Introduction to Engineering Design

Final Examination

Part C

College Credit Performance

Spring 2009

PRACTICE EXAM

Student Name: _____

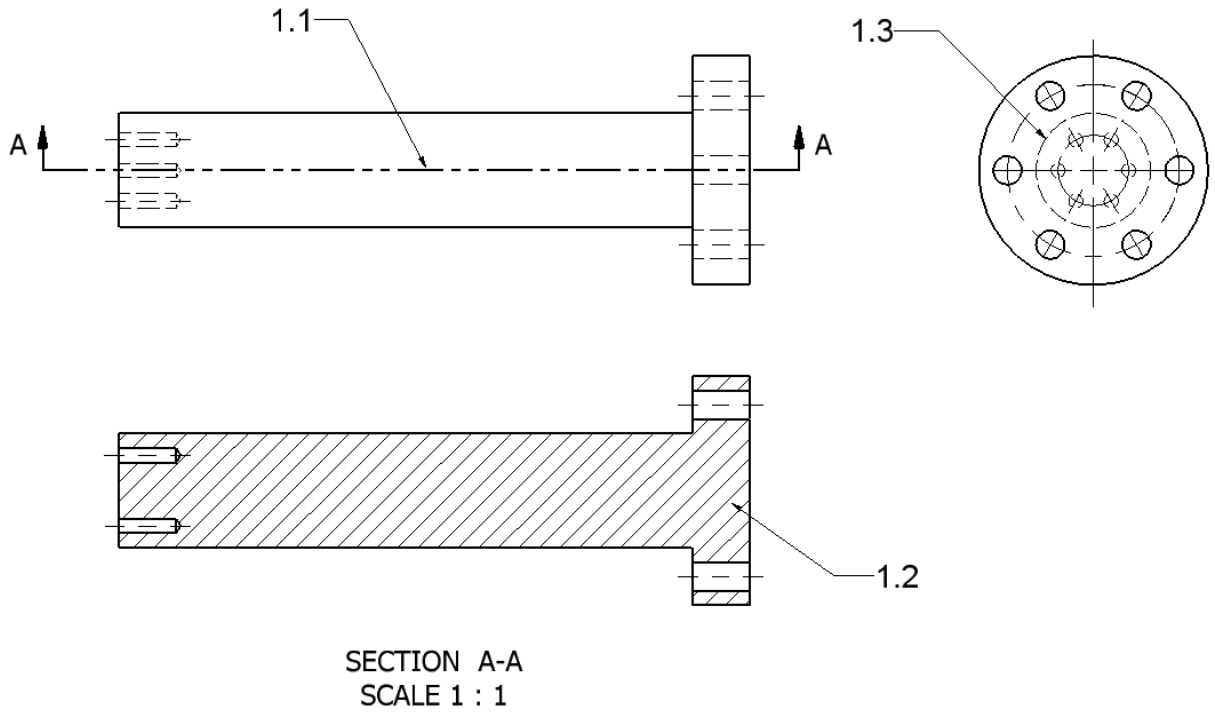
Date: _____

Class Period: _____

Total Points: _____/50

1. Identify the three line types indicated on the orthographic drawing below and explain why each is used?

[6-POINTS: *1 point for each line type, 1 point for each explanation of use*]



