



THE UNIVERSITY OF BRITISH COLUMBIA
Department of Electrical & Computer Engineering
ELEC 311 – Electromagnetic Fields and Waves
2025 W1

Soft Skills

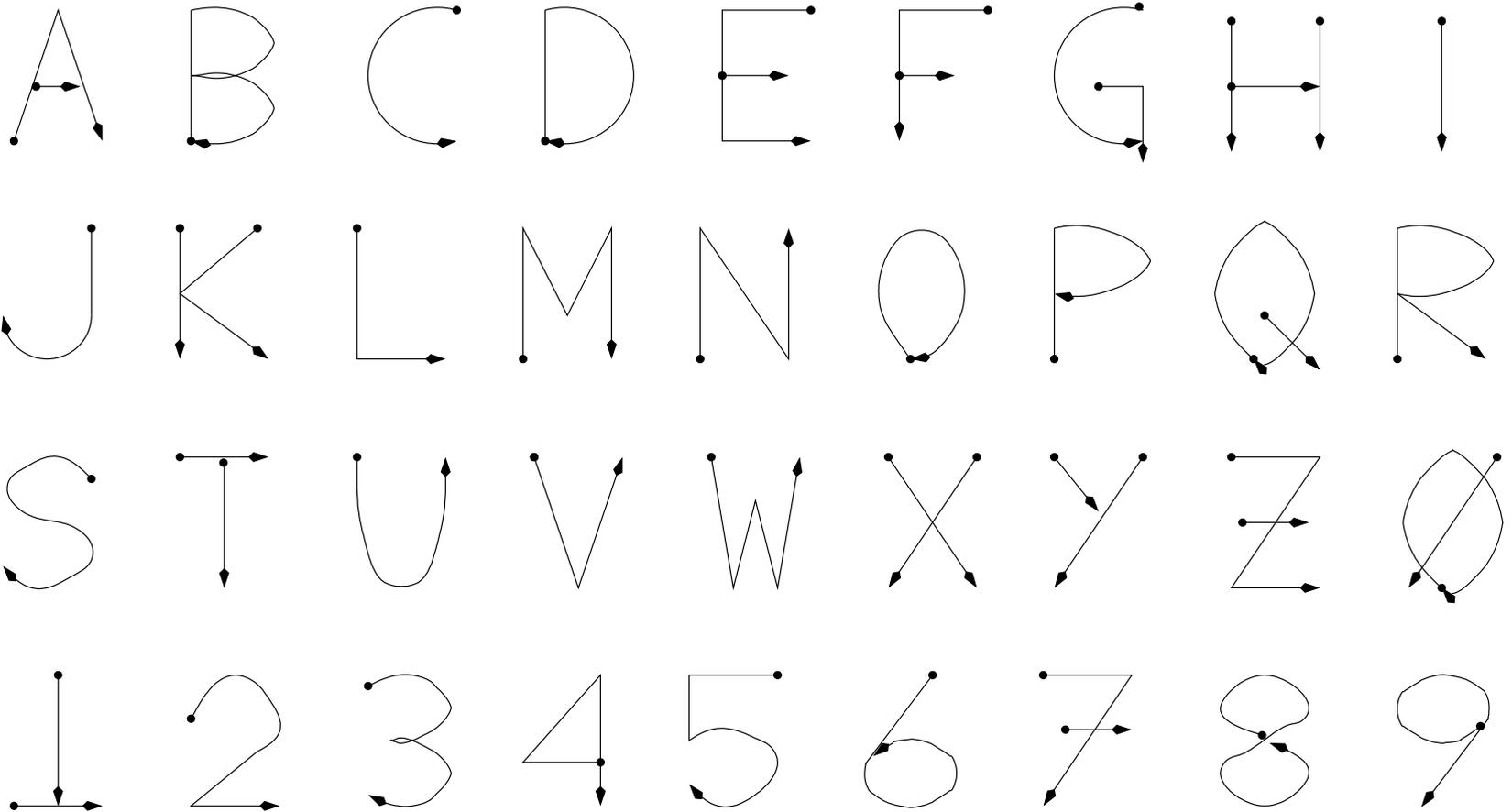
Free-Hand Sketching and Drawing



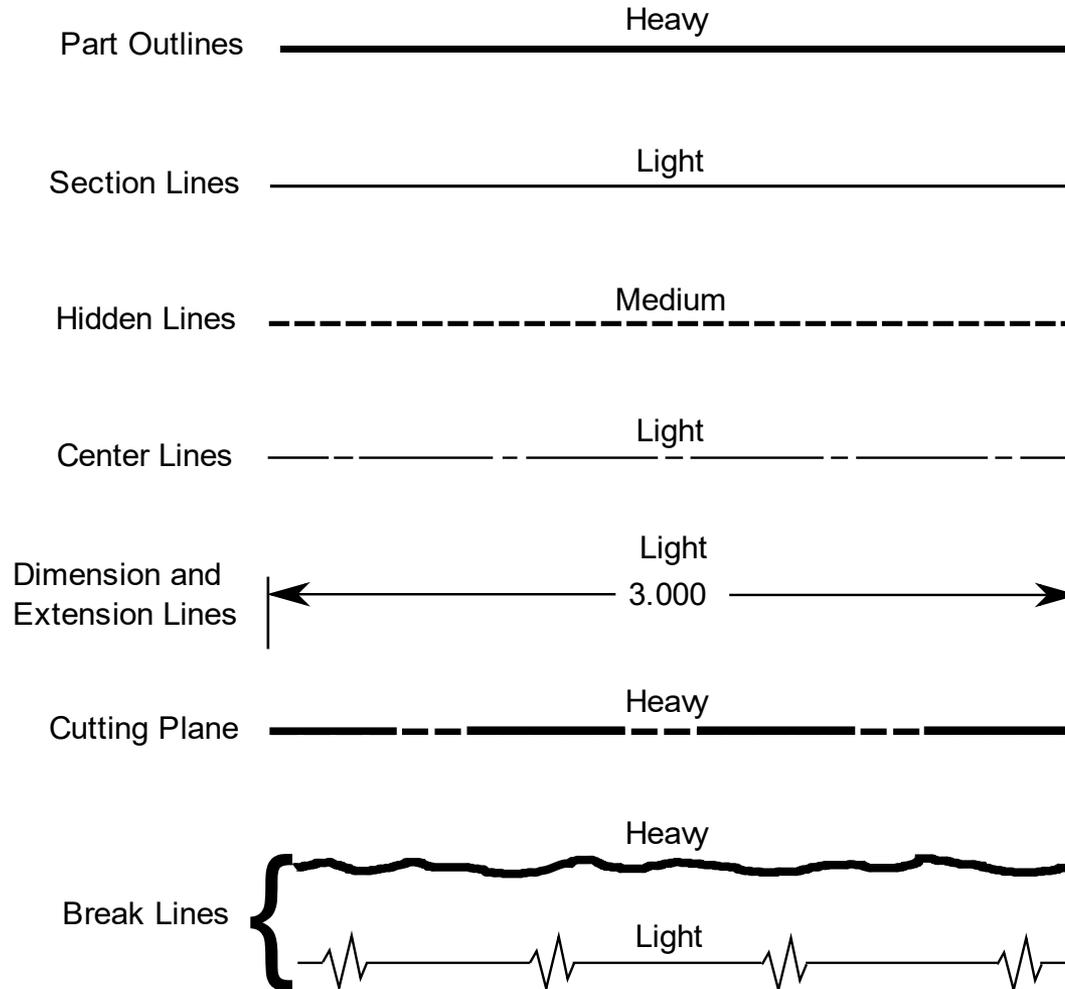
The Role of Freehand Writing and Sketching

- As an engineer, you won't always have the luxury of preparing technical notes or documents using a word processor.
- At meetings, in the shop, or in the field, you will often be required to record data or prepare memos, notes, plans, and other documents freehand.
- First impressions count, and your technical writing often precedes you.
- Make your freehand documents easy to read and understand:
- Learn to organize your thoughts, block or speed print quickly and neatly, and draw a straight line, box, or circle without a ruler or compass.

