

Figure 4-1
Points and Lines.

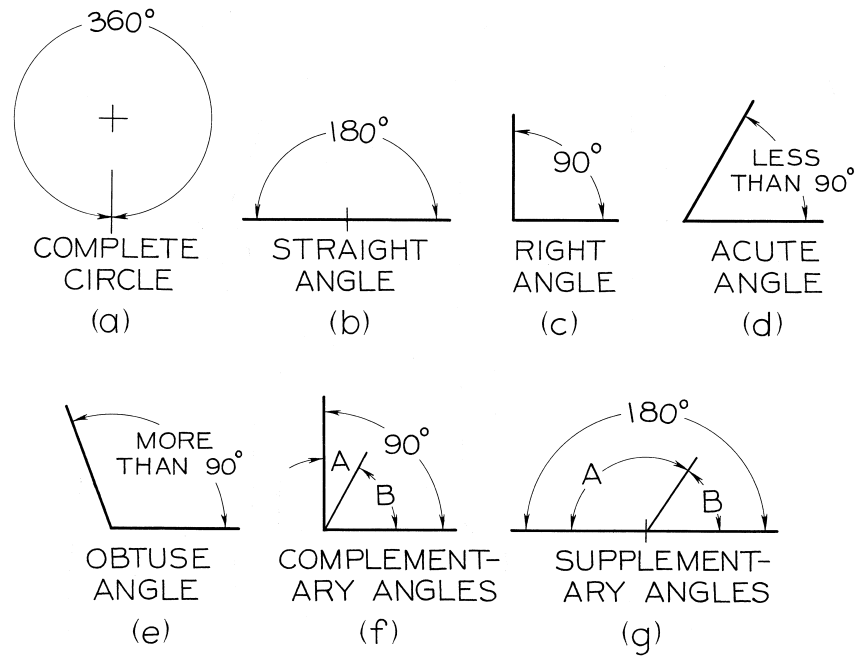


Figure 4-2
Angles.

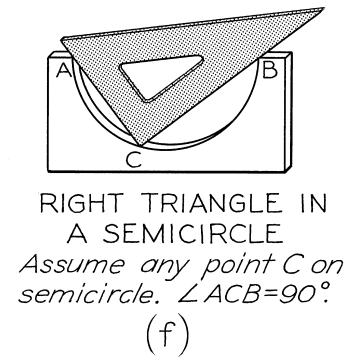
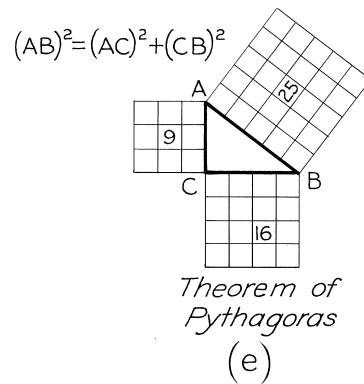
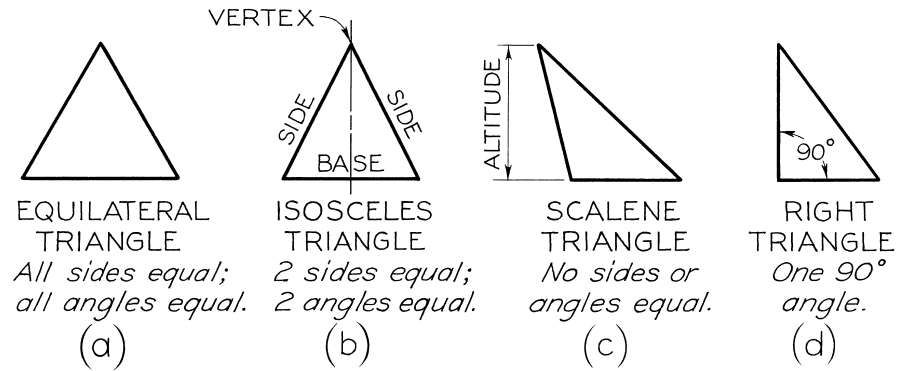


Figure 4-3
Triangles.

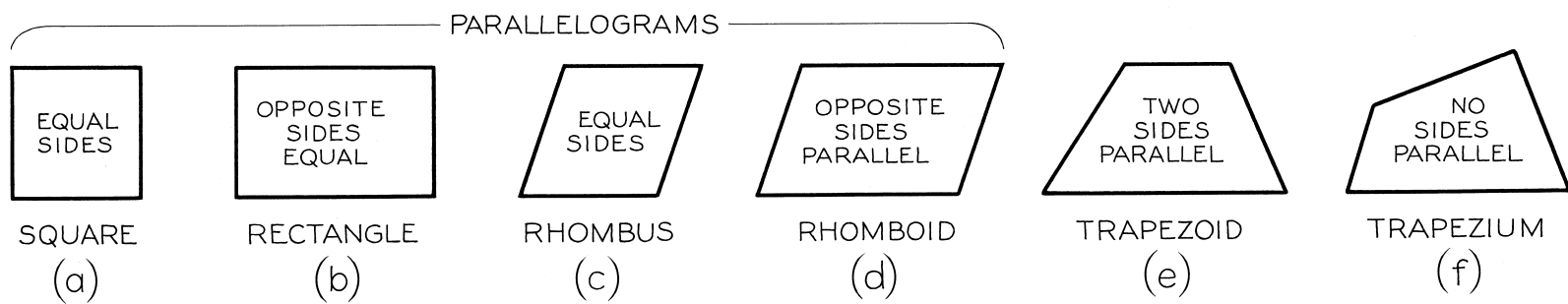


Figure 4-4
Quadrilaterals.

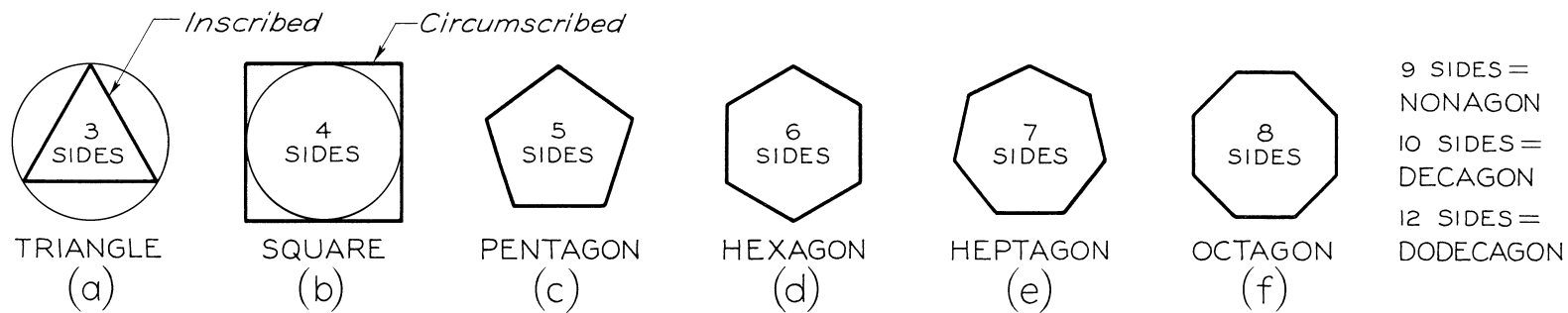


Figure 4-5
Regular Polygons.

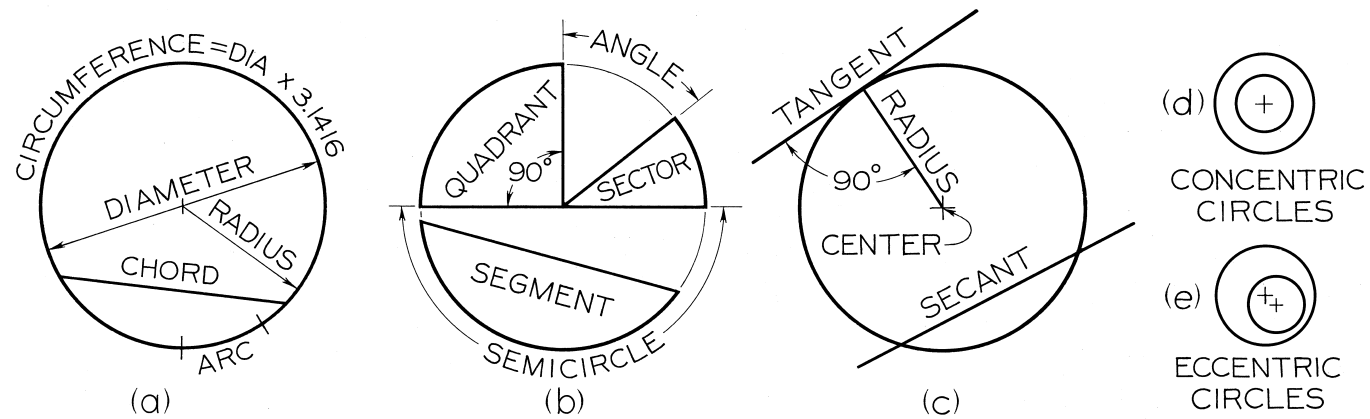


Figure 4-6
The Circle.

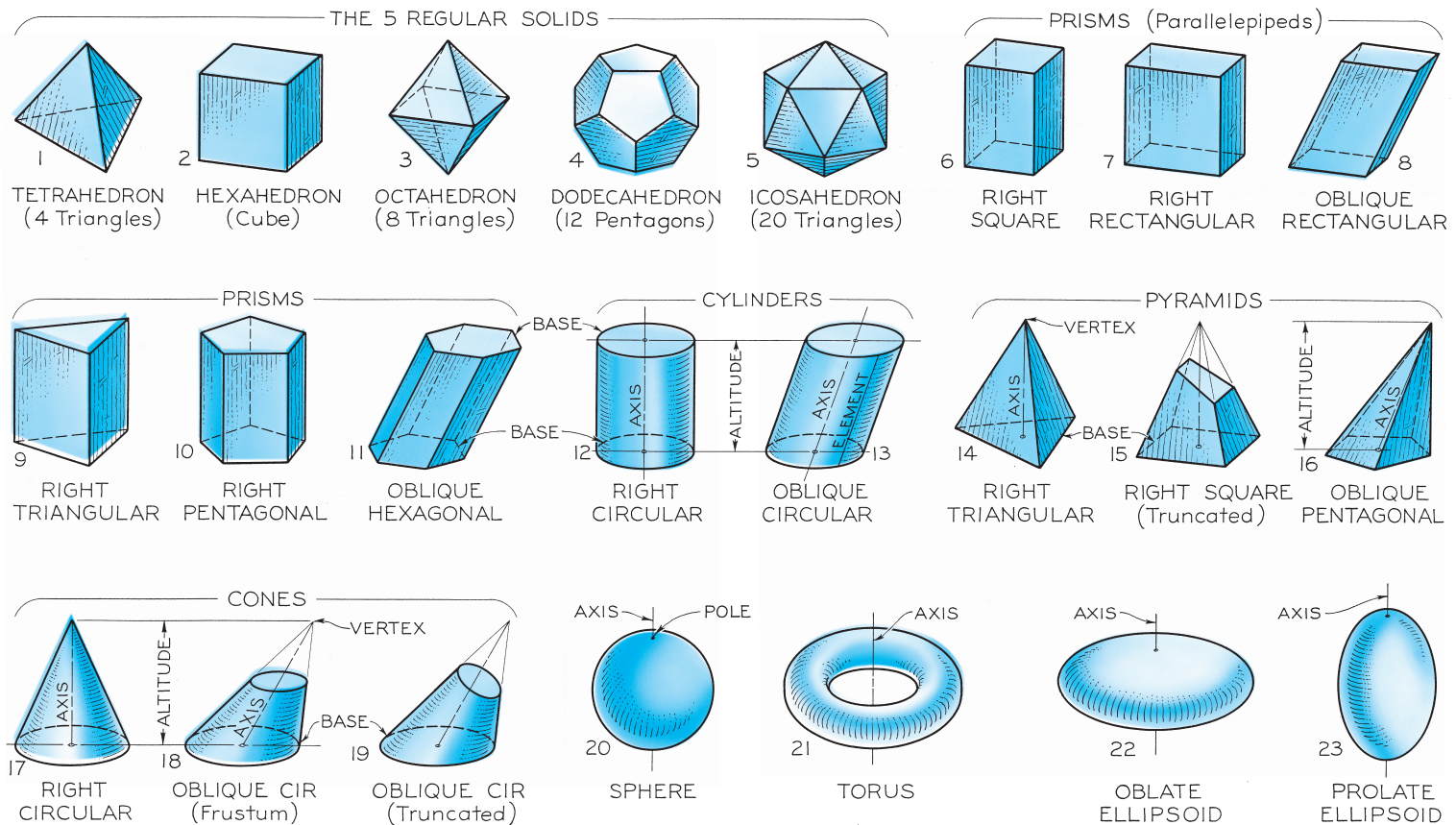


Figure 4-7
Solids.

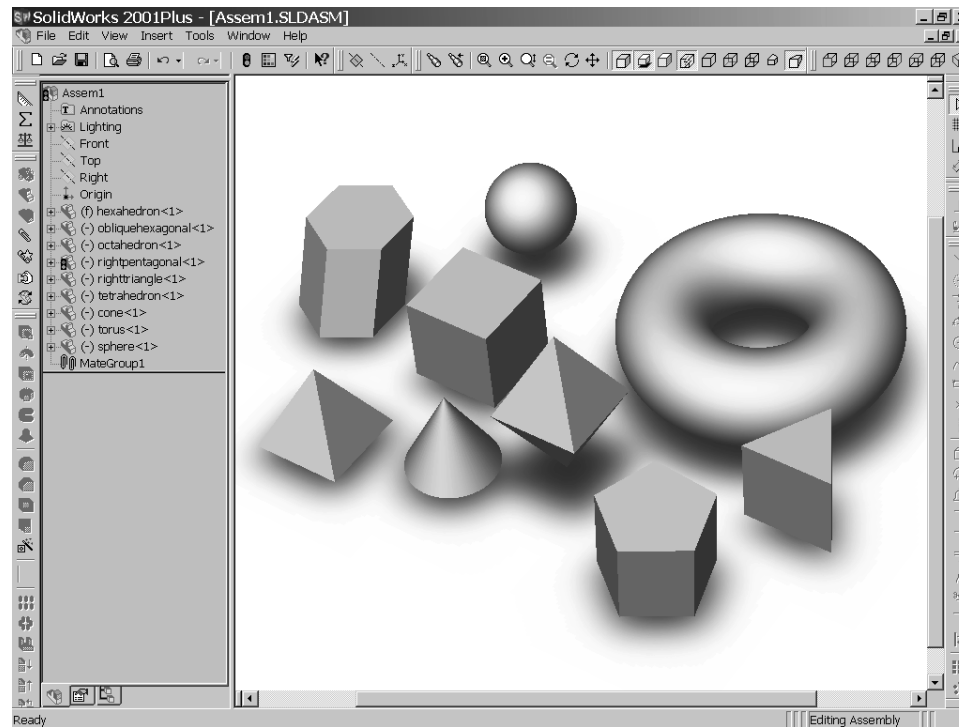


Figure 4-7.1

Examples of Solids Created with CAD. *Courtesy of SolidWorks Corporation.*

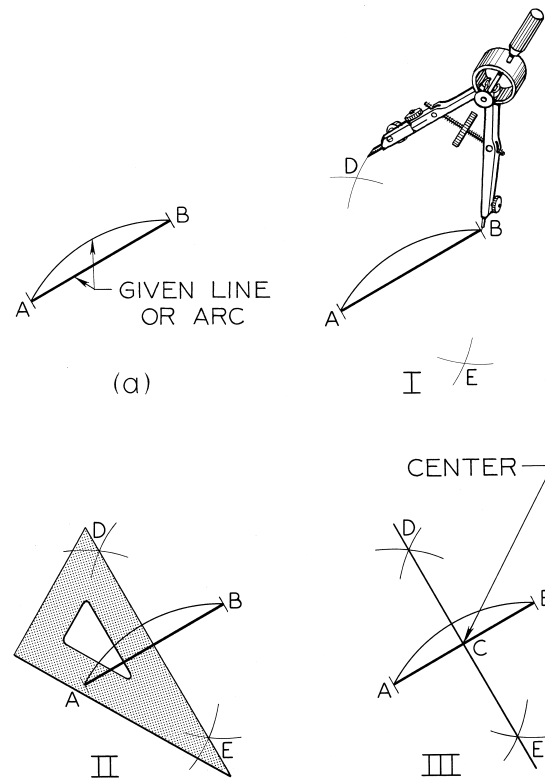


Figure 4-8
Bisecting a Line or a Circular Arc (§4.8).

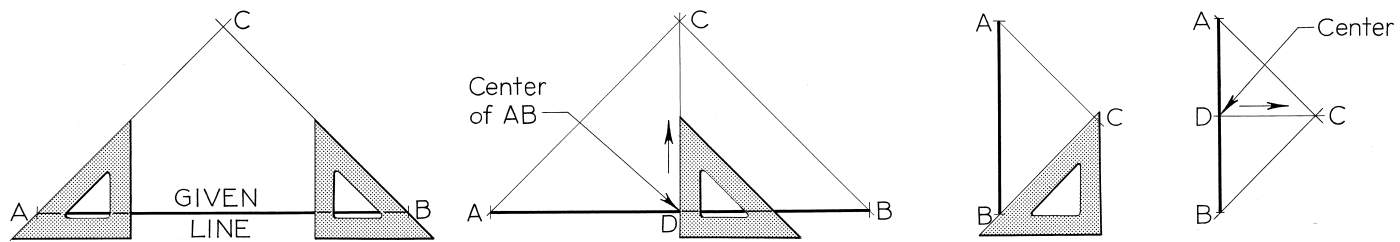


Figure 4-9

Bisecting a Line with Triangle and T-square (§4.9).