1.1
Line type: _____

Purpose: _____

_____

1.2
Line type: _____

Purpose: _____

_____

1.3
Line type: _____

Purpose: _____

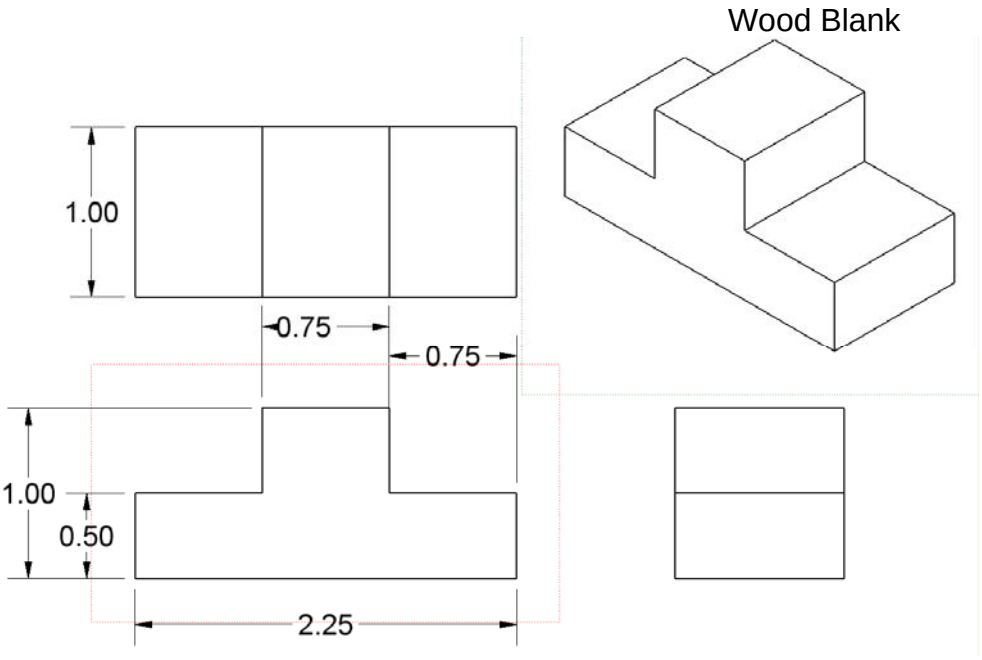
_____

2. Calculate the surface area for the part below and determine the amount of stain the manufacturer would have to buy in order to cover 80 wood blocks; assuming each quart would cover 160 square inches. *Show your work below.*

What is the surface area of the part? _____

How many quarts of stain should be ordered for 80 blocks? _____

[4-POINTS: *2 points for surface area, 2 points for amount of stain*]

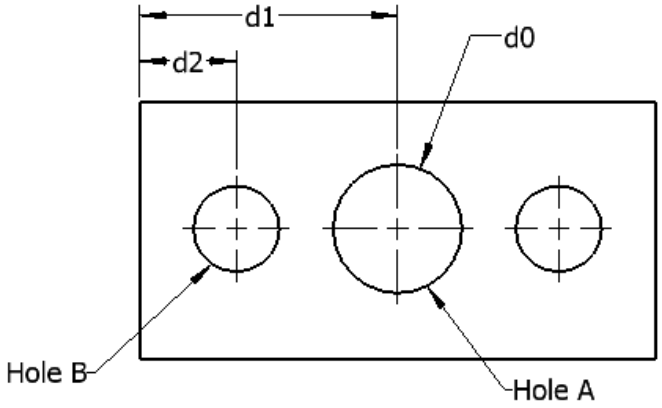


Surface Area Calculations:

Quantity of Stain Calculations:

3. **Using the dimension parameters shown on the drawing below, write the equation for <u>d2</u> so that Hole B is always centered between the left edge of the block and the *edge* of Hole A.** *Note: d0 is a diameter.*

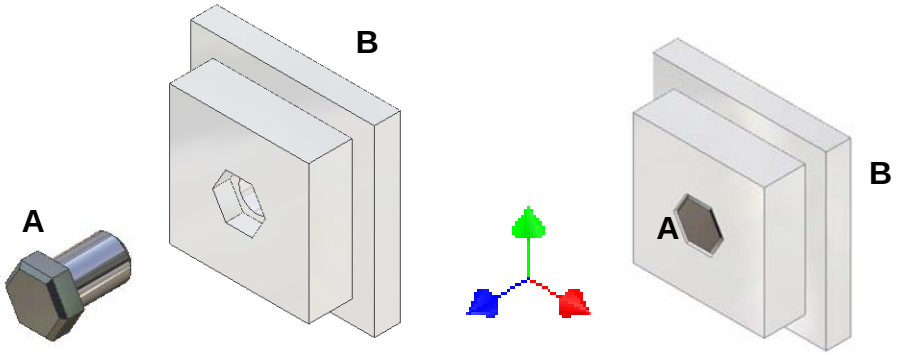
[5-POINTS]



Equation: _____

4. **List the assembly constraints needed to properly constrain the parts in the three assemblies shown below. List the Degrees of Freedom (DOF), if any, that remain on Part A based on the constraints applied. Assume that Part B in each problem below is the grounded part.**

