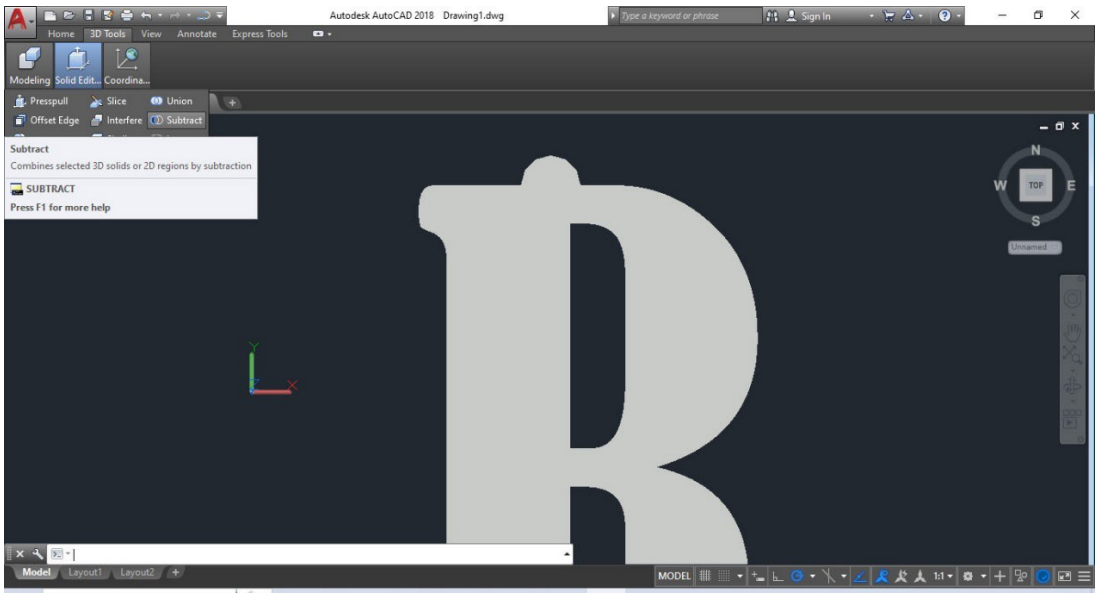


So, now the 3D letter “R” is created.

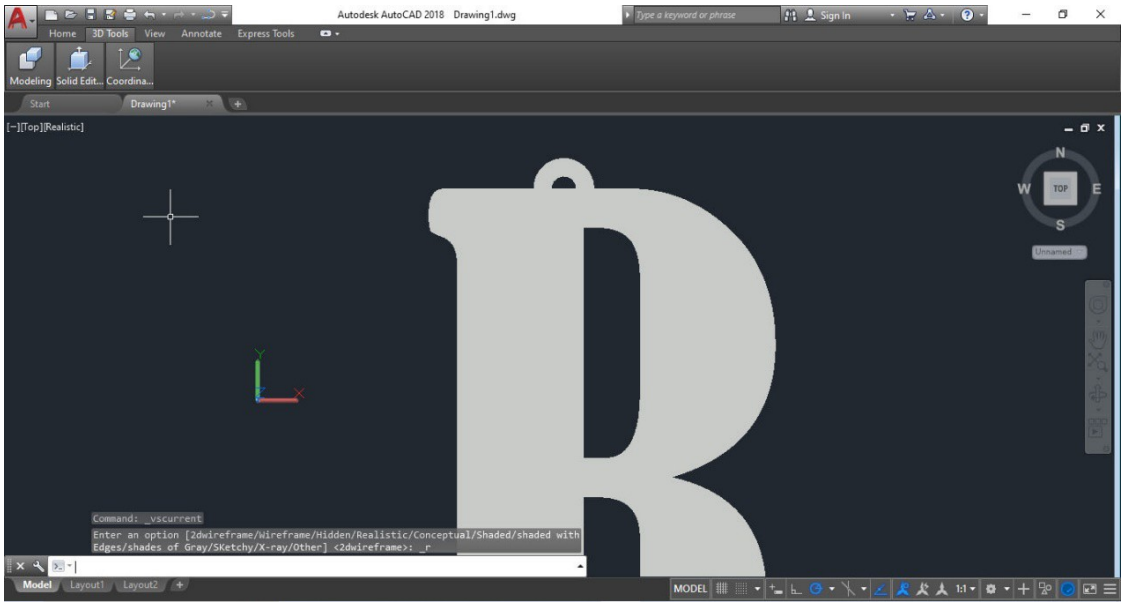
- **<u>STEP 7: “SUBTRACT” command (</u>**<u>Creating the hole on the ring cylinder</u>**<u>)</u>**

The **“SUBTRACT”** command creates a new object by subtracting one overlapping region or 3D solid from another:

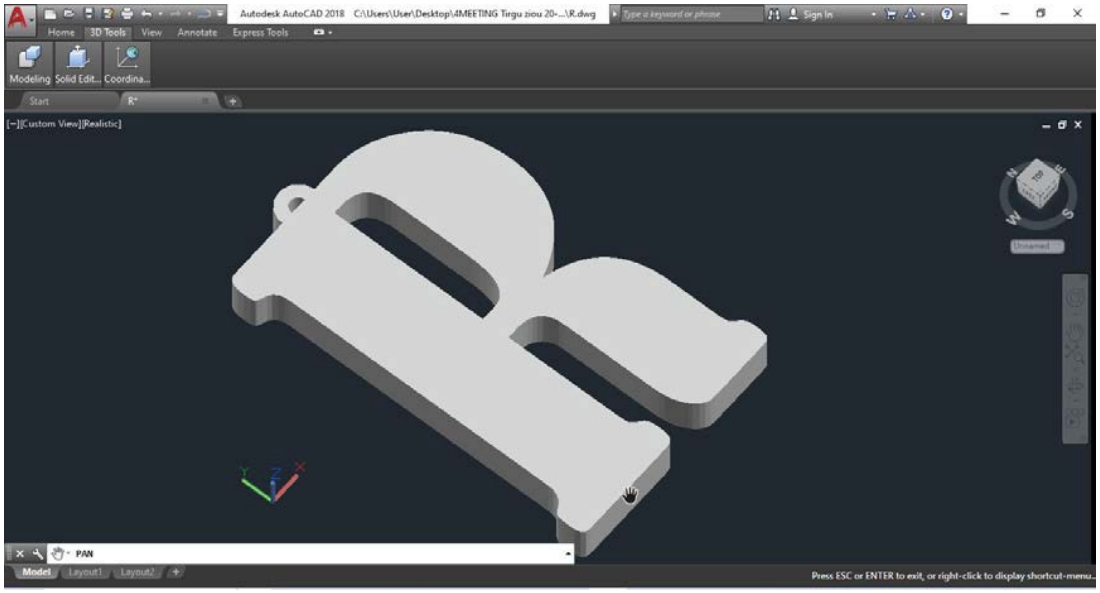
How to select: “**3D TOOLS**” ----“"**SOLID EDITING**" ----- “**SUBTRACT”:**



At the prompt “**Select objects**” first we “**click**” on the outer/the larger cylinder press “**Enter**” and then we “**click**” on the inside/smaller one , that is where the hole is going to be created and press “**Enter**”.



- Finally, we created the 3D letter “R” keychain ready to 3D print itout!!!



3D PRNTING

Now we can export it as **stl file** in order to 3Dprint it out: How to select “**EXPORT**” ---- "**OTHER FORMATS**”