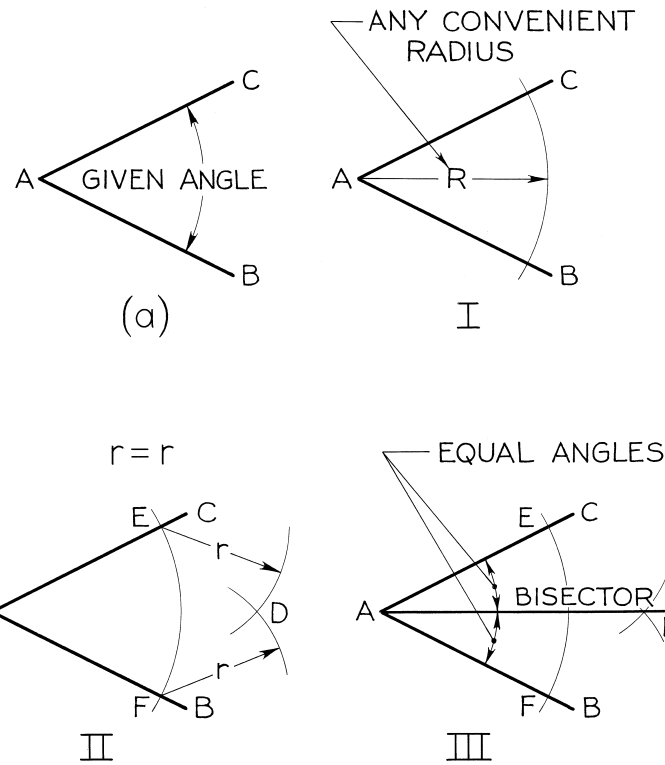


Figure 4-10
Bisecting an Angle (§4.10).

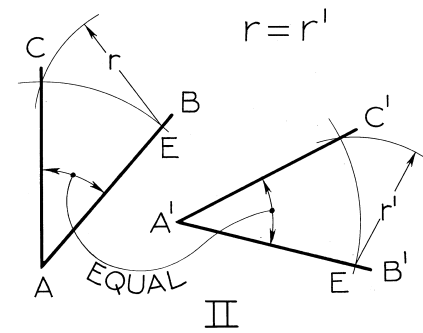
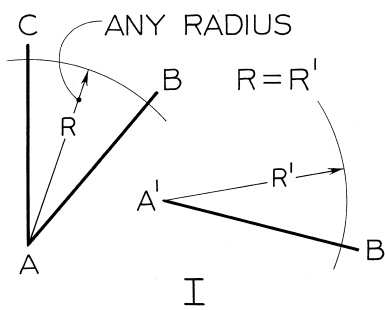
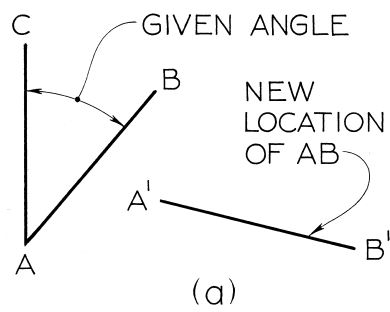


Figure 4-11
Transferring an Angle (§4.11).

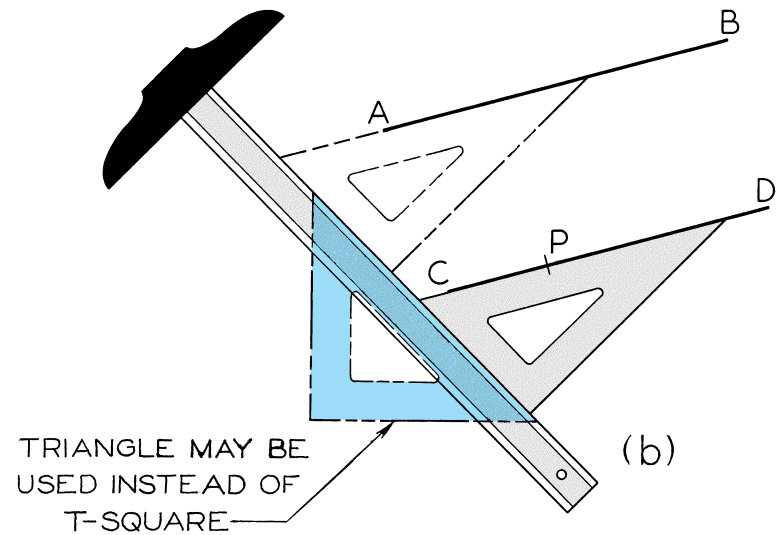
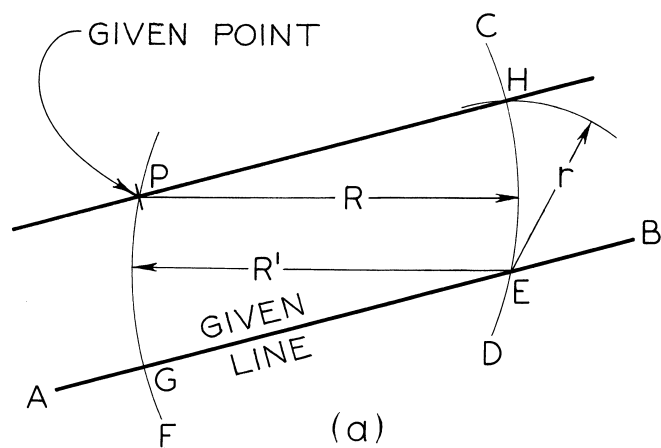


Figure 4-12
Drawing a Line Through a Point Parallel to a Line (§4.12).

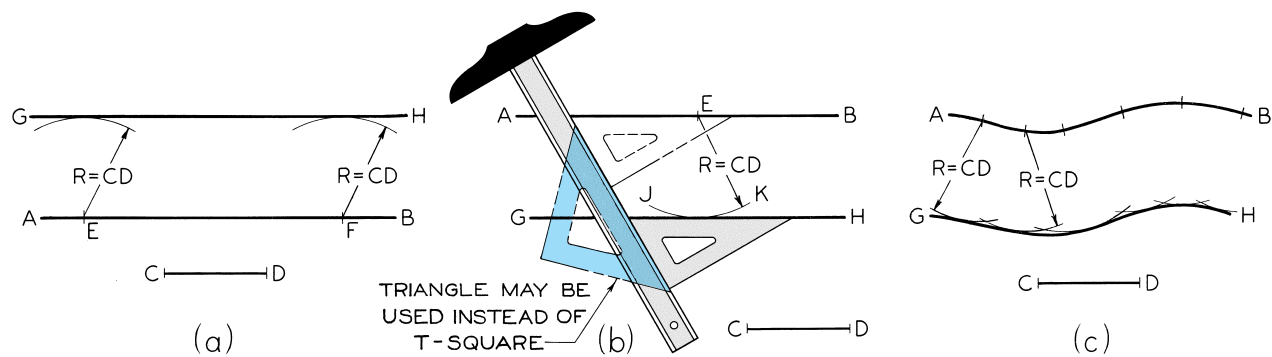


Figure 4-13

Drawing a Line Parallel to a Line at a Given Distance (§4.13).

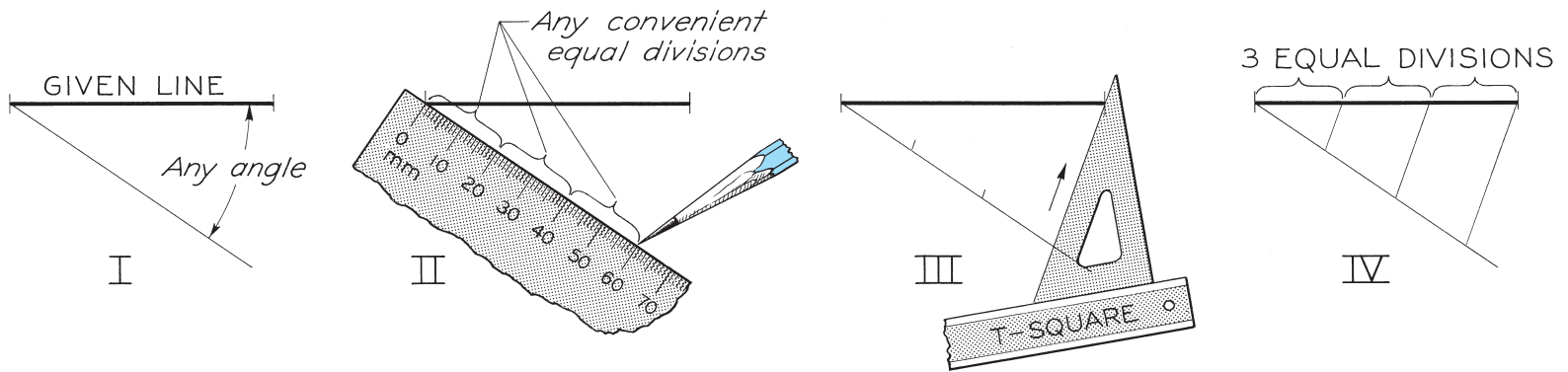


Figure 4-14
Dividing a Line into Equal Parts (§4.14).

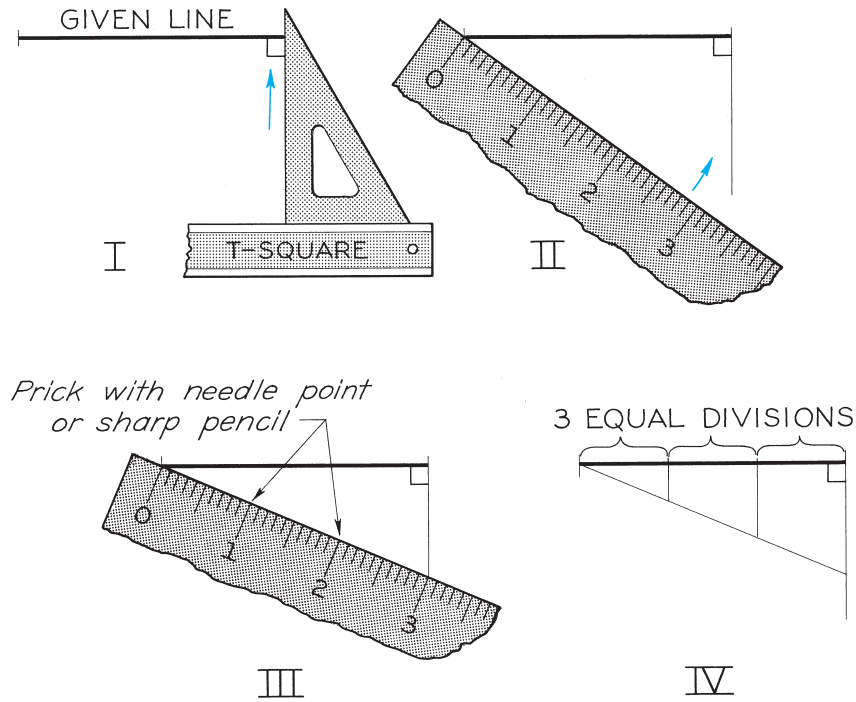


Figure 4-15
Dividing a Line into Equal Parts (§4.14).

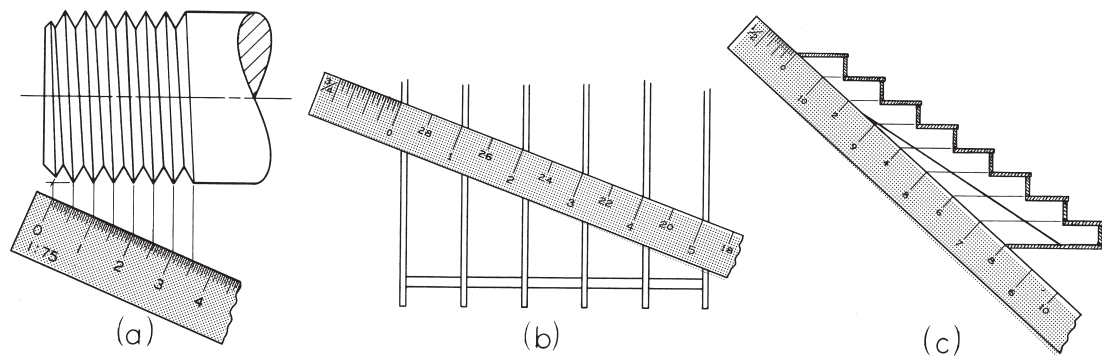


Figure 4-16
Practical Applications of Dividing a Line into Equal Parts (§4.14).

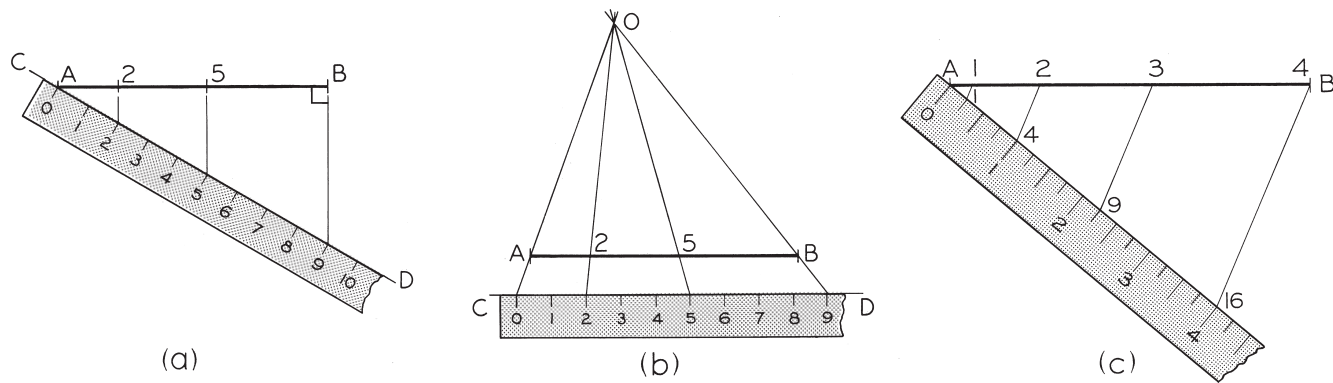


Figure 4.17

Dividing a Line into Proportional Parts (§4.15).

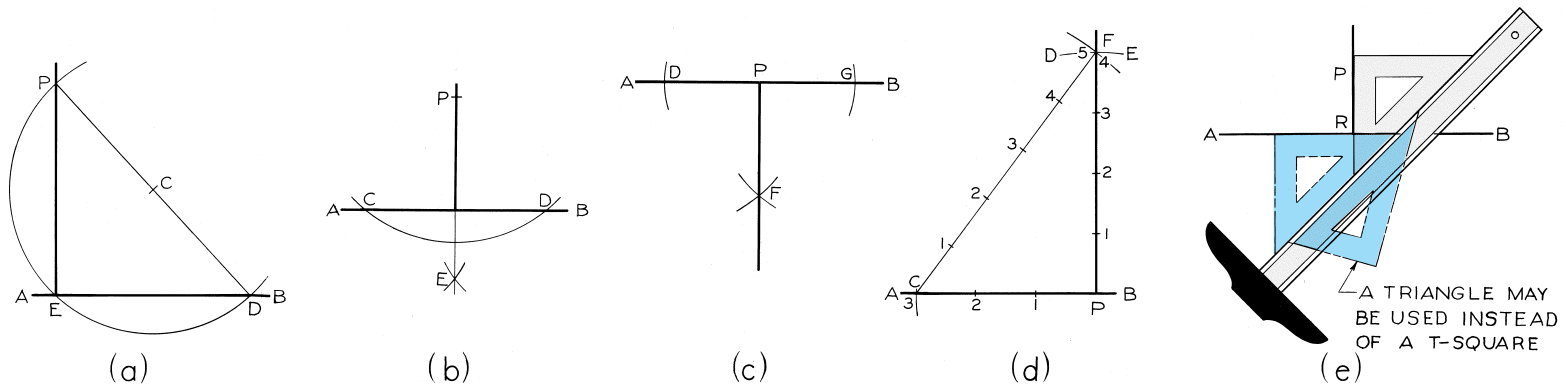


Figure 4-18

Drawing a Line Through a Point and Perpendicular to a Line (§4.16).

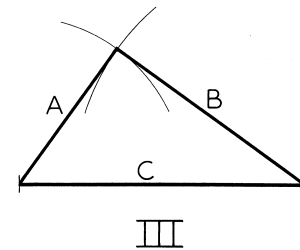
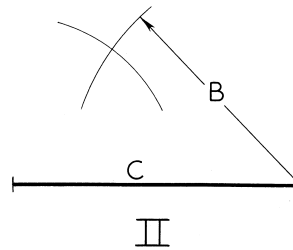
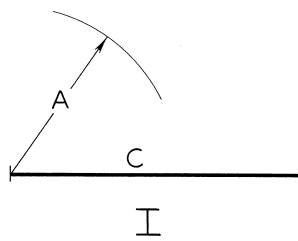
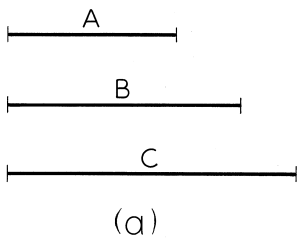


Figure 4-19
Drawing a Triangle with Sides Given (§4.17).

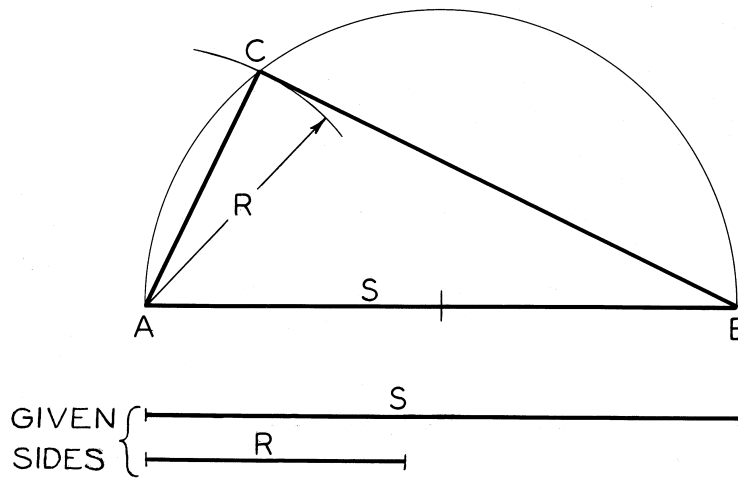


Figure 4-20
Drawing a Right Triangle (§4.18).