Block or Speed Printing



Line Types



Do Your Freehand Documents Stack Up?

- Do you think and plan ahead before you write?
- Are your notes, solutions and other documents neatly laid out and well-organized?
- Will others (colleagues, superiors, subordinates) be able to understand your work?
- Will you be able to understand your own work (long) after you wrote it?

Organization and layout are key, but don't overdo it!

Bullet Journals and Doodling

- Bullet Journalling, doodling, and related freehand techniques have become increasingly popular in recent years.
- Such techniques take full advantage of the opportunities to be creative when writing or sketching freehand

10 benefits of doodling for creativity, productivity and focus

Bujo Keys/legend

- A task/to-do
- x Completed task/todo
- Event
- Idea/ Note
- > Task migrated to later date within this month
- < Task migrated to other modules such as future log or collection*

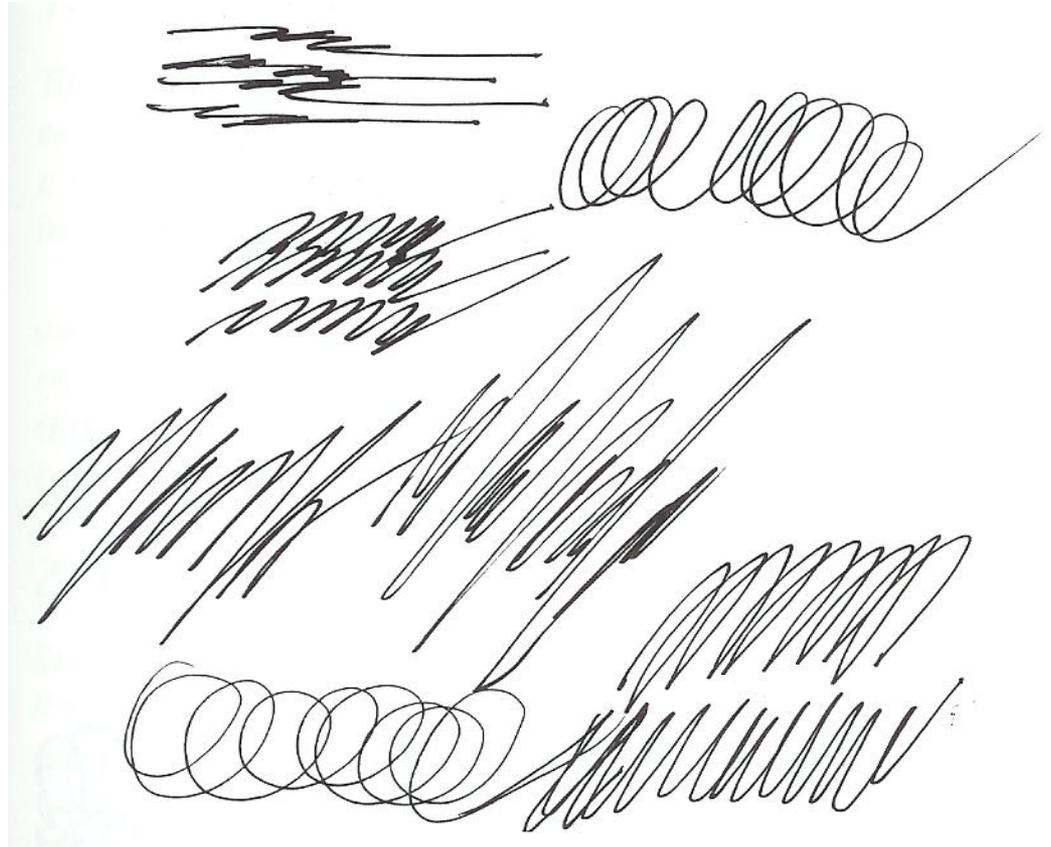
BULLET ⚡ JOURNAL



Line Exercises

Line exercises

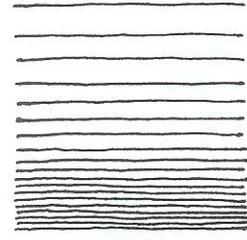
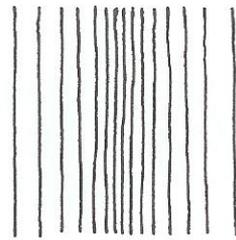
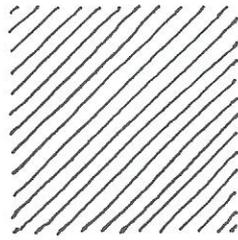
- ▶ “Loosen-up” exercises
 - ▶ Fast
 - ▶ Loose
 - ▶ Serve as warm-up



Line Control Exercises

▶ Basic Line Consistency

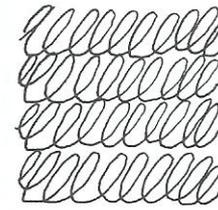
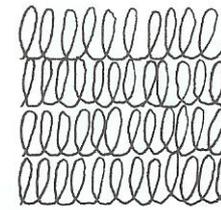
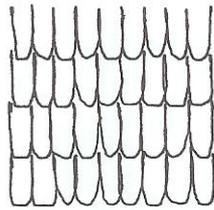
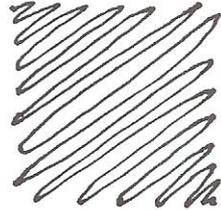
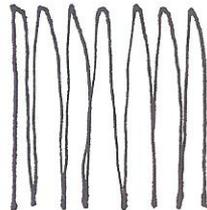
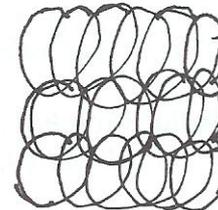
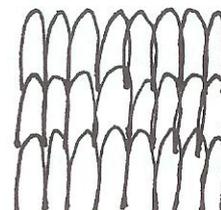
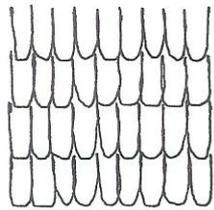
- ▶ Keep equal spacing
- ▶ Horizontal , diagonal, vertical lines
- ▶ Keep **consistent thickness**
- ▶ Control is the key
- ▶ Make 3 of 1" x 1" square for each directional line below