[9-POINTS – *2 points for assembly constraints, 1 point for identifying degrees of freedom*]



Hex Head Pin and Plate Assembly

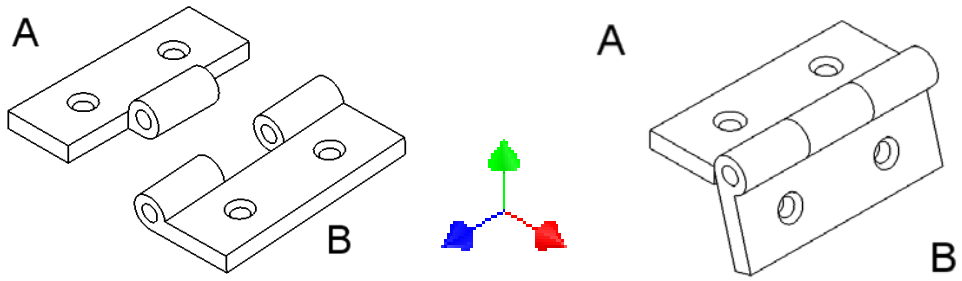
4.1
Assembly Constraints: _____

_____

_____

List the Degrees of Freedom that remain on Part A (be specific):

_____



HINGE ASSEMBLY

Note: The user wants to drive one of the constraints to show the articulation of the hinge.

4.2
Assembly Constraints: _____

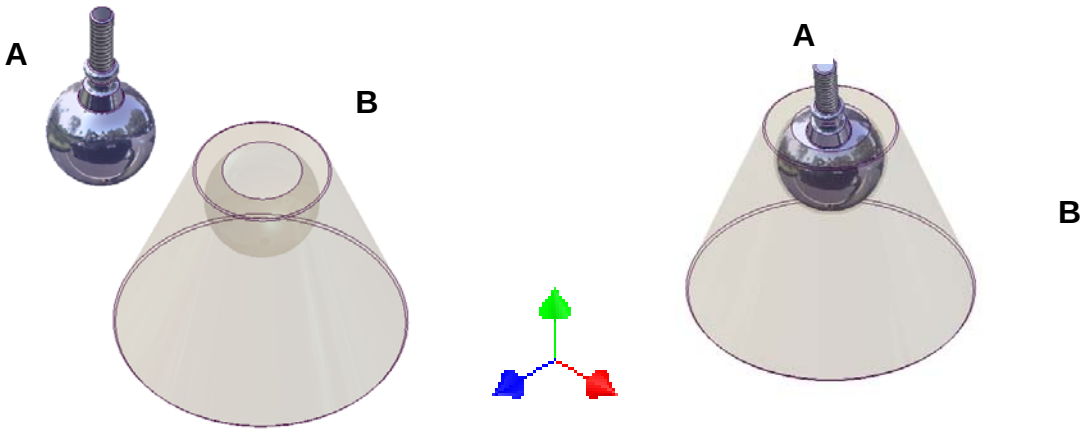
_____

_____

List the Degrees of Freedom that remain on Part A (be specific).

_____

_____



Ball Joint and Socket

4.3
Assembly Constraints: _____

_____

_____

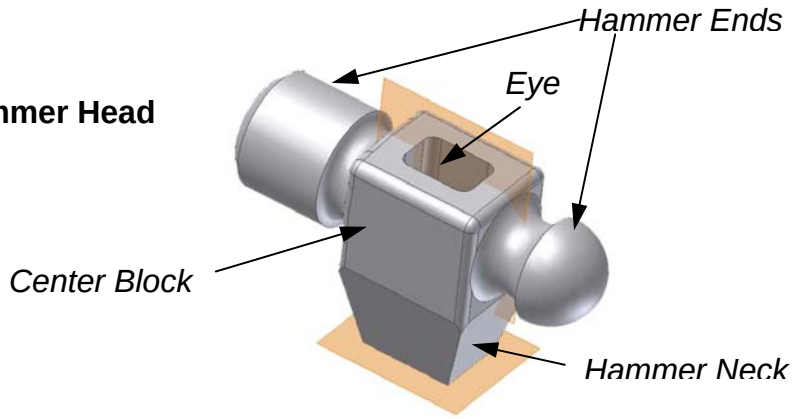
List the Degrees of Freedom that remain on Part A (be specific):

