Activity 4.1b Engineering Graphics

Introduction

Technical drawings are used by engineers to graphically communicate engineering designs to those who will analyze or build the product or system. In order that the drawings are interpreted correctly by all stake holders, the drawings are created using a graphical language based on accepted standard practice and should include all information necessary to correctly manufacture and/or assemble the product. In the past technical drawings were created by hand; however, today technical drawings can be created using computer software or generated by 3D solid modeling programs. However, even with the available computer technology, designers still use hand drawn representations to convey design ideas and details, especially in the beginning phases of the design process.

In this activity you will document alternate designs with pictorial sketches and specify your final puzzle cube design by creating a multi-view drawing for each piece.

Equipment

- Orthographic grid paper
- Isometric grid paper (optional)
- Pencil
- Computer with Internet access

Procedure

1. Using the puzzle part options that you generated during Activity 4.1a Puzzle Cube Combinations, create **two** different puzzle cube designs. One design should be relatively easy to solve and the other more difficult. You will need a total of **two** solutions with ten unique parts. Note that, in general, more interlocking pieces make a puzzle cube more difficult to solve.

   For each design, neatly sketch and color code an isometric view of each of the five component parts and show how they fit together in the isometric view of the cube. See your teacher for an example.

2. Choose the best design from the two options. Document the reasons for your choice in your engineering notebook.

3. On orthographic grid paper, create a multi-view drawing of each of your five puzzle pieces for the selected design. Carefully select the best front view and include all object and hidden lines. Show the minimum number of orthographic projections necessary to fully detail the part. Do not show the joints between individual wooden cubes.

4. Exchange your multi-view sketches (preferably copies) with a classmate.

5. **(Optional)** Build one or more of your partner's puzzle pieces using the Isometric Drawing Tool accessible via the National Council of Teachers of Mathematics

Illuminations website (http://illuminations.nctm.org/ActivityDetail.aspx?ID=125). Use the cube tool to add cubes to create a piece and the Select Tool and the Unit Movement Buttons (colored arrows) to position the cubes in the orientation shown on your partner's isometric view. Then choose the View button (the eye) to display an isometric view. You may rotate the piece to view it from different angles. Then uncheck the 3D box to display the orthographic projections. To document your work, create a word document that includes a screen captures of the isometric view and the orthographic projections of the most complicated puzzle piece in your partner's puzzle design.

6. Review your partner's sketches. Consider the following questions for the multi-view drawing of each puzzle piece. Record notes on a separate sheet of paper to provide feedback to your partner to help them correct their sketches.
    - Is the chosen front view the BEST front view?
    - Has the designer used the minimum number of orthographic projections needed to represent the part? That is, could fewer orthographic projections be used to adequately represent the part?
    - Are the orthographic views properly shown based on the orientation of the isometric sketch of each piece?
    - Are the orthographic projections properly oriented to each other?
    - Are all object lines shown properly (thick and dark)?
    - Are all hidden surfaces represented with a hidden (dashed) line where necessary?

Conclusion

1. Why is it important to have designs and drawings reviewed by peers?