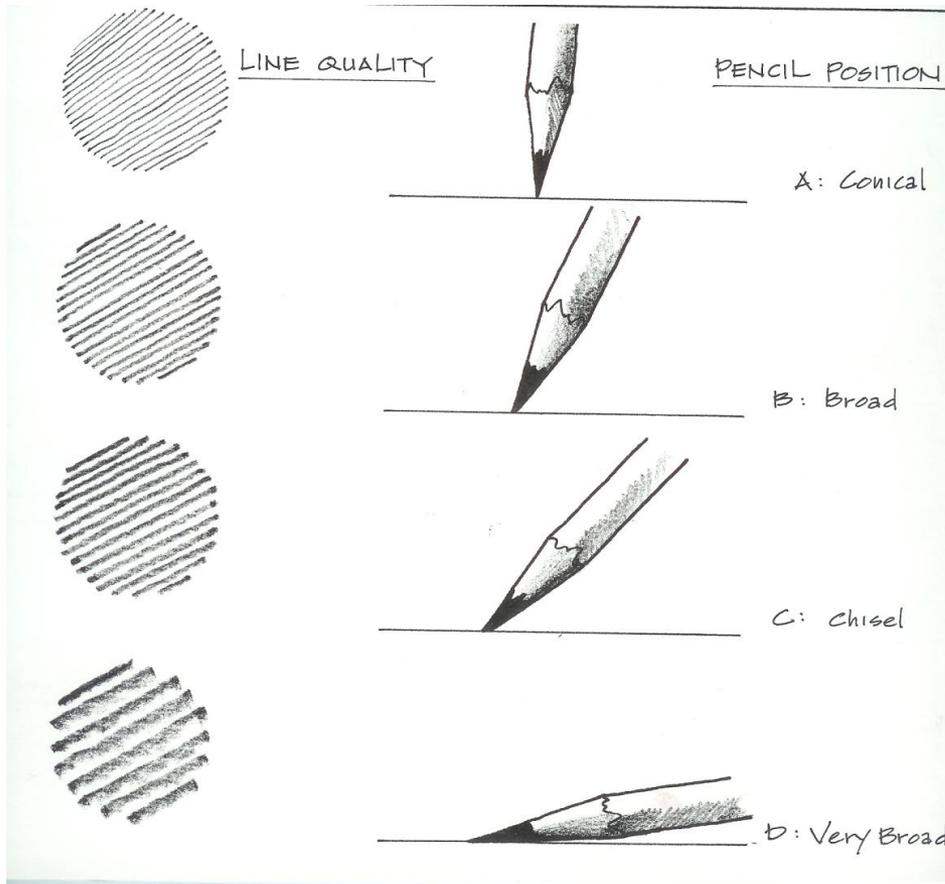
Line Control Exercises

▶ Line Consistency with Variety

- ▶ Use imagination to draw interesting line movements
- ▶ Make 1" x 1" square for each curvilinear line below



Line thickness



- ▶ Make 1" diameter circle for each line qualities on the left from A thru D
- ▶ Using different pencil position
- ▶ Showing line thickness and weights
 - ▶ Light to heavy lines

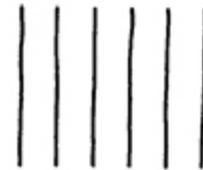
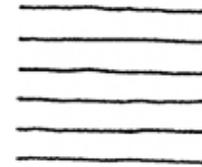
Estimate line exercises for next slides

- ▶ Learning activity
- ▶ 'Practice makes perfect' - so if a particular exercise doesn't look right, do it again, and keep practicing until you're happy with your efforts.
- ▶ Do all your drawing freehand without a ruler.
- ▶ When you finish each exercise, check your measurements with a ruler, to see how accurate your estimates were.
- ▶ The same applies to the drawings that require angles - check your angles when you've finished.

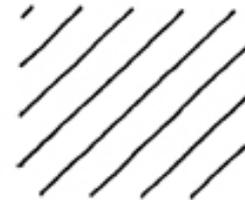


Line technique

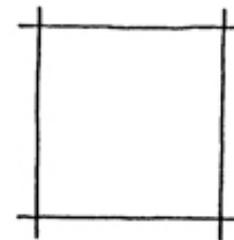
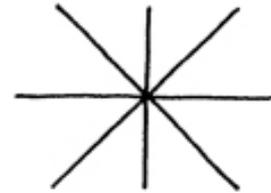
1. Draw a horizontal line about 1" long, and then another five lines underneath, each separated by about $\frac{1}{4}$ ".
2. Draw a vertical line about 1" long, and then another five lines beside it, separated by about $\frac{1}{4}$ ".