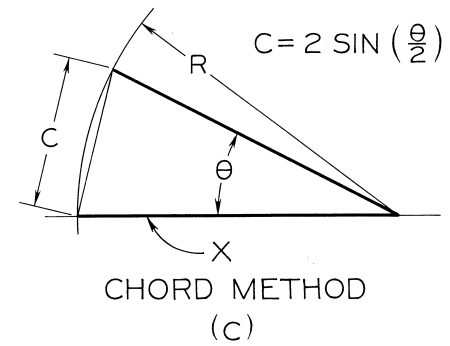
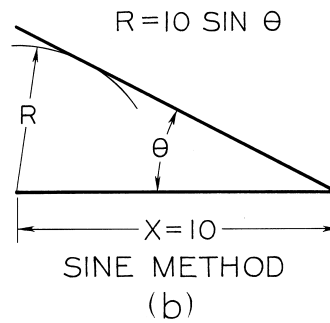
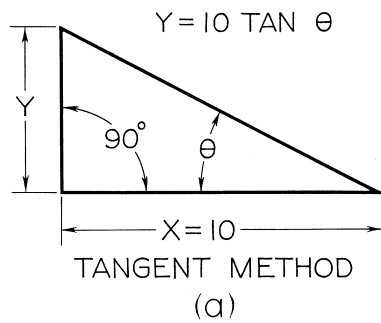


Figure 4-21
Laying Out Angles (§4.19).

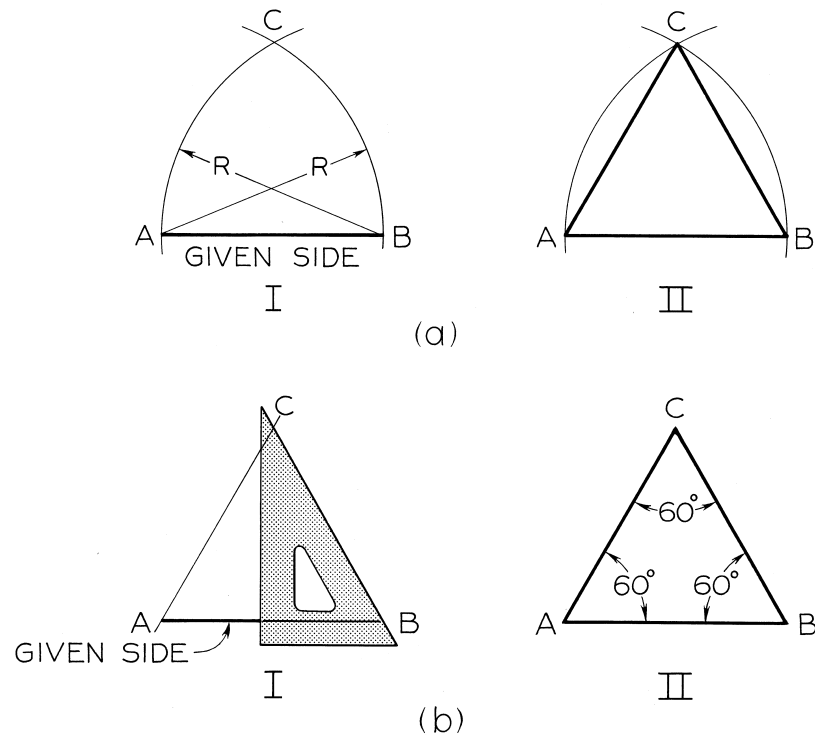


Figure 4-22
Drawing an Equilateral Triangle (§4.20).

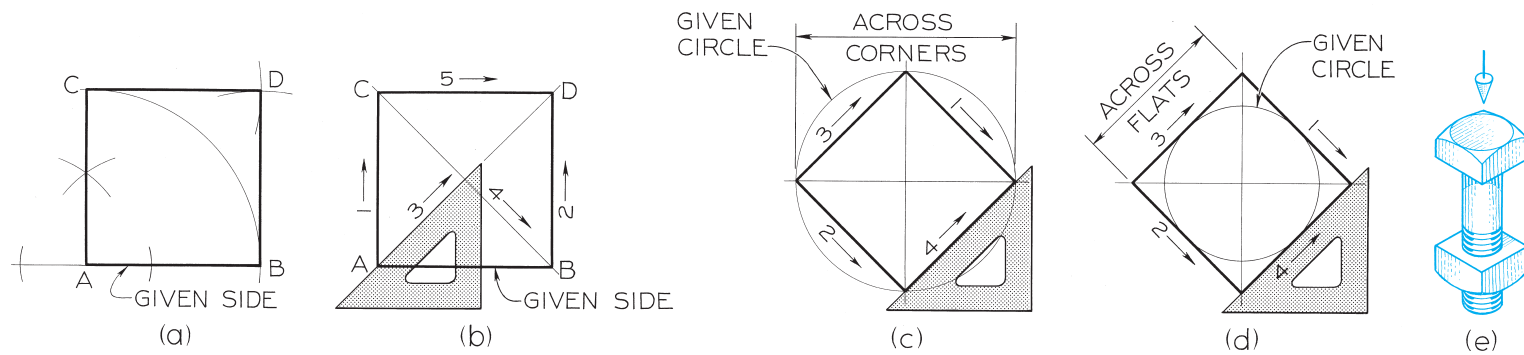


Figure 4-23
Drawing a Square (§4.21).

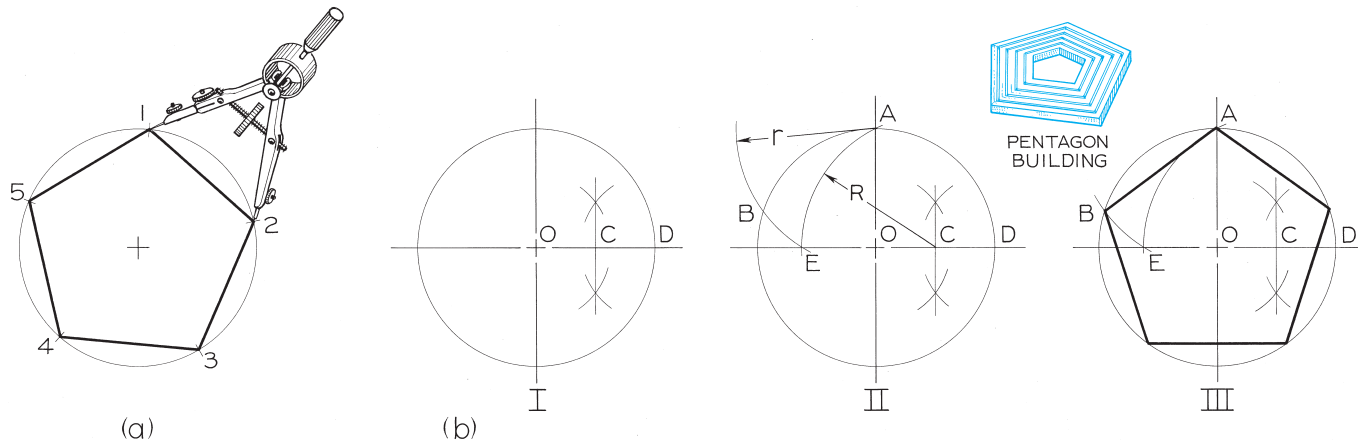


Figure 4-24
Drawing a Pentagon (§4.22).

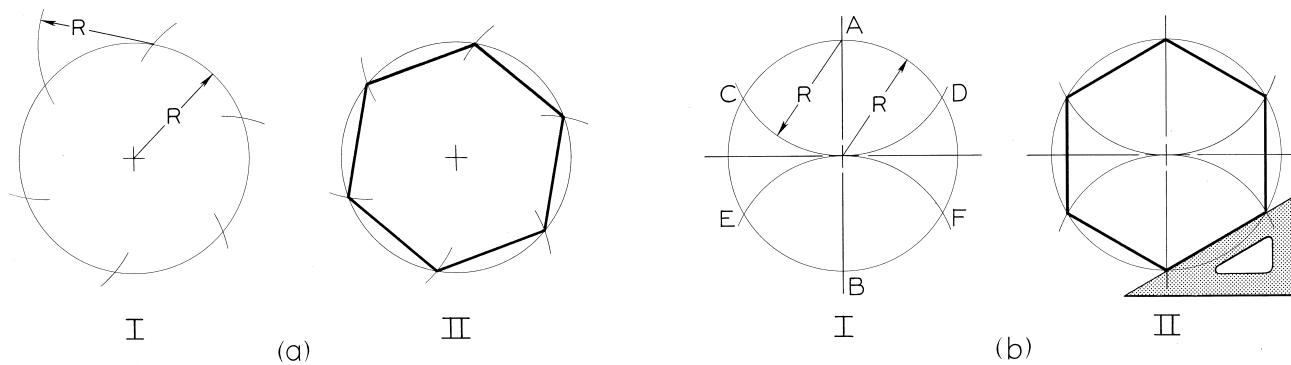


Figure 4-25
Drawing a Hexagon (§4.23).

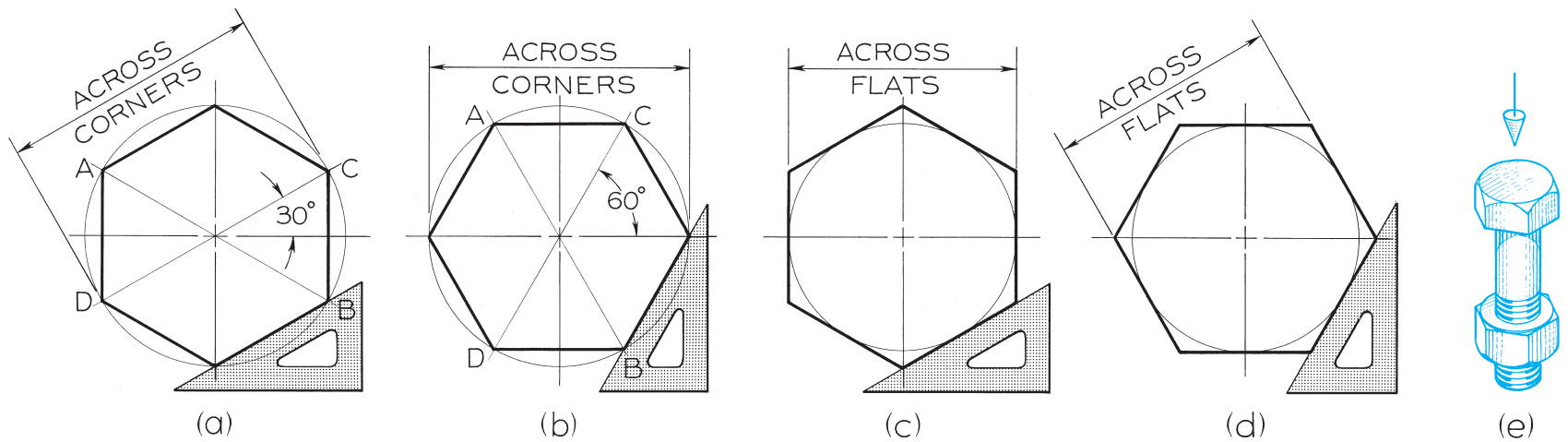


Figure 4-26
Drawing a Hexagon (§4.23).

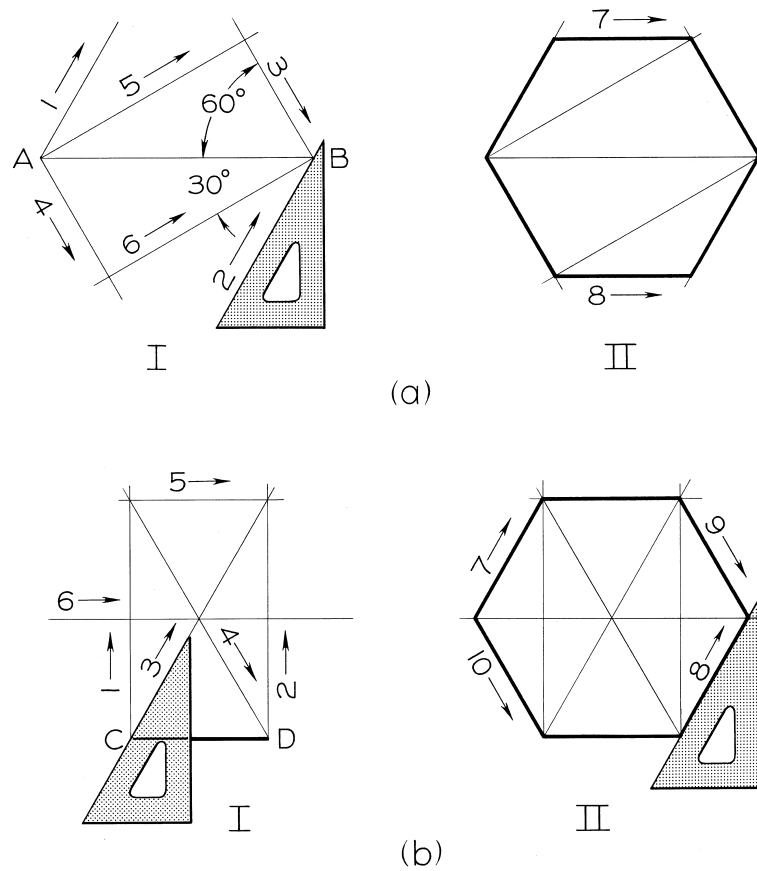


Figure 4-27
Drawing a Hexagon (§4.23).

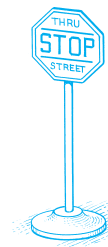
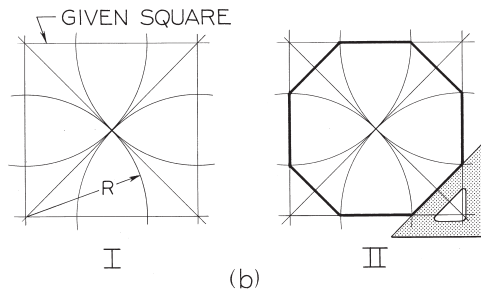
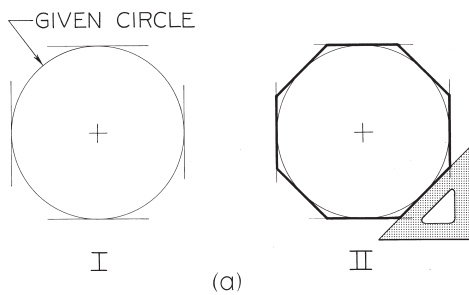


Figure 4-28

Drawing an Octagon (§4.24). *Photo by Laima Druskis.*

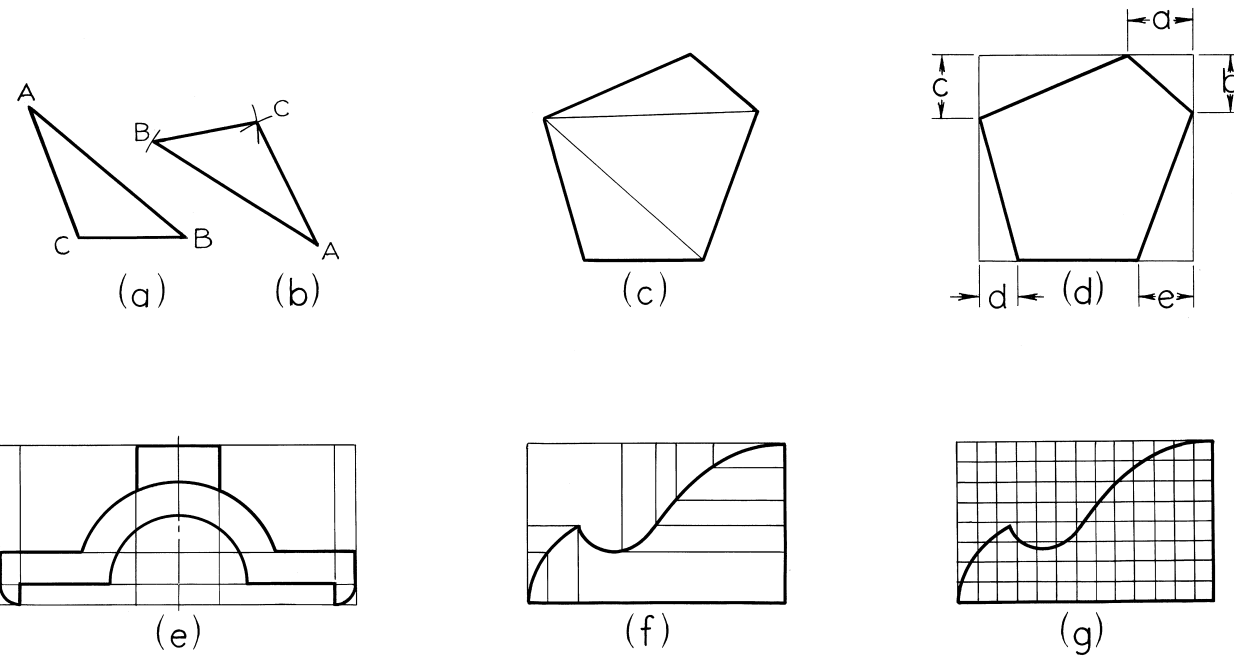


Figure 4-29
Transferring a Plane Figure (§4.25).

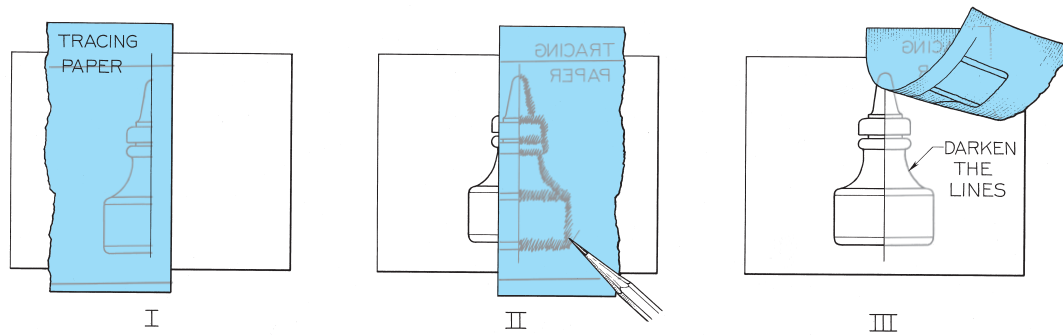


Figure 4-30
Transferring a Symmetrical Half (§4.26).

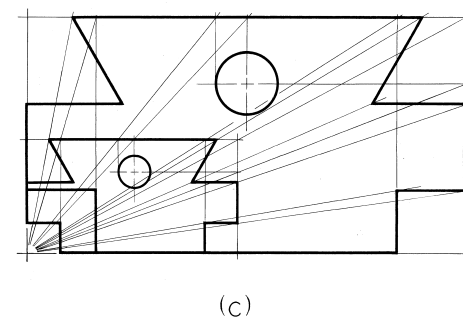
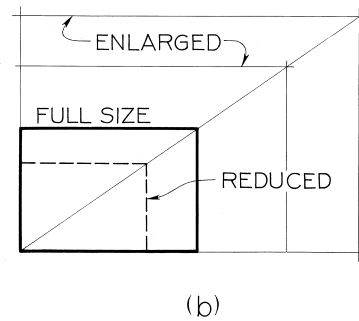
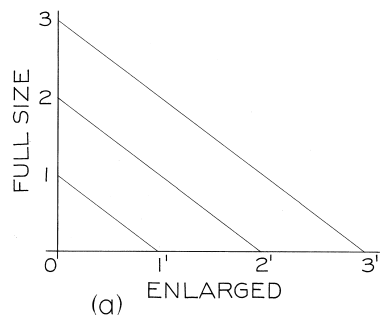
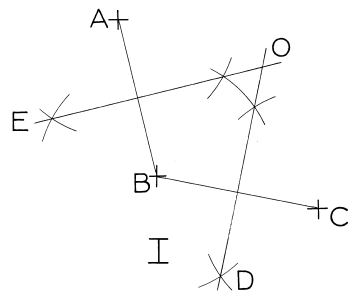
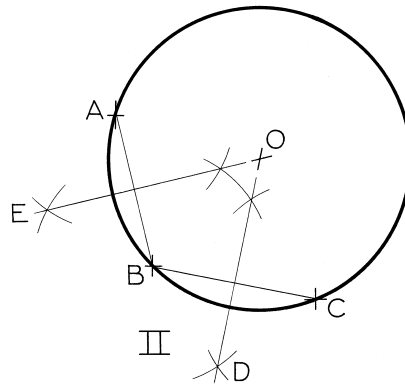


Figure 4-31
Enlarging or Reducing (§4.27).



(a)



(b)

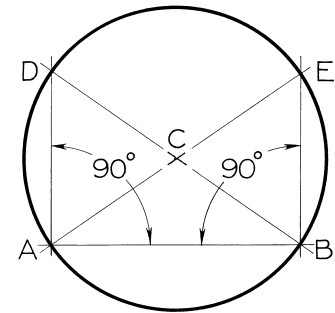


Figure 4-32

Finding Center of Circle (§§4.28 and 4.29).

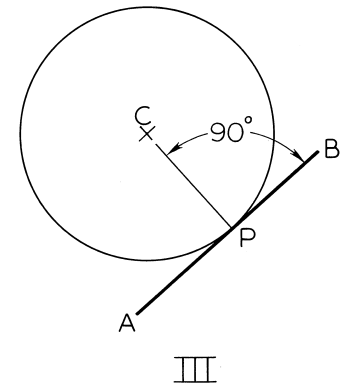
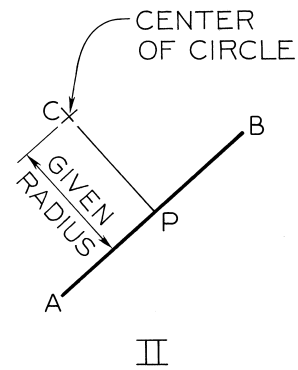
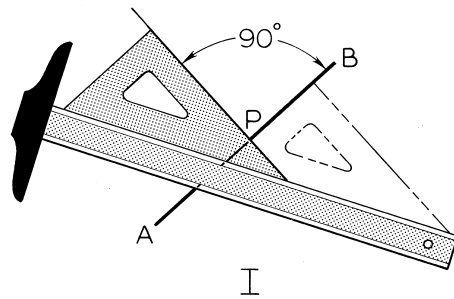
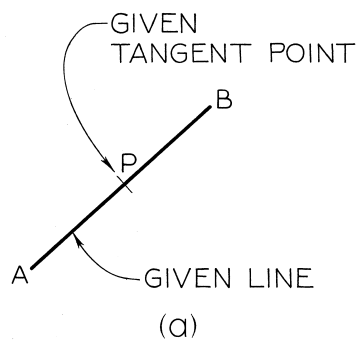


Figure 4-33
Drawing a Circle Tangent to a Line (§4.30).

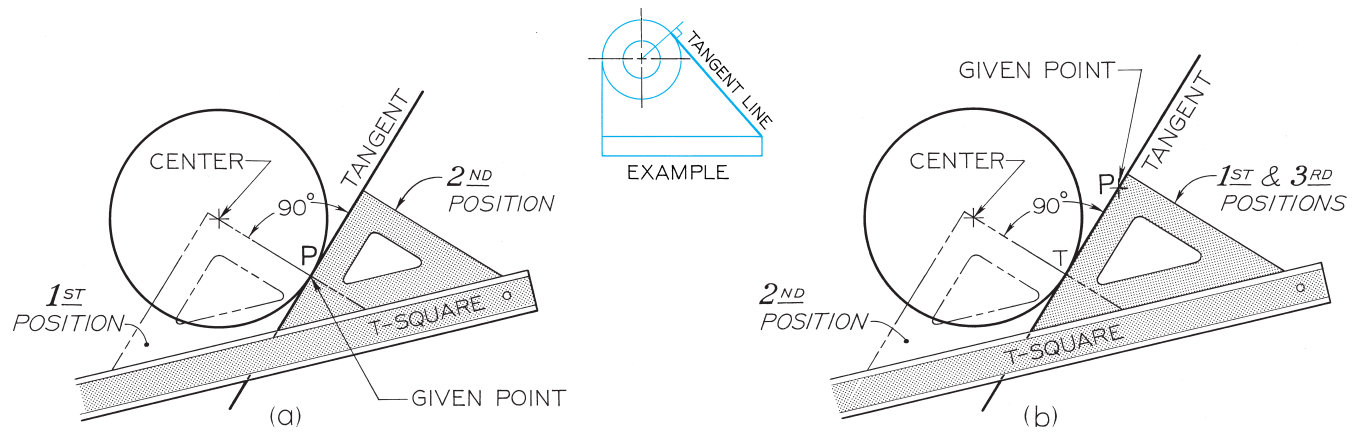


Figure 4-34
Drawing a Tangent to a Circle Through a Point (§4.31).

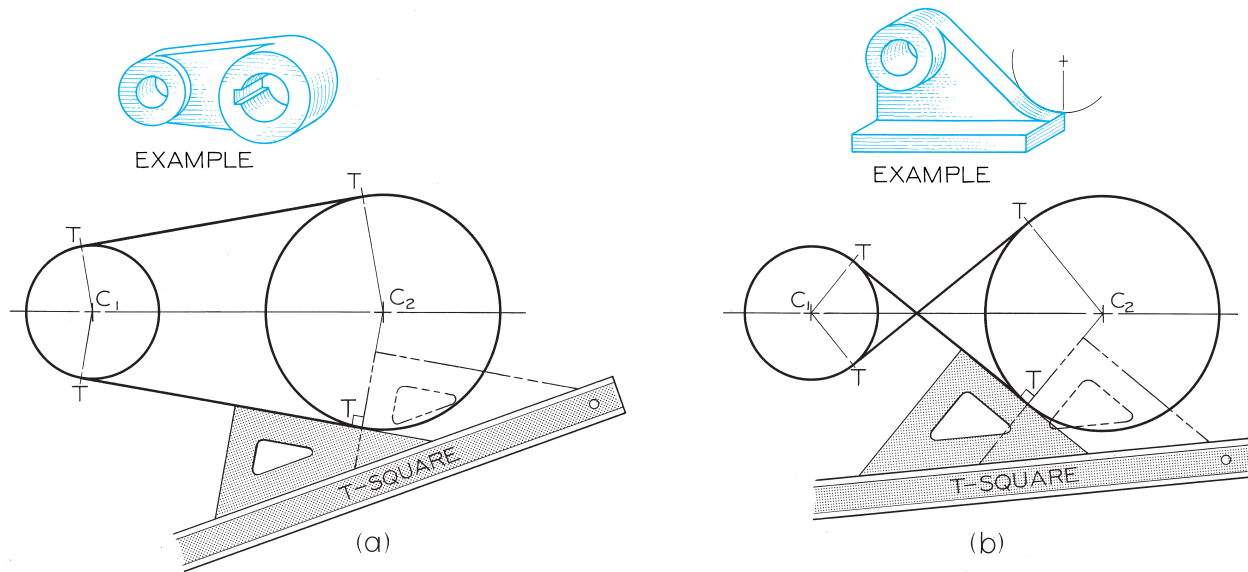


Figure 4.35
Drawing Tangents to Two Circles (§4.32).

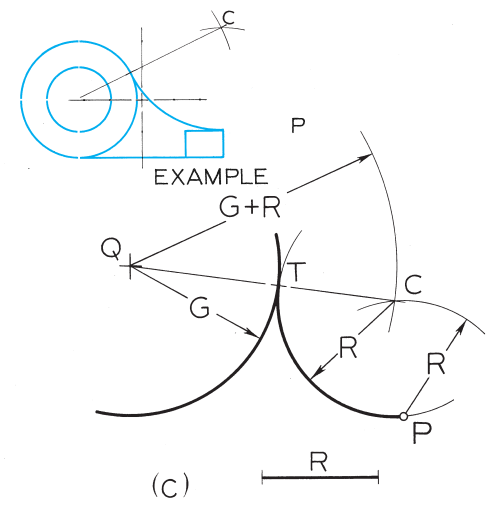
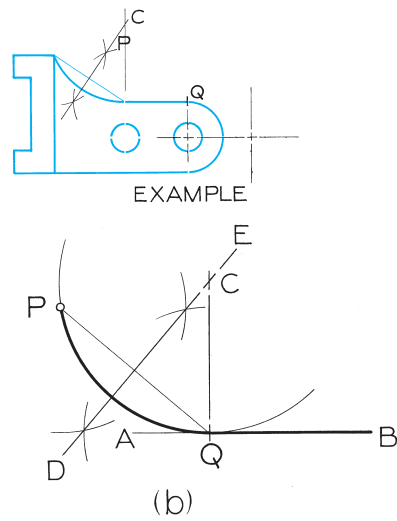
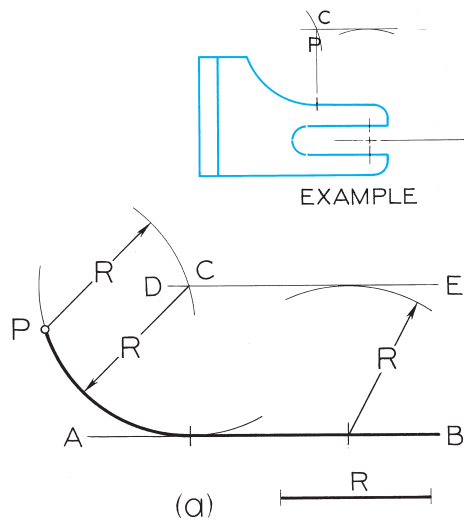


Figure 4-36
Tangents (§4.33).

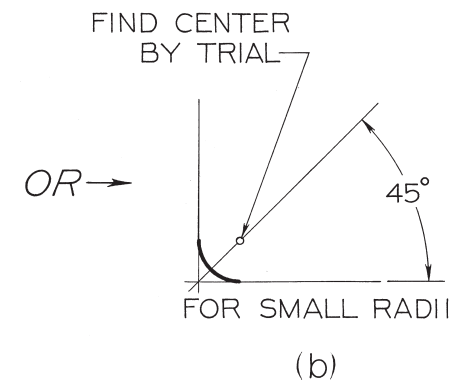
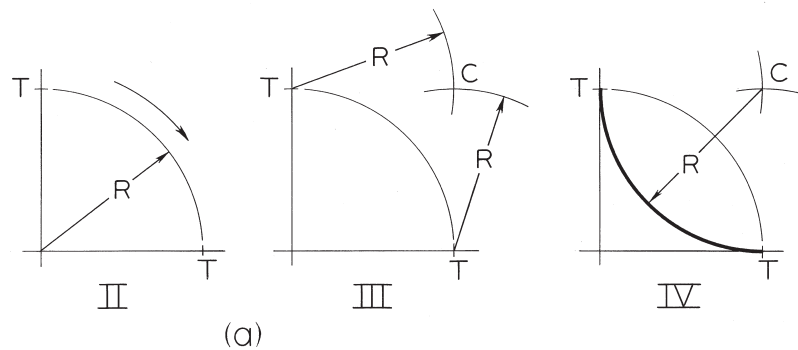
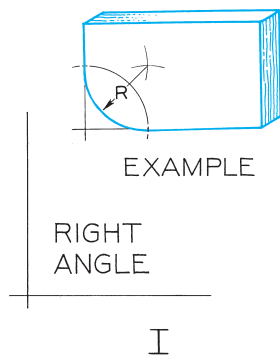


Figure 4-37

Drawing a Tangent Arc in a Right Angle (§4.34).

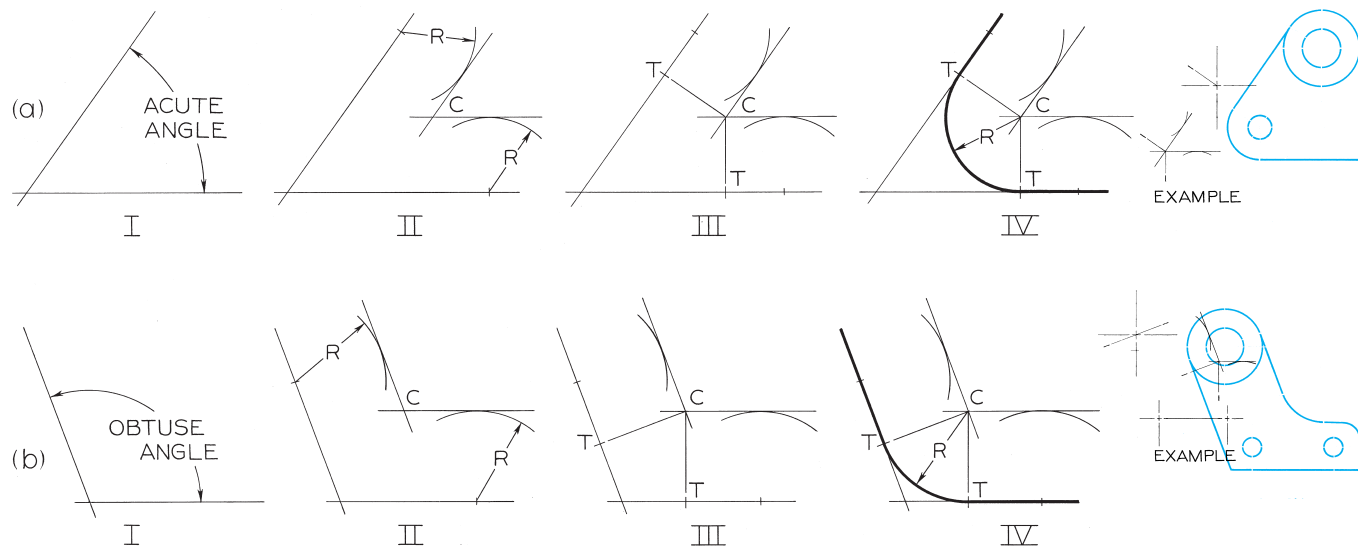


Figure 4-38
Drawing Tangent Arcs (§4.35).

