

# Additive Manufacturing

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# using Metrology and Card

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# Board 3D Star

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# Additive Manufacturing using Metrology



**Objective:** In this lesson, the students will be able to follow the Engineering Design Process to create a prototype that meets the criteria given in the Engineering Design Process/Problem Solving Rubric.

- Use the Engineering Design Process to create the "Cardboard 3D Star" that follows the guidelines given: (9 th -11th Grade)

**TEKS Correlations:** Engineering Design and Presentation: 130.365(c)(1)(D)(E)

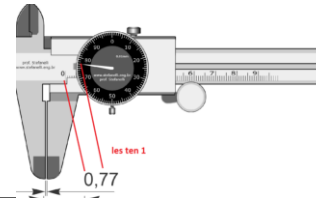
## Engineering Design Process

- \*Define the problem
- \*Do Background Research
- \*Specify the Requirements
- \*Brainstorm
- \*Prototype
- \*Test the Solution
- \*See if the solution meets the requirement
- \*Communicate the results

## Material List:

- \*Glue stick
- \*Scissor
- \*Ruler or dial caliper
- \*Spray paint
- \*Cardboard (Recycled material)
- \*Pencil and eraser
- \*Engineering Notebook or Orthographic Sketch Paper

1. Make the guidelines for the activity
2. Teach how to use the measurement tools
3. Make sure they Sketch the 3D star



## Outcome

- \*Meet Rubric Criteria for making star
- \*Quiz about the meteorology and Engineering Design Process

# Section 1: Reading Rulers

## Objective:

In this lesson, all students will be able to make precise measurements using the "Inch" and the "Metric." The degree of precision will be determined by each student's educational level to the satisfaction of the teacher.

**Teks:** 130.362(c)(2)(A) ...use clear and concise written, verbal, and visual communication techniques  
111.34(b)(6)(A)(C) ... describe and draw the intersection of a given plane with various three-dimensional geometric

**Activit 1:** to make measurements with accuracy and precision and record data using engineering notebook.

Web Site some cool activity

<https://www.funbrain.com/games/measure-it>

# Section 2 : How to use Engineering Notebook and sketch 3D Star

## Objective

To create and maintain a design and computation notebook executing several guidelines and demonstrate, they can apply what they have learned by completing the Assignment – Engineering Notebook and rubric.

**Teks:** 130.362 (c) (2)(A)(B)(C)(D)

To use a clear and concise written, verbal, and visual communication techniques and maintain a design and computation engineering notebook;

## Warm Up:

Question: What type of information is maintained in an Engineering Notebook?

Activity 1: How to use engineering notebook presentation

Activity 2: How to draw 3D Star

# Rubric

How your grade will be calculated:

<b>Graded Elements</b>	<b>Total Points</b>
<b>Engineering Notebook Class Discussion</b>	30
<b>Engineering Notebook Quiz</b>	50
<b>Spelling and Grammar</b>	10
<b>Reflection</b>	10
<b>Total</b>	<b>100</b>

# Section 3- How to make a 3-D Cardboard Star

After learn how to use rulers and engineering notebook.

1. Twenty students will individually make a technical drawing of a part of their star.
2. Then, the students will be in groups and they will choose the best square drawing out of their group.
3. Next, each group will cut out their square and tape it onto cardboard and then cut the cardboard to make a cardboard square. This process will be done five times in total.
4. Lastly, the squares will be folded halfway diagonally, and all of the squares will be connected by glue on their flaps to form a 3D star.

## Section 4- Using CAD Design to make 3D Star

The model of a star will also be made by measuring the cardboard star using dial calipers. It will then be modeled in AutoDesk Fusion or TinkerCad depending on student availability/knowledge.

## Section 5: Printing 3D star with 3D Printer

Using either Simplify 3D or Cura 3D Printer. Then, the students will design their 3D model to print out their stars in plastic using an FDM process. After this, students will measure their stars using the metrology skills they have learned and compare cardboard 3D star with the printed one.

**Enhancement 3D Star:** This will enhance their strength and durability much more than cardboard.



# Cost and Material List

1. 5 digital dial caliper: Source: [Amazon](#)  
-Cost: \$20 x 5 ~= \$100
  2. Steel Black Metal Ruler Set(12) Source: [Amazon](#)  
-Cost: \$10
  3. Paint Pens Fine Tip 15-Pack for Artists & Painters Source: [Amazon](#)  
-Cost: \$60 (3 set)
  4. Gorilla Super Glue: Source: [Amazon](#)  
-Cost: \$36 (6 of them)
  5. Cardboard : Recycle
  - 6 -Scissors : Provided by school.
- Total: \$206

# Approved curriculum implementation



**Muhammed Kaya** <kaya@harmonytx.org>

Mon, Apr 8, 2:48 PM



to hung, me ▾

Dr. **Hung**,

I am Dean of Academics at HSA Houston. Mr. Yagli informed me that You need approval for the implementation of summer learning. Mr. Yagli can integrate the new learnings to his classes next year.

**Best regards,**

Muhammed **Kaya**, M.Ed, CDF

Assistant Principal -Dean of Academics| Harmony Science Academy Houston

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