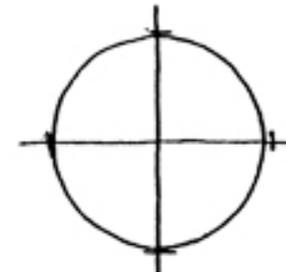
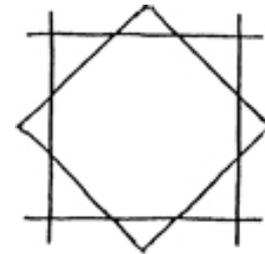
-
- ▶ Draw a faint dotted line in a 1" square, and then draw diagonal lines inside the square, separated by $\frac{1}{4}$ ".
 - ▶ Draw a faint dotted line in a 1" square, and then draw one horizontal and one vertical line in a cross shape. Check the angle in the middle for square once you've finished.



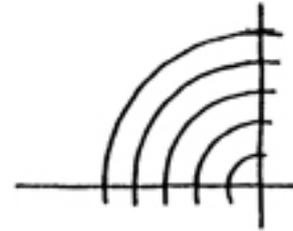
-
- ▶ Draw the cross again, and then add two diagonal lines. Check the two right angles in the middle for square.
 - ▶ Draw a square, with each side about 1" long. Check the corners for square when you've finished.



-
- ▶ Draw another 1" square, as before, and then draw a diamond on top. Check all corners for square when you've finished.
 - ▶ Draw a faint dotted line in a 1" square. Mark 1/2" from the center in all four directions. Then draw four separate arcs, so that they meet up as a circle.



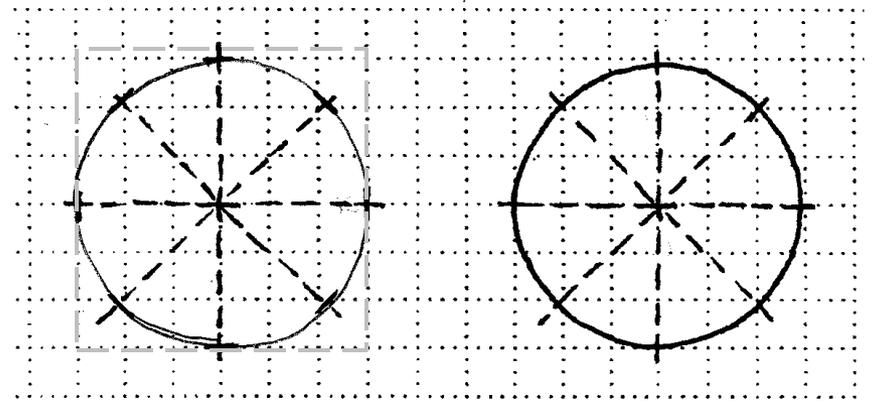
-
- ▶ Draw one horizontal and one vertical line, each 1" long, meeting at one end. Then draw five concentric arcs, separated by $\frac{1}{4}$ ".
 - ▶ Draw a faint dotted line 1" square. Then draw a series of continuous loops inside the box.



Sketching arch and circle

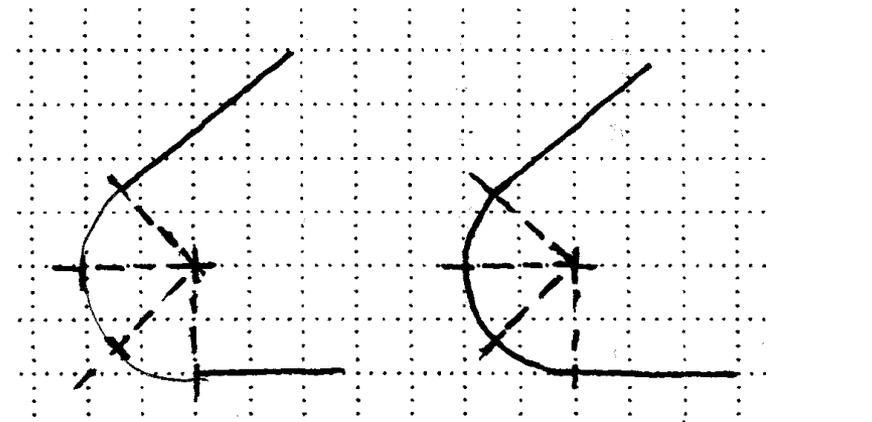
▶ Circle

- ▶ Draw a faint dotted line 1" square. Then draw horizontal and vertical lines at 45 degree
- ▶ Mark all four points. Then draw an arc to connect all the points



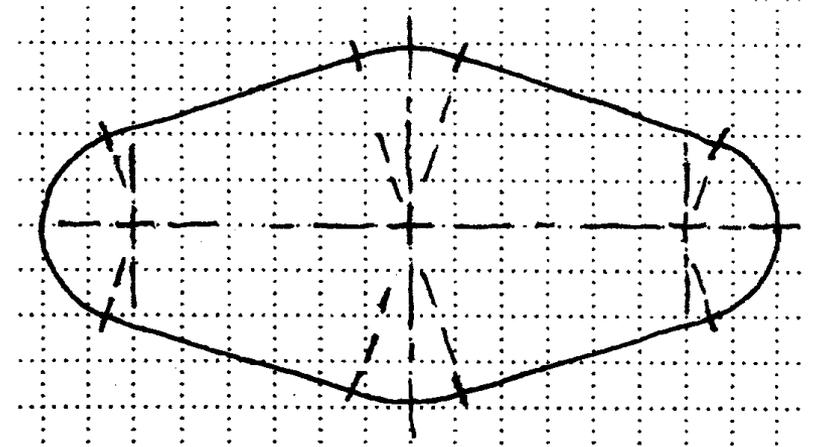
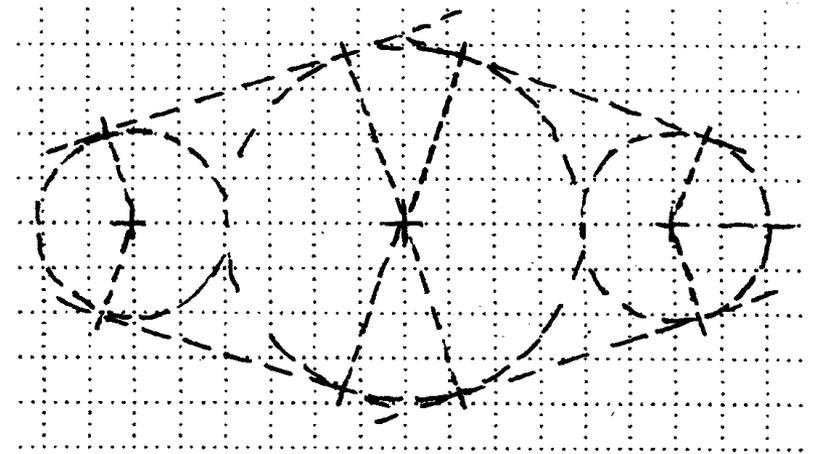
▶ Arch

- ▶ Tangent points help to define arch
- ▶ Locating tangent points will improve the appearance of sketches
- ▶ Draw 1" radius from the center point
- ▶ Mark all four points. Then draw an arc to connect all the points



Sketching techniques

- ▶ **Unique shape**
 - ▶ 1st sketch a large and two equal smaller circles (from previous slide) and construct tangent lines
 - ▶ Block in the entire circle
 - ▶ Sketch the three circles
 - ▶ Sketch the lines tangent to the circles
 - ▶ Sketch each radius perpendicular to each tangent
 - ▶ These constructions help locate points needed for darkening-in final shape
 - ▶ The final shape is sketched by pressing down hard on the pencil to create a smooth black outline



Sketching geometric shapes

▶ Hexagon/Octagon

- ▶ 1st sketch a circle (from previous slide) and construct tangent lines
- ▶ Draw the hexagon using the circle as a control surface
- ▶ Blacken the lines for the final shape