_____

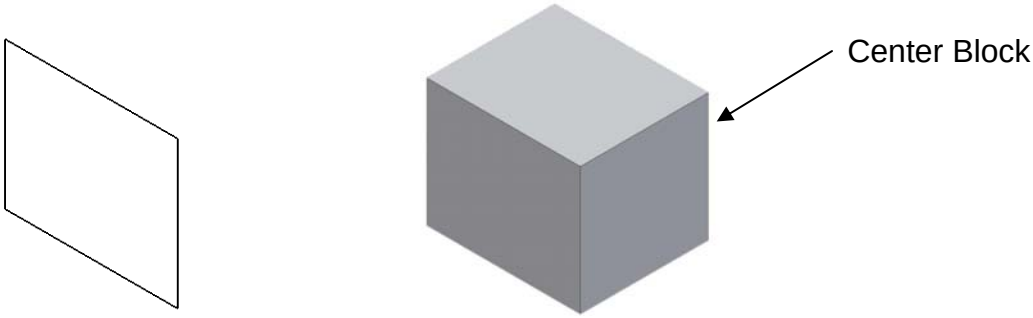
5. Part Model Creation
[5-POINTS – *1 point each*]

The process of developing a 3D CAD solid model of a hammer head has been divided into four phases. Each phase lists specific steps in the model's creation. Based on the graphics below and the steps that are given for each phase, complete the process by writing the missing steps on the lines provided. *In each case, you must identify the specific CAD function(s) being used, along with the name of the model feature (as labeled below) that you are referencing.*

Finished Hammer Head



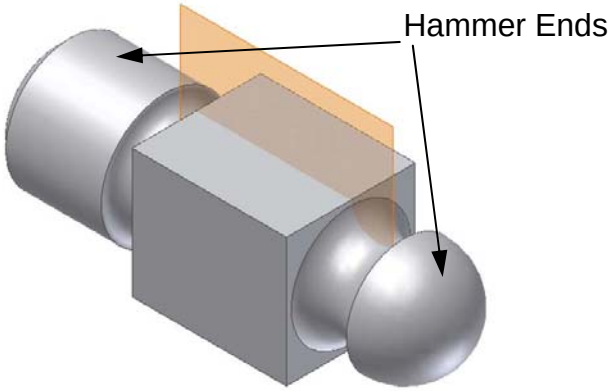
Phase 1: Creating the Center Block



Step 5.1: **Draw** and **dimension** a sketch of the **Center Block** feature.

Step 5.2: _____

Phase 2: Creating two Hammer Ends



Step 5.3: **Offset** a vertical **work plane** halfway through the width of the **Center Block**.

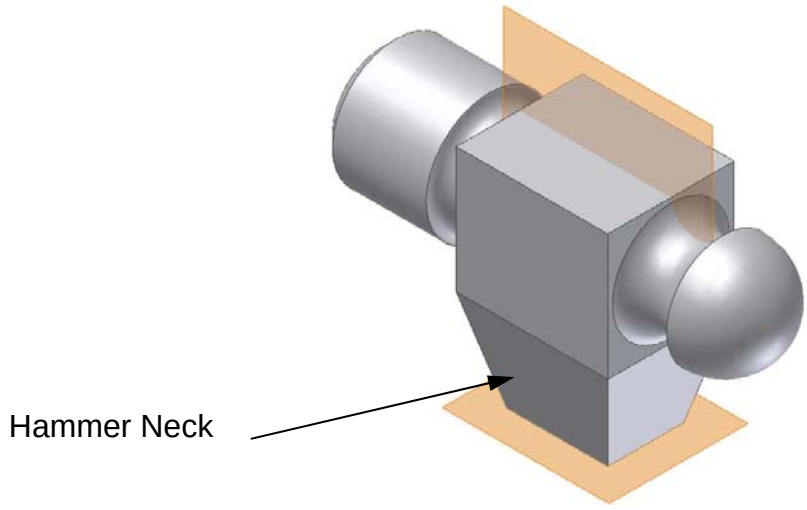
Step 5.4: Create a **sketch plane** on the **work plane**.