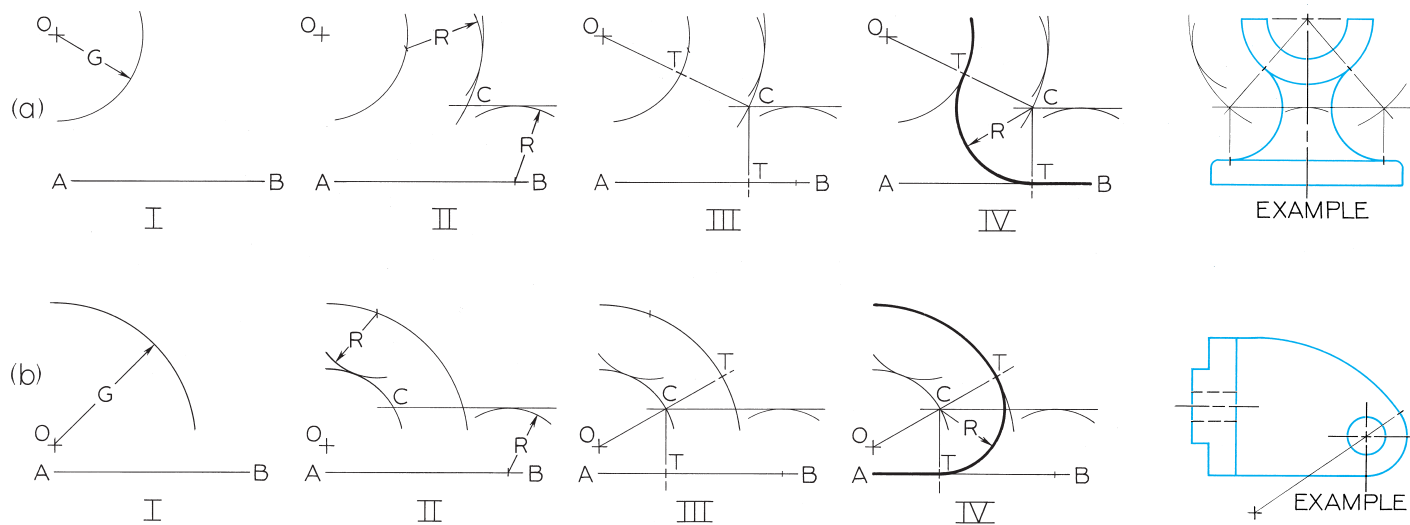
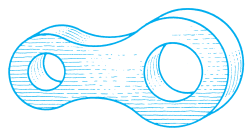
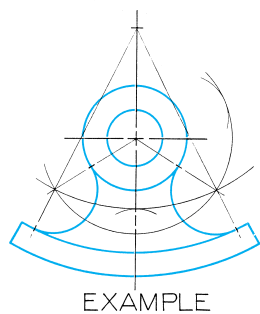
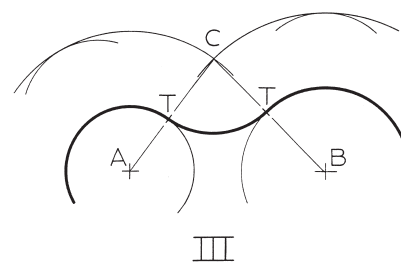
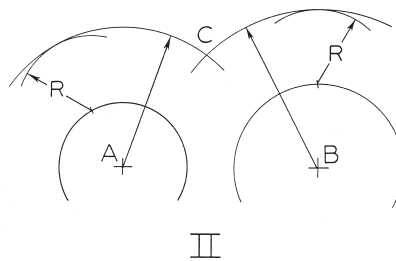
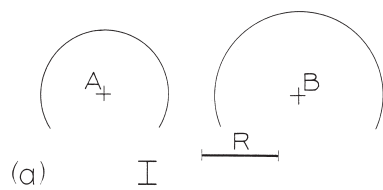


Figure 4-39

Drawing an Arc Tangent to an Arc and a Straight Line (§4.36).



EXAMPLE



EXAMPLE

(b)

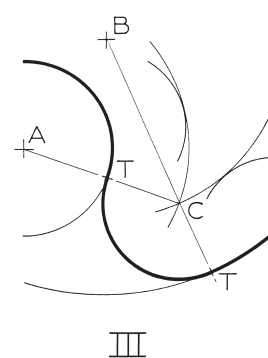
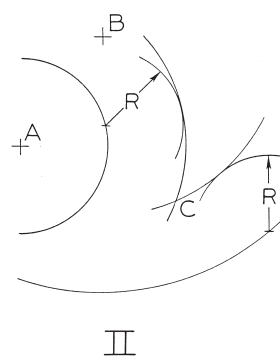
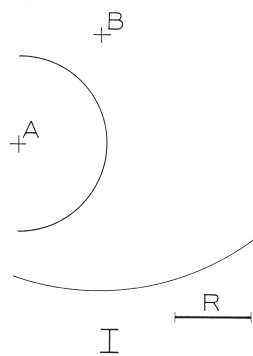


Figure 4-40

Drawing an Arc Tangent to Two Arcs (§4.37).

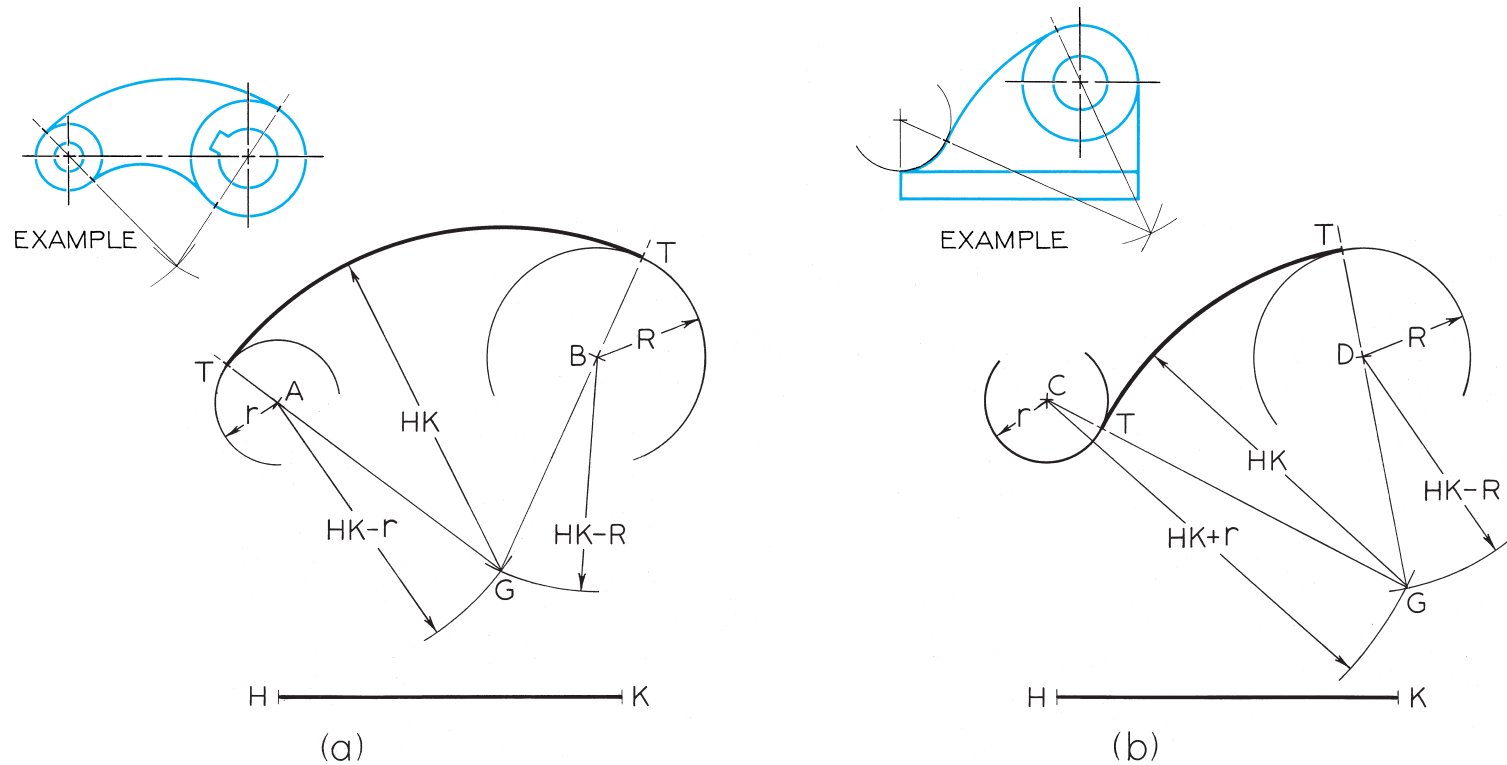


Figure 4-41

Drawing an Arc Tangent to Two Arcs and Enclosing One or Both (§4.38).

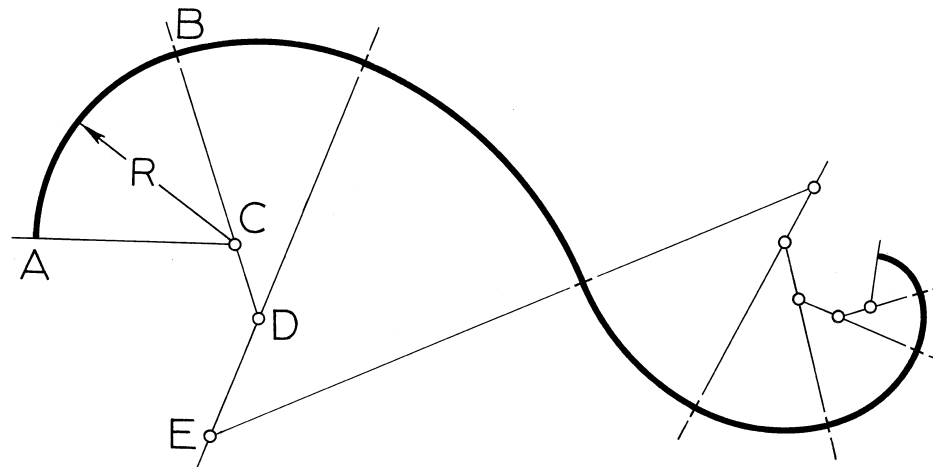


Figure 4-42

Drawing a Series of Tangent Arcs Conforming to a Curve (§4.39).

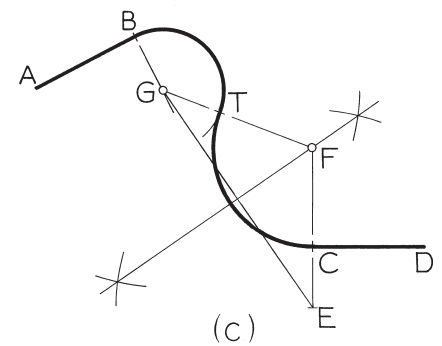
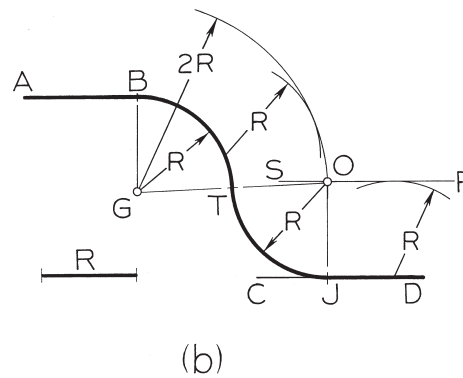
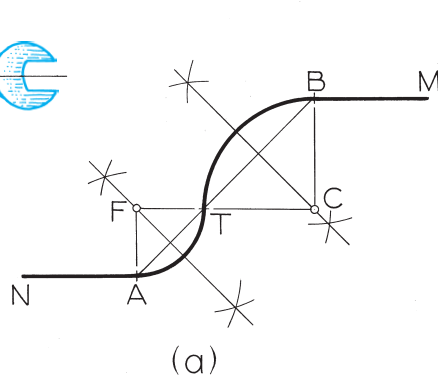
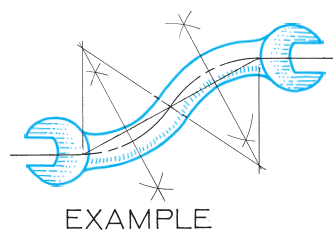


Figure 4-43
Drawing an Ogee Curve (§4.40).

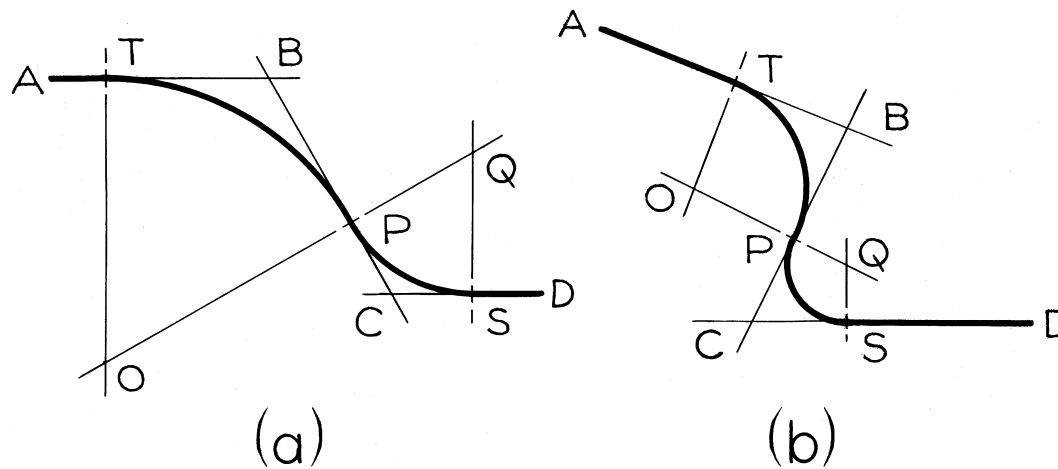
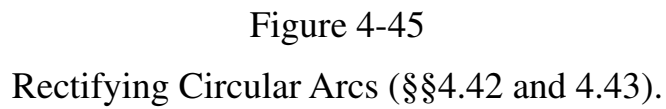


Figure 4-44

Drawing Two Curves Tangent to Three Intersecting Lines (§4.41).



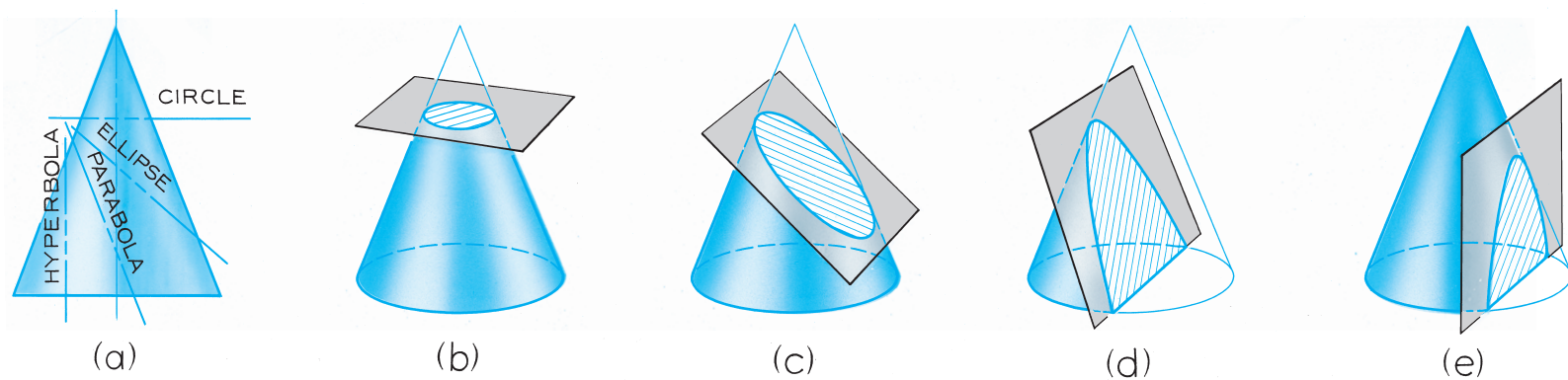


Figure 4-46
Conic Sections (§4.44).

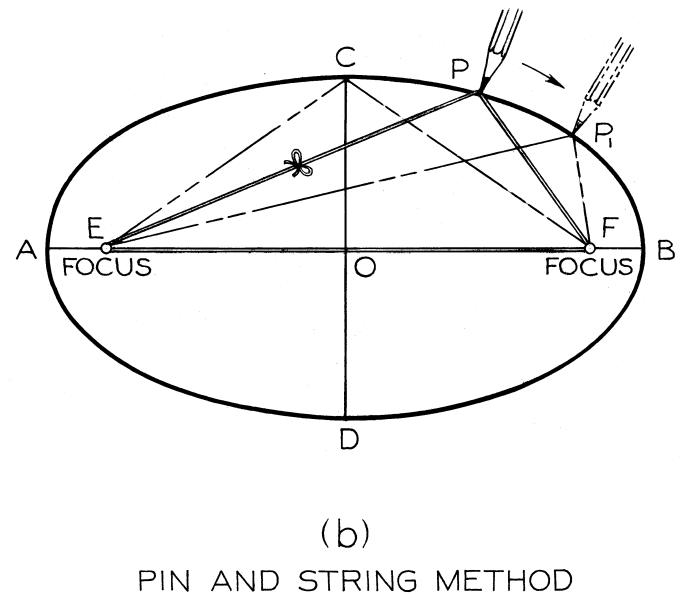
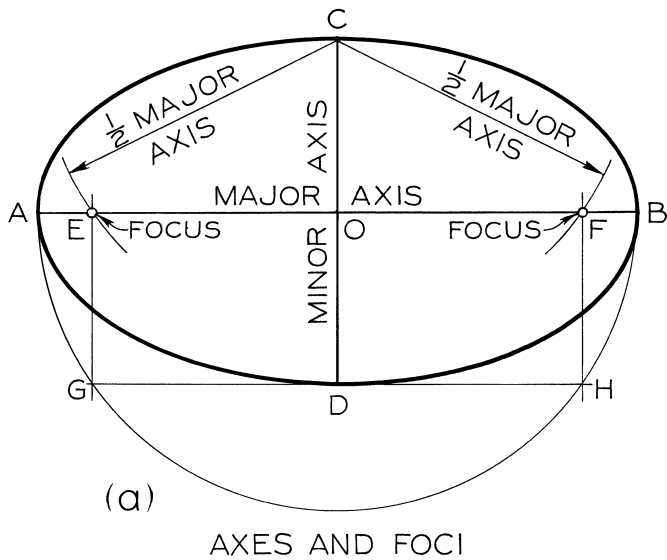


Figure 4-47
Ellipse Constructions (§4.45).

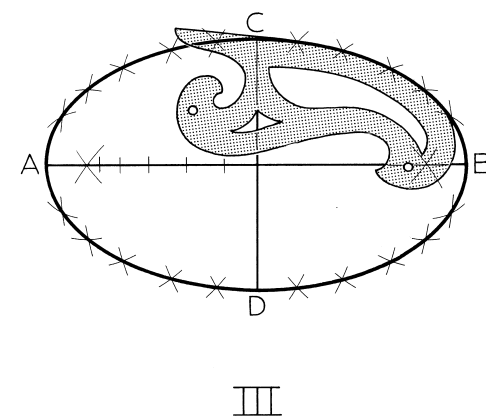
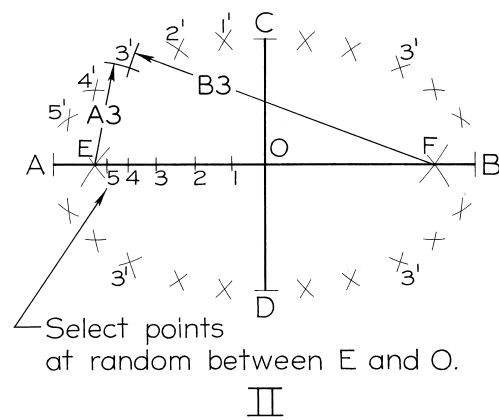
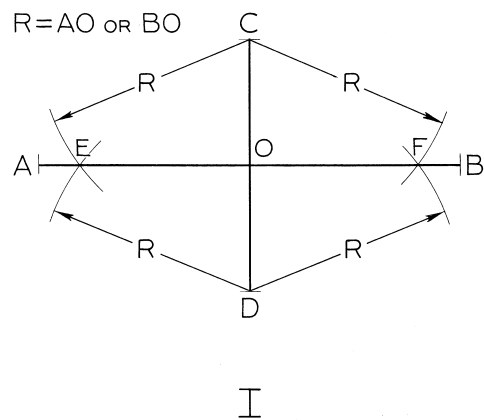


Figure 4-48

Drawing a Foci Ellipse (§4.46).

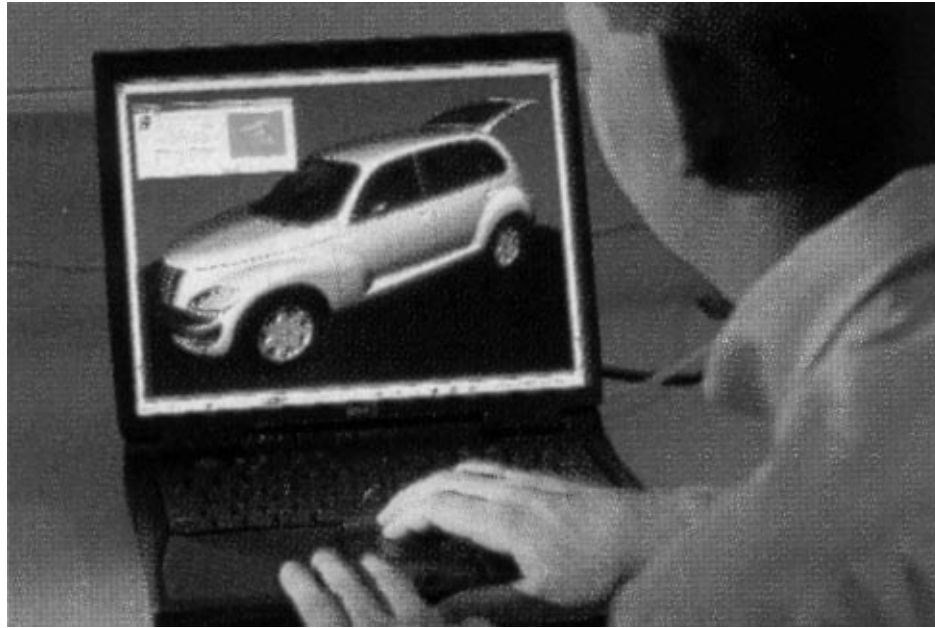


Figure 4-48.1

Courtesy of DaimlerChrysler AG.

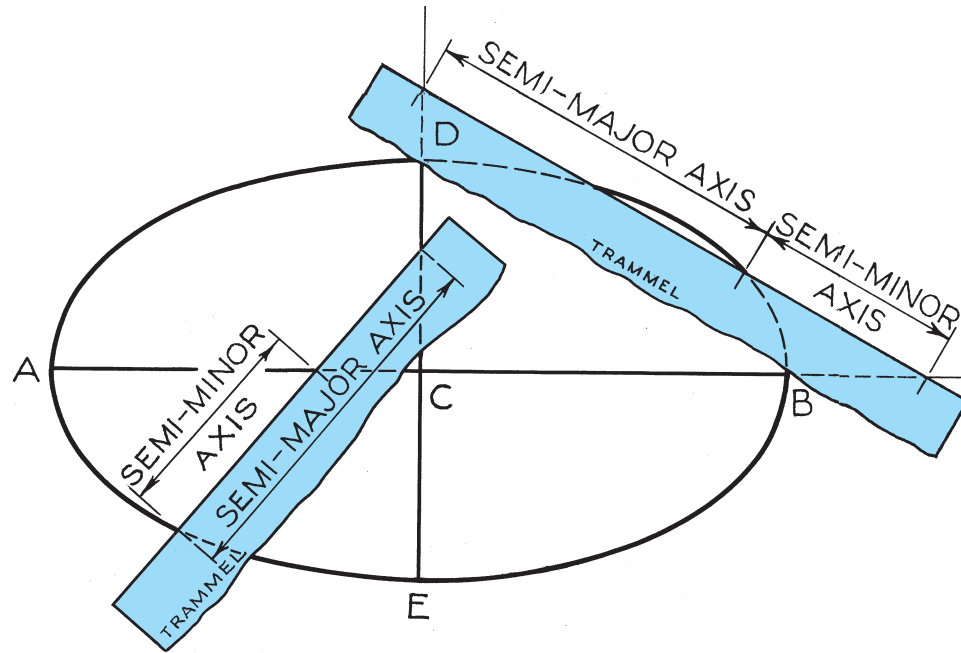


Figure 4-49

Drawing a Trammel Ellipse (§4.47).

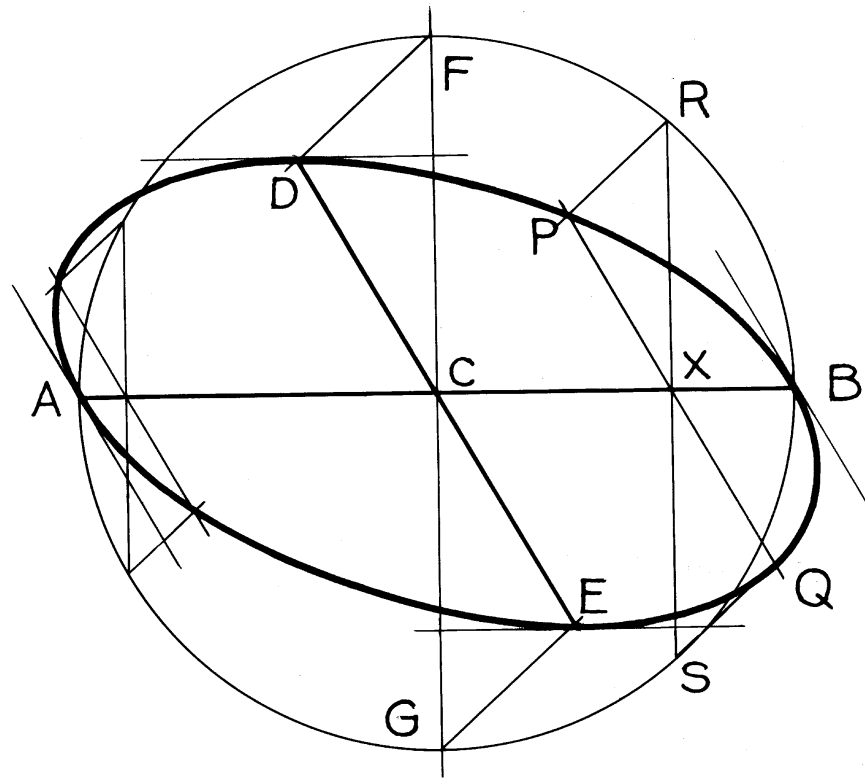
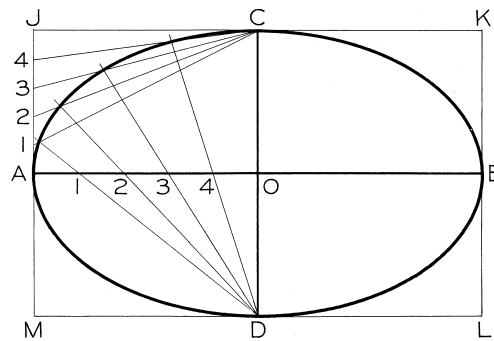
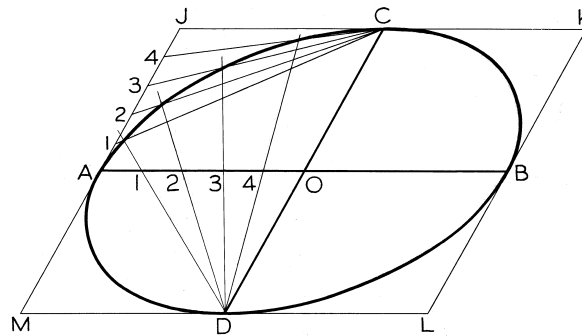


Figure 4.51
Oblique-Circle Ellipse (§4.49).



MAJOR & MINOR AXES GIVEN

(a)



CONJUGATE DIAMETERS GIVEN

(b)

Figure 4-52
Parallelogram Ellipse (§4.50).

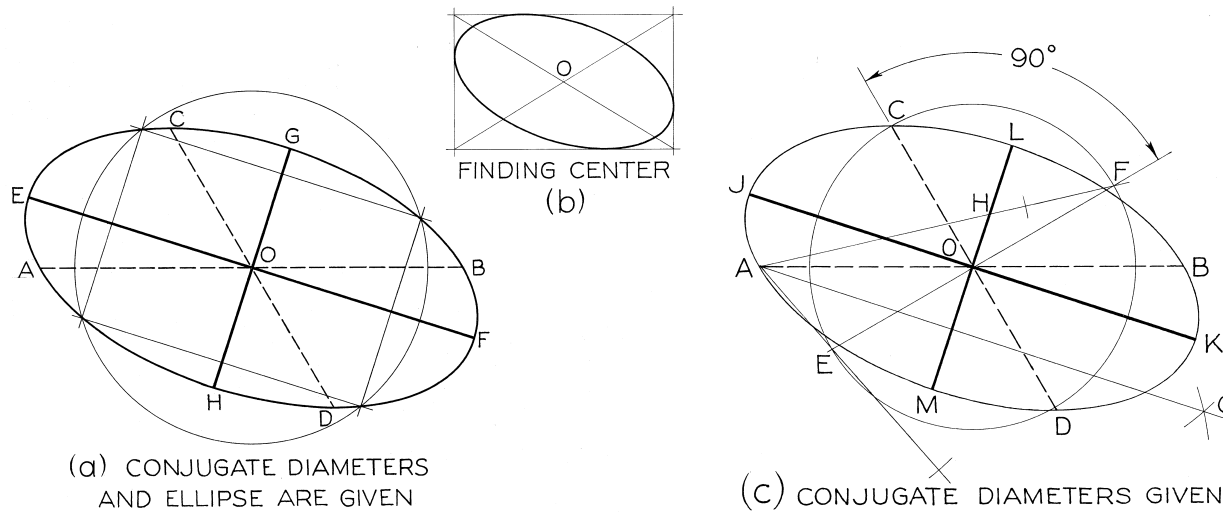


Figure 4-53
Finding the Axes of an Ellipse (§4.51).

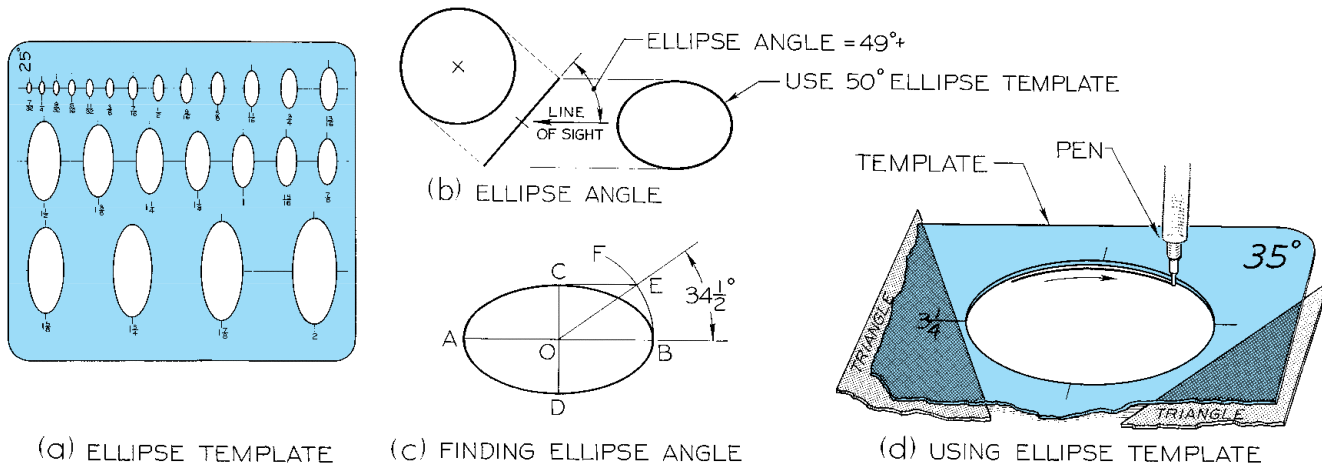


Figure 4.55
Using the Ellipse Template (§4.53).

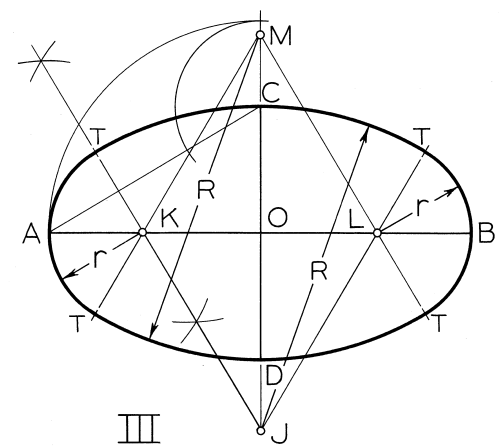
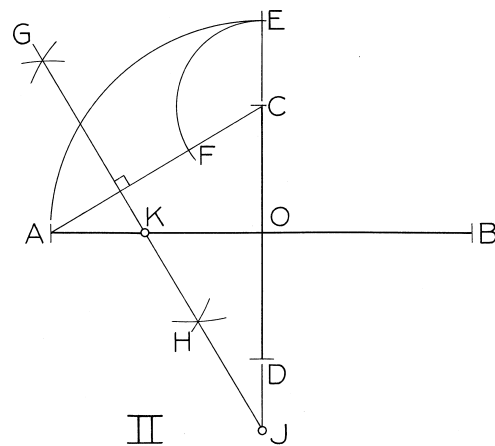
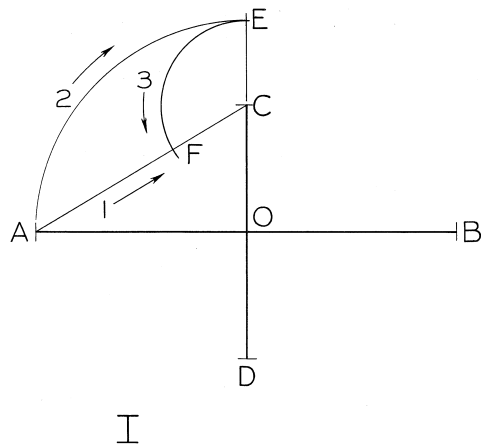


Figure 4-56
Drawing an Approximate Ellipse (§4.54).

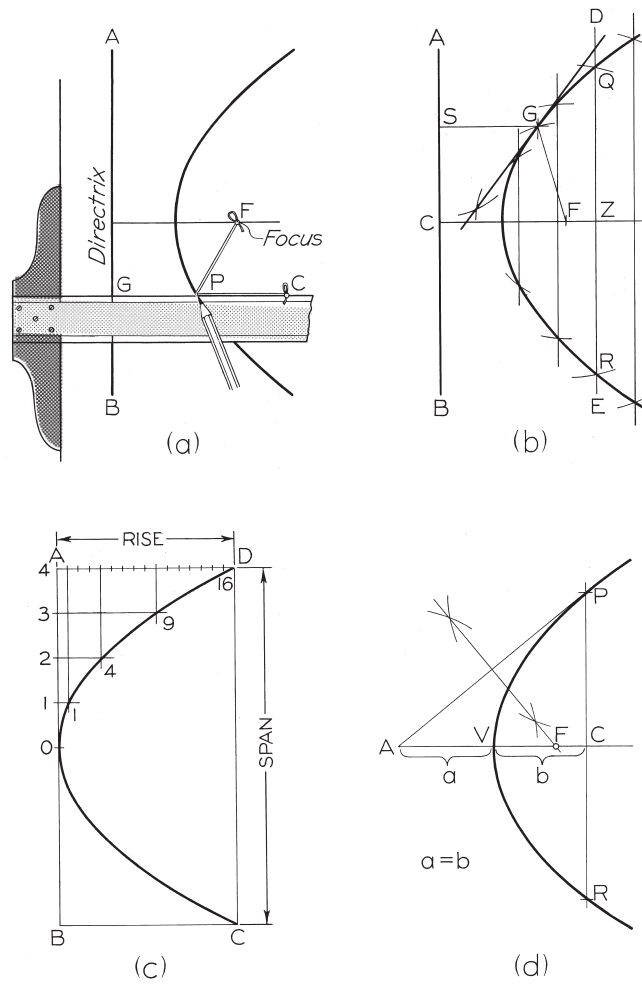


Figure 4-57

Drawing a Parabola (§4.55).

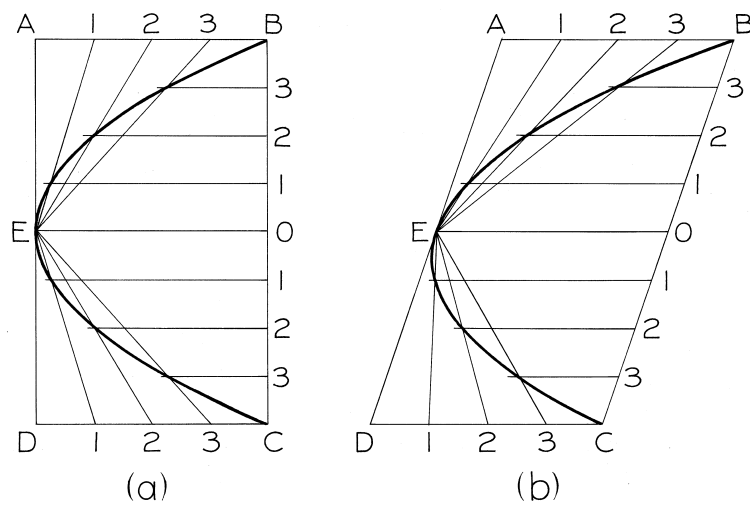


Figure 4-58
Drawing a Parabola (§4.55).

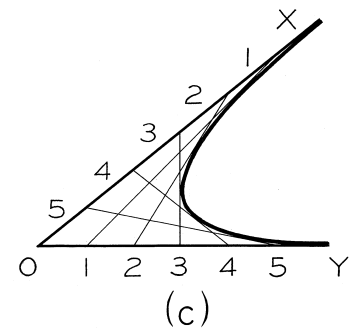
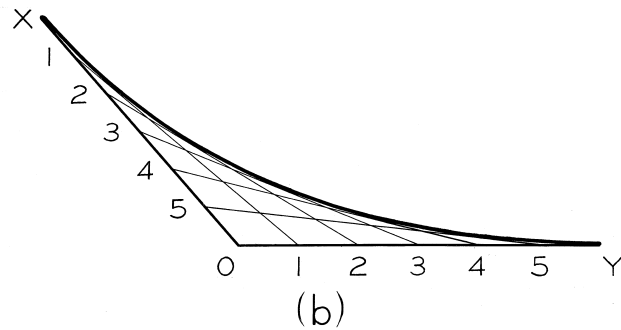
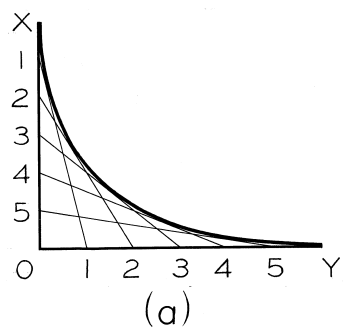


Figure 4-59
Parabolic Curves (§4.56).

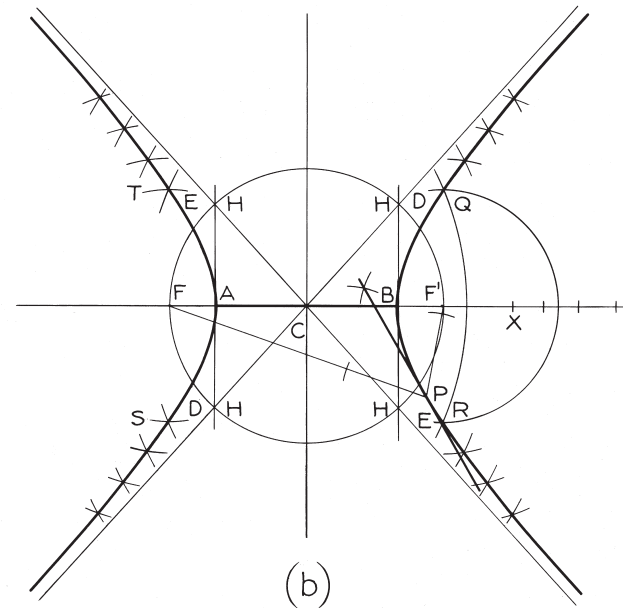
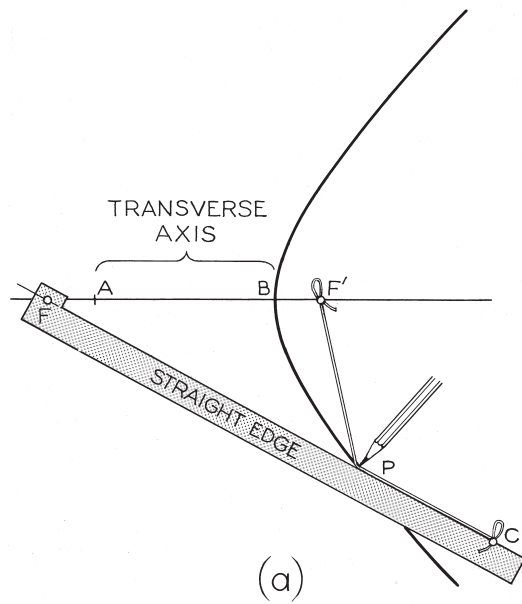


Figure 4-60
Drawing a Hyperbola (§4.57).

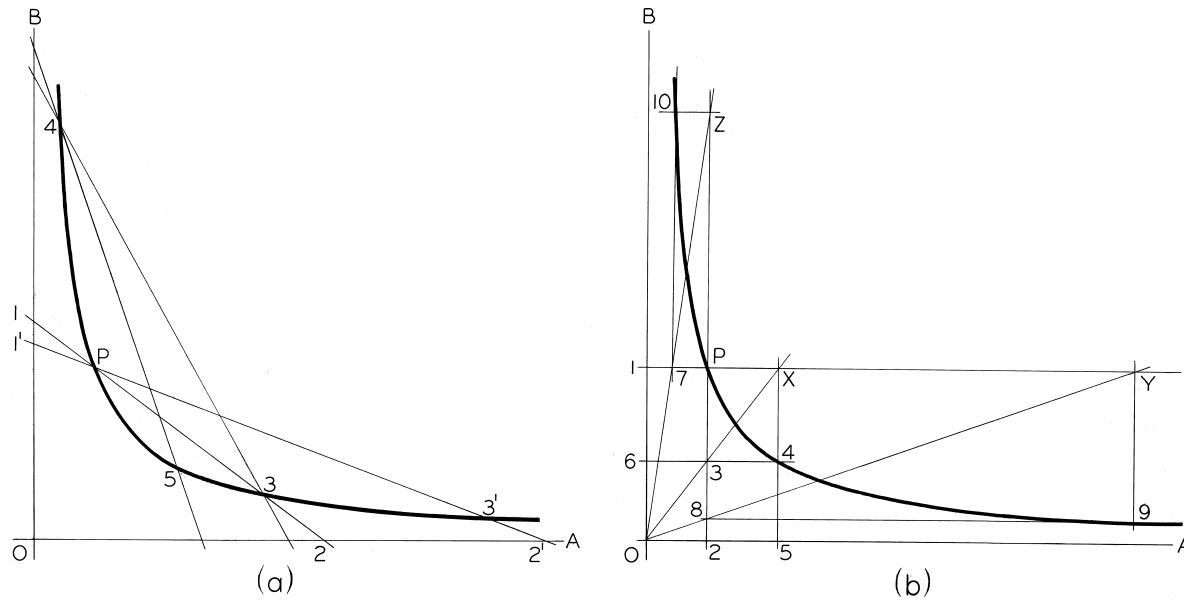


Figure 4-61
Equilateral Hyperbola (§4.58).

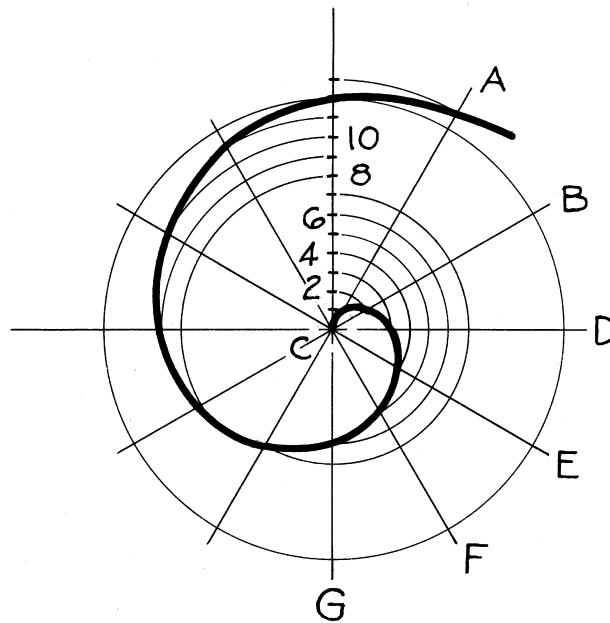


Figure 4-62
Spiral of Archimedes (§4.59).

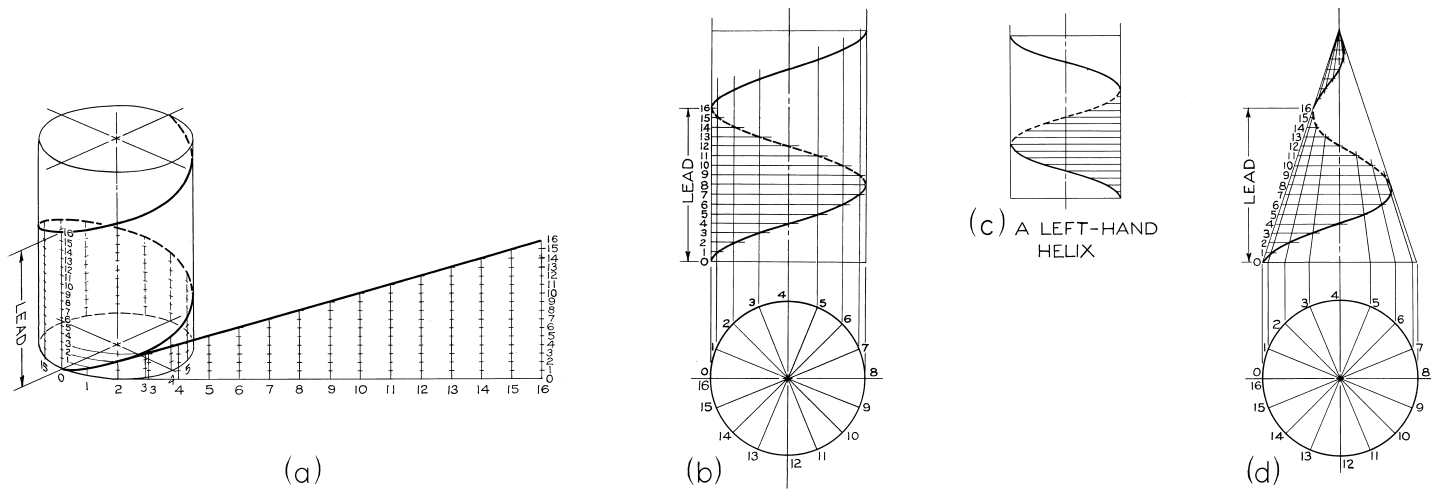
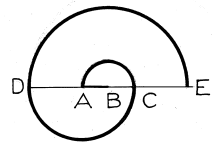
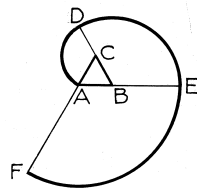


Figure 4-63
Helix (§4.60).

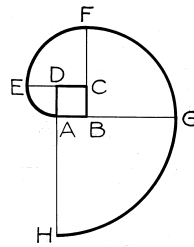
ALTERNATE CENTERS
BETWEEN A AND B



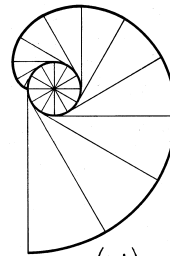
(a)



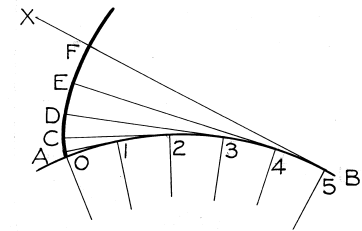
(b)



(c)



(d)



(e)

Figure 4-64
Involute (§4.61).

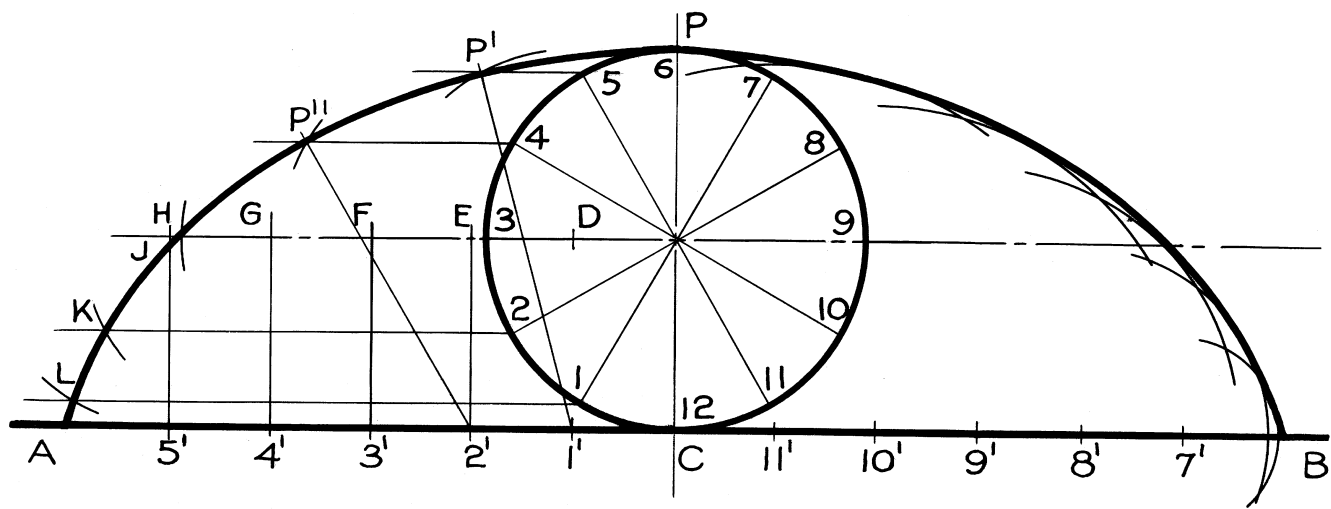


Figure 4-65
Cycloid (§4.62).

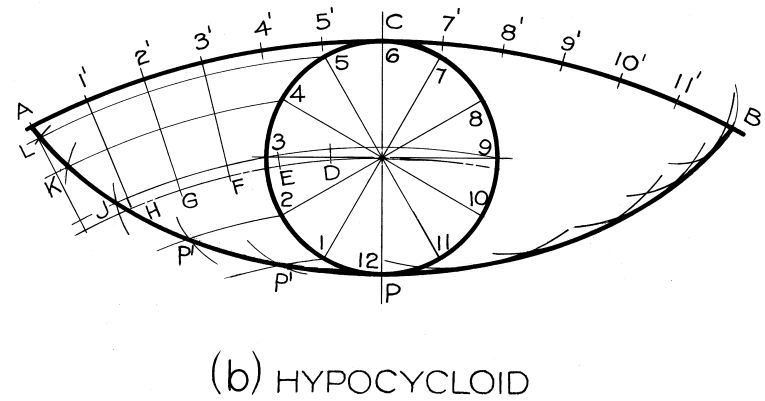
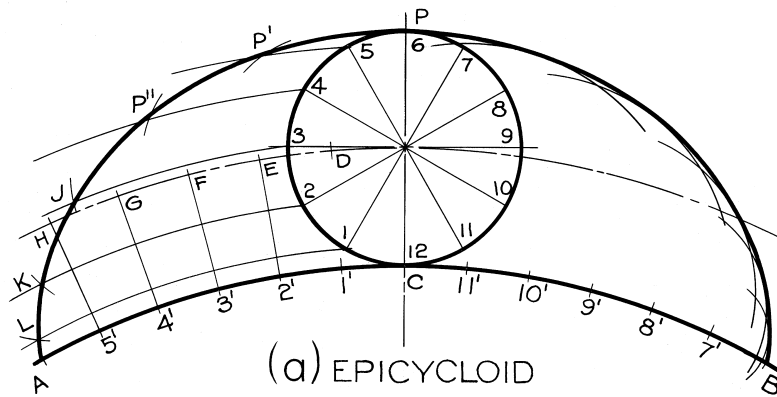
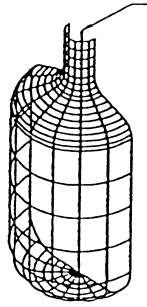
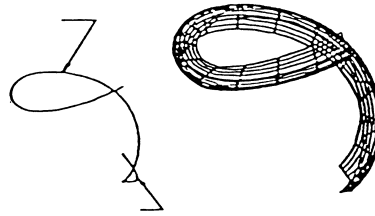


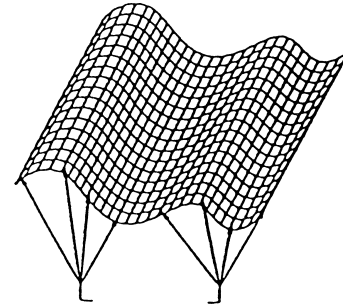
Figure 4-66
Epicycloid and Hypocycloid (§4.63).



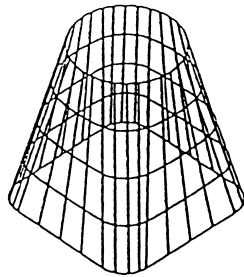
SURFACE OF REVOLUTION



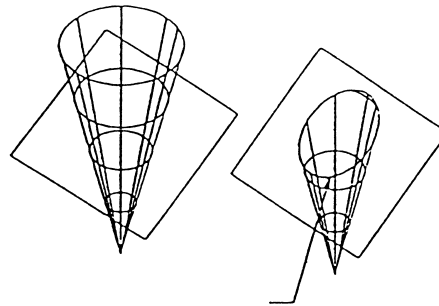
SWEPT SURFACE



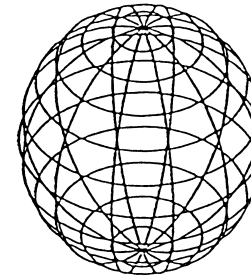
MESH SURFACE



RULED SURFACE



PLANE/SURFACE INTERSECTION



SPHERE

Figure 4-67

Geometric Shapes and Surfaces Produced with TRI-CAD System. *Courtesy of Lodgrafx, Inc. (§4.64).*

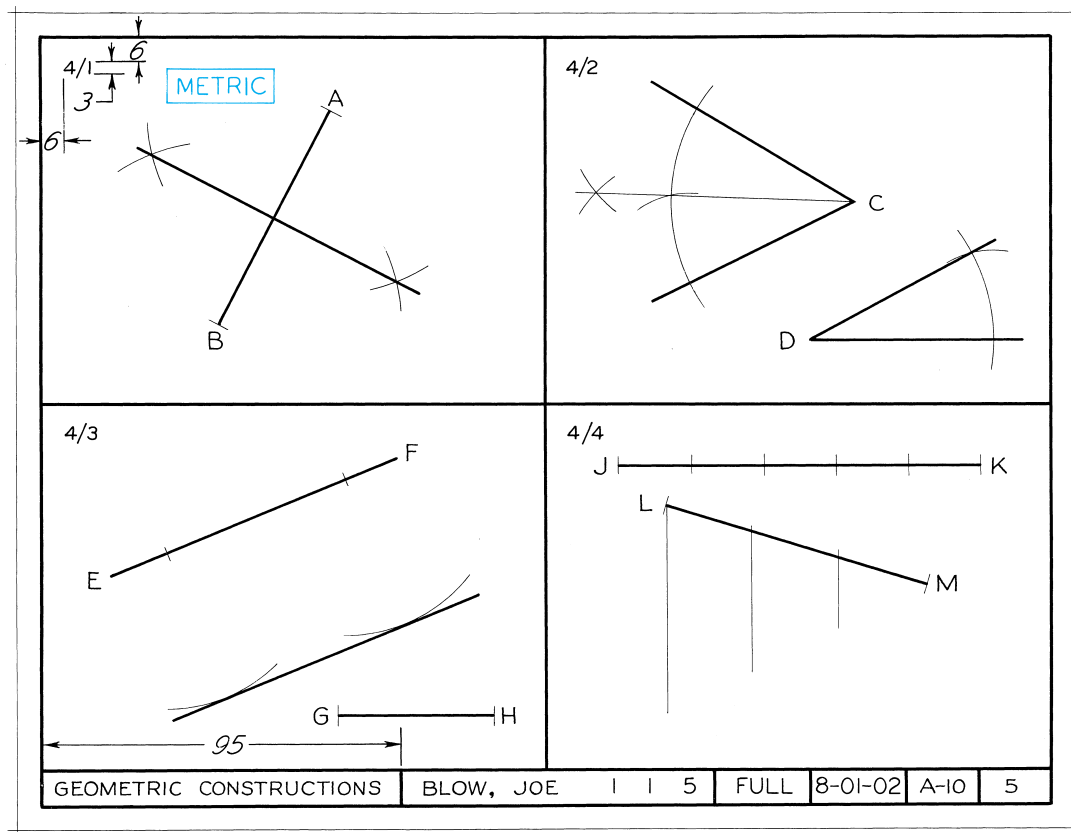


Figure 4-68

(Probs. 4-1–4.4) Geometric Constructions. Layout A-2 or A4-2 (adjusted).

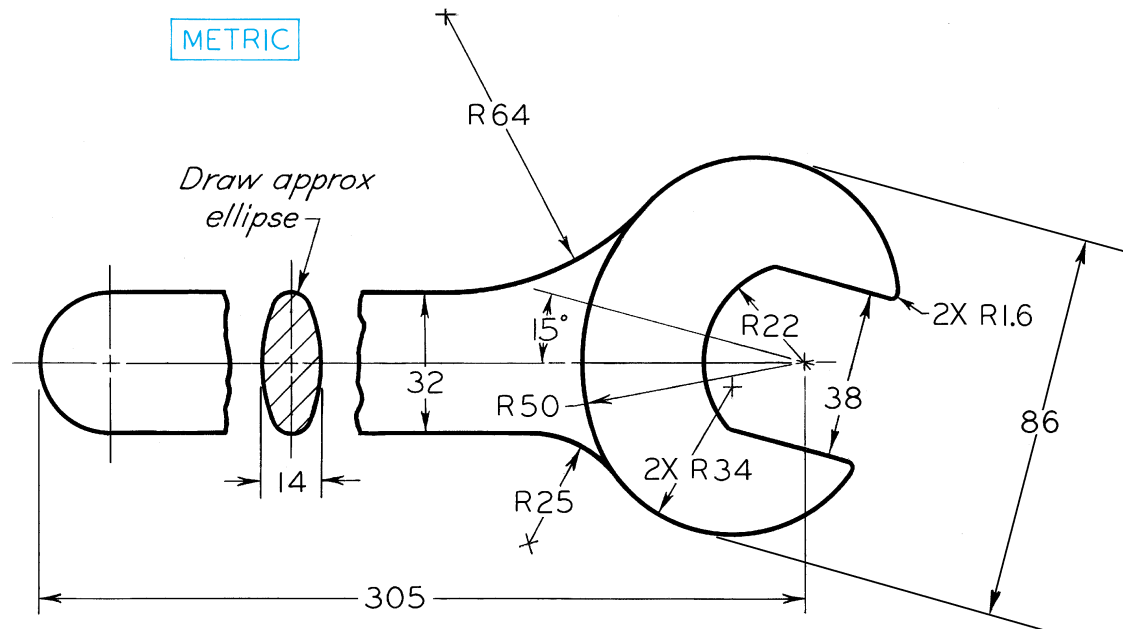


Figure 4-69

(Prob. 4.52) Spanner.

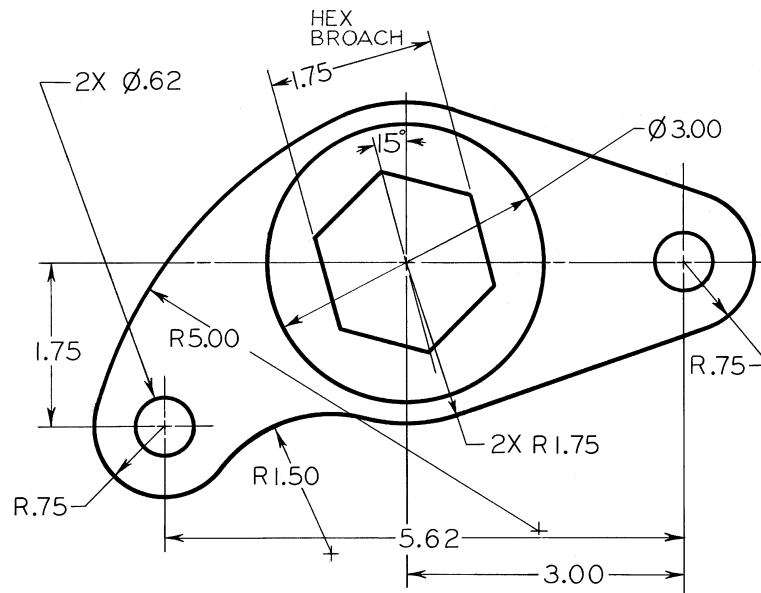


Figure 4-70
(Prob. 4.53) Rocker Arm.

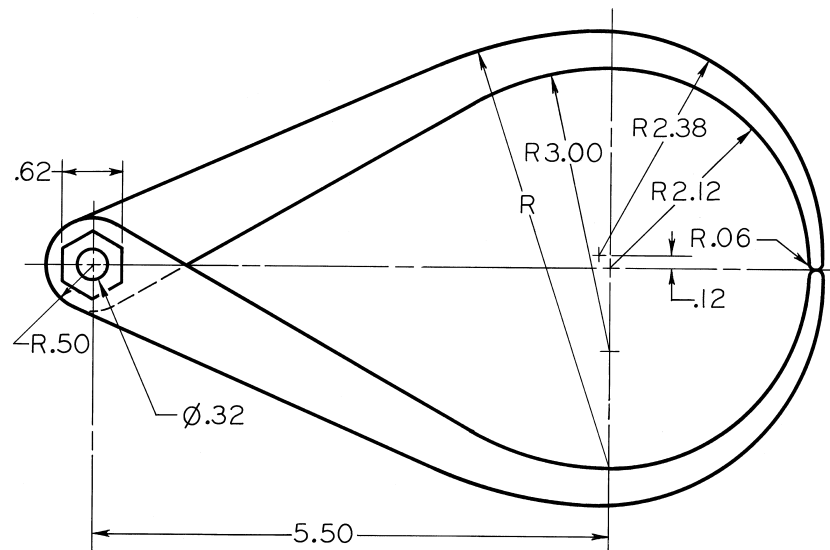


Figure 4-71
(Prob. 4.54) Outside Caliper.

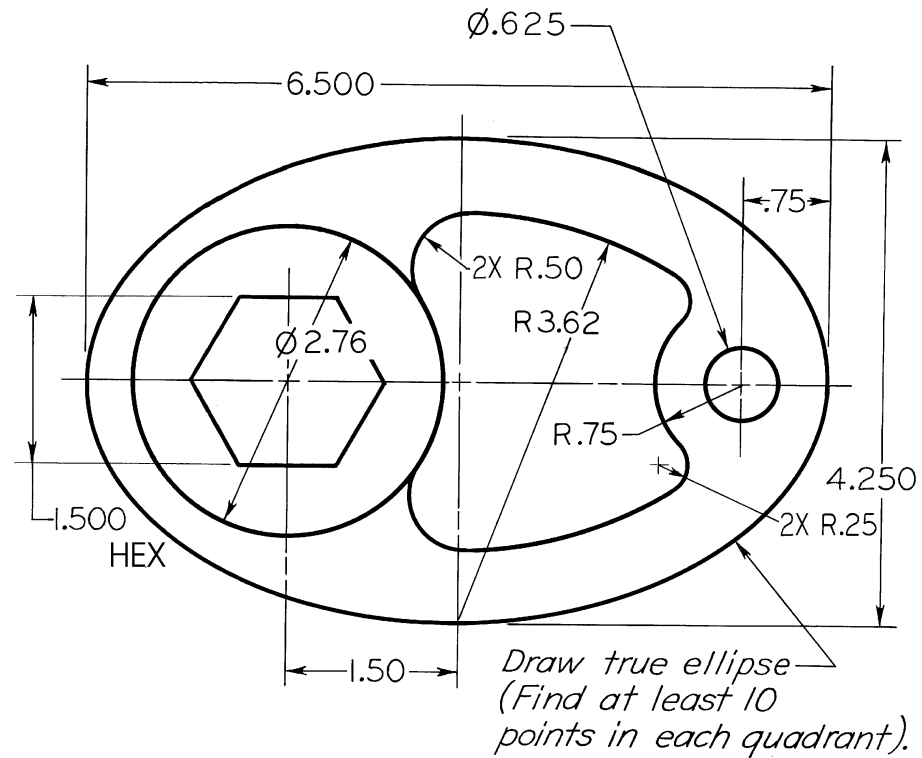


Figure 4-72
(Prob. 4.55) Special Cam.

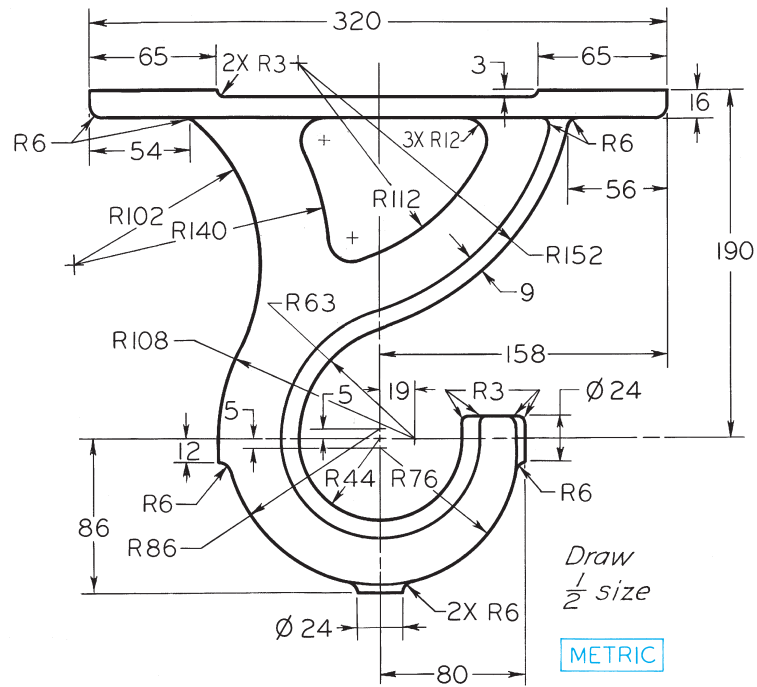


Figure 4-74
(Prob. 4.57) Shaft Hanger Casting.

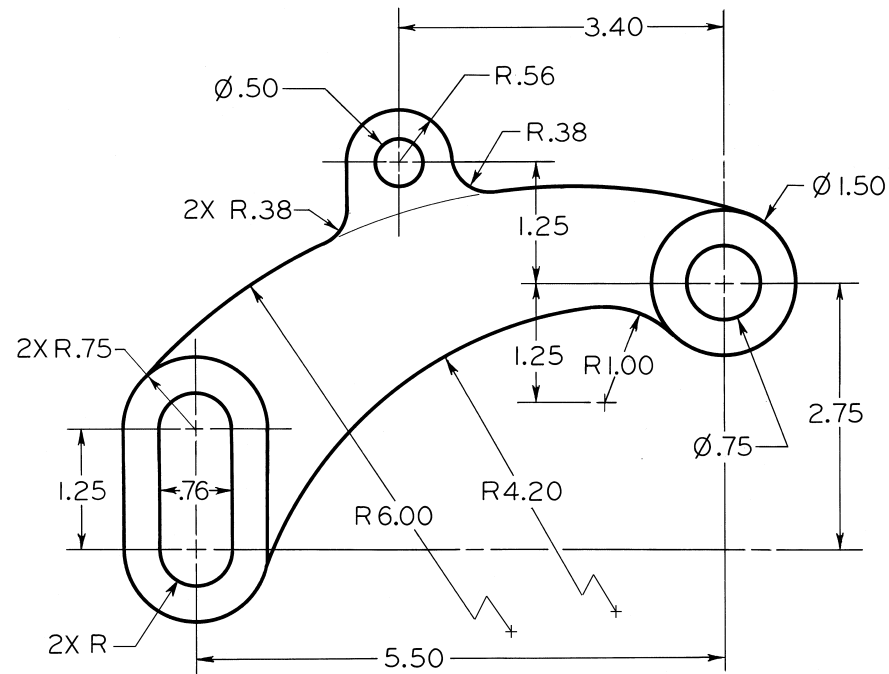


Figure 4-75
(Prob. 4.58) Shift Lever.

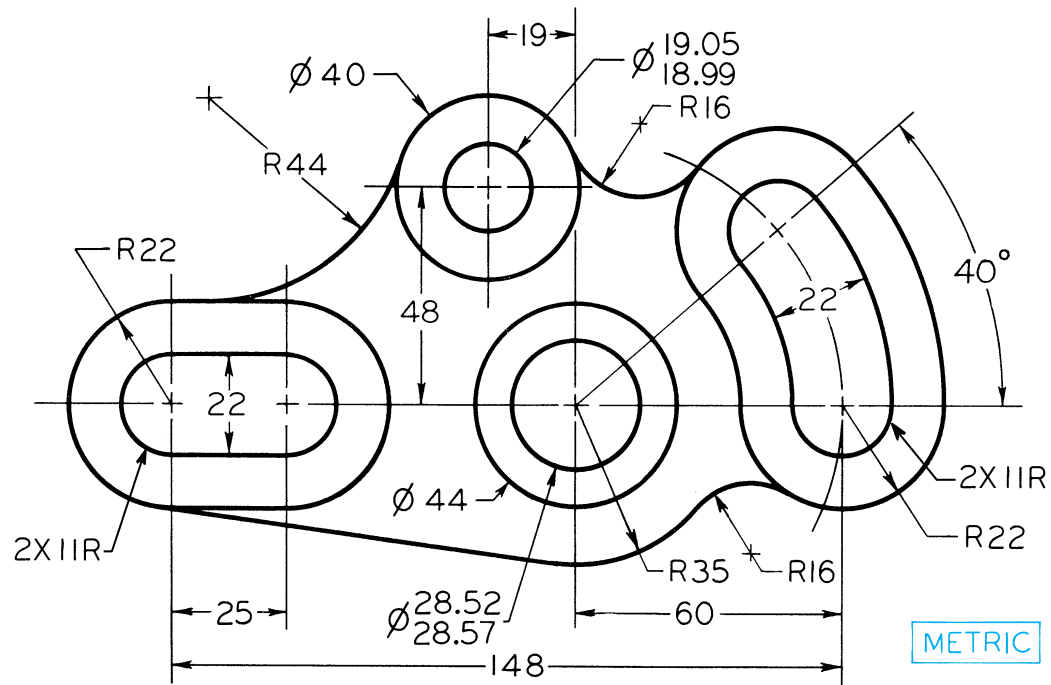


Figure 4-76
(Prob. 4.59) Gear Arm.