Step 5.5: Draw and dimension half of the profile of the two **Hammer Ends** and constrain them to the geometry of the **Center Block**.

Step 5.6: _____

_____

Phase 3: Creating the Hammer Neck



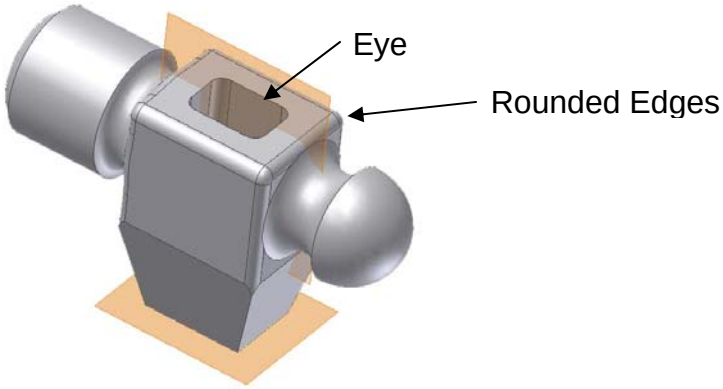
Step 5.7: **Offset** a horizontal **work plane** from the bottom of the **Center Block** to a distance that is equal to the height of the hammer neck .

Step 5.8: Create a new **sketch plane** on the offset **work plane**.

Step 5.9: _____

Step 5.10: Loft the bottom of the **Center Block** to the Sketch of a rectangle.

Phase 4: Creating the Eye and Rounded Edges on the Hammer Head



Step 5.11: Create a new **sketch plane** on the top of the **Center Block**.

Step 5.12: Draw a sketch of a rectangle with corner fillets and constrain it to the Hammer Head.

Step 5.13: _____

Step 5.14: Use the _____ tool to create the rounded edges on the **Center Block.**

6. Use the Answer Bank to fill in the missing steps of the design process by placing the letter that corresponds to the missing step in the blank space provided. [6 Points – *1 point each*]

Phase 1: **Problem Identification**

Description: Identify areas of need or want through market research. Compose a formalized design brief stating the problem that needs to be solved. Identify all constraints that affect the design and classify the constraints within the various resources available.

Phase 2: _____

Description: Brainstorming occurs and ideas are collected and/or recorded, often in graph form. Research is completed. Thumbnail sketches of ideas are drawn.

Phase 3: **Refinement of Preliminary Ideas**

Description: _____

Phase 4: **Design Analysis**

Description: _____

Phase 5: _____

Description: Detailed documentation of final design is created. Prototyping is done. Testing and analysis completed.

Phase 6: _____

Description: _____

Phase 7: **Presentation**

Description: Several forms of reporting may be used to adequately express the design solution to any and all parties involved.

ANSWER BANK:

A. Development and Implementation

B. Reassess the design specifications. Implement any modifications that might be necessary. Update drawings.

C. Conceptualization

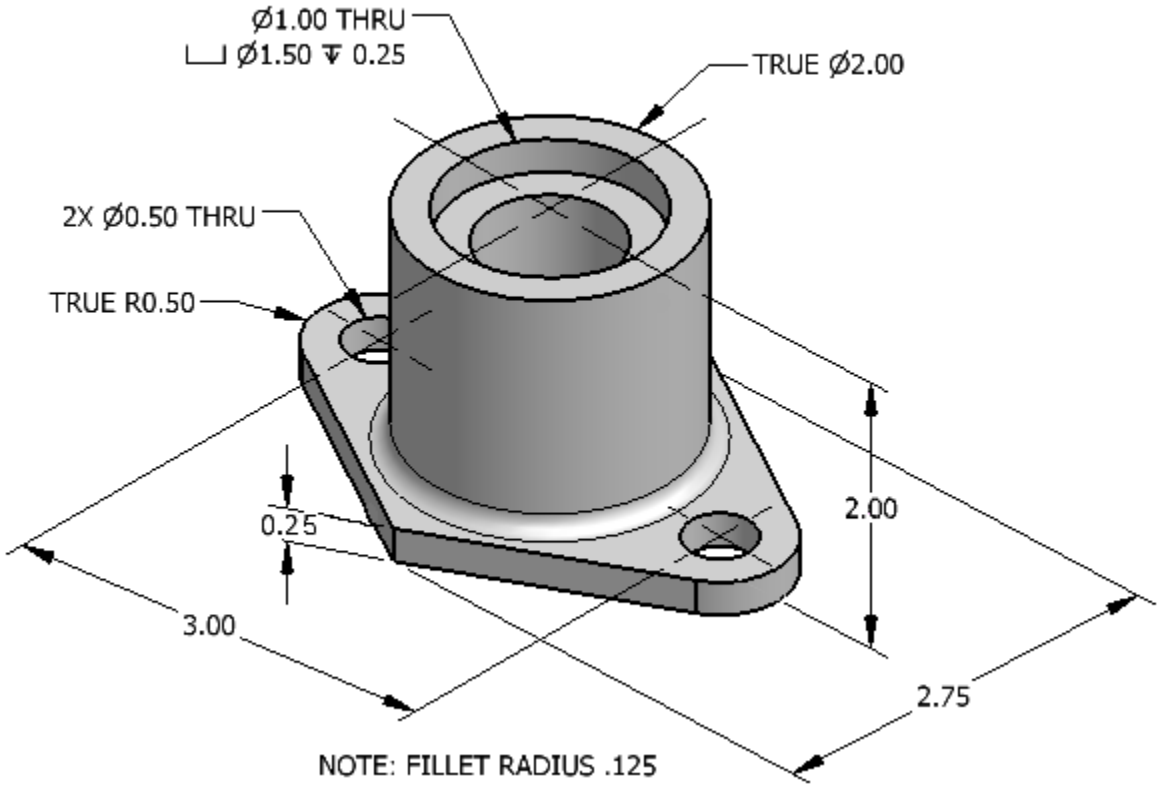
D. Compare alternatives and specifications. Create a decision-making matrix to compare the attributes of the various design solutions and analyze trade-offs. Generate alternative solutions that better satisfy the design criteria. Narrow the available solutions and select a final design.

E. Optimization

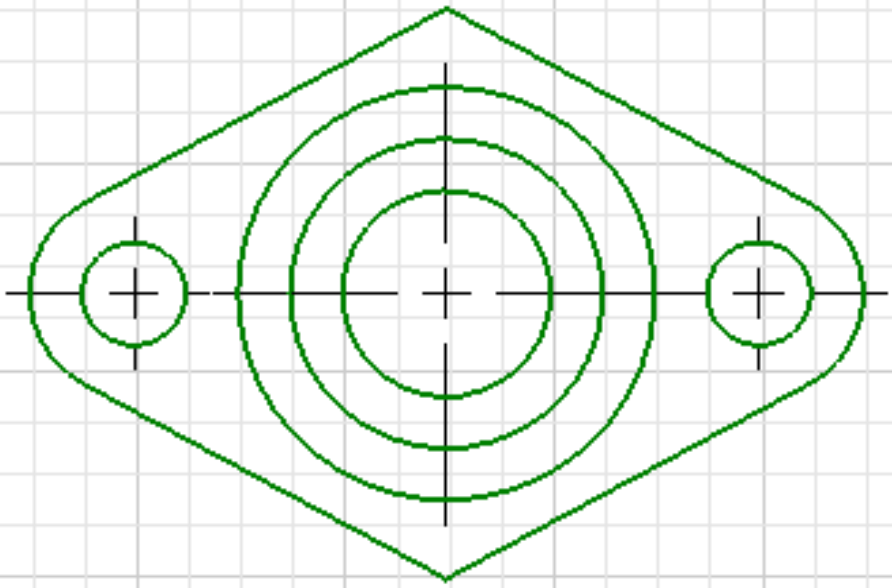
F. Workable solutions are identified. Detailed/annotated sketches are developed. Analysis of possible solutions assembled.

7. Sketch a full section, front view of the mounting bracket on the ¼- inch grid paper on the following page. Dimension and annotate both the top and front views of the drawing.

[10 points]



Top View



8. Use the drawing of the pivot arm to answer the following questions.

[5-POINTS: *1 point each*]

8.1 What is size of dimension **A**? _____

8.2 What is the thickness of the part at **B**? _____

8.3 What is the overall horizontal length of the part? _____

8.4 What is the width of the keyway? _____

8.5 From what material is the part made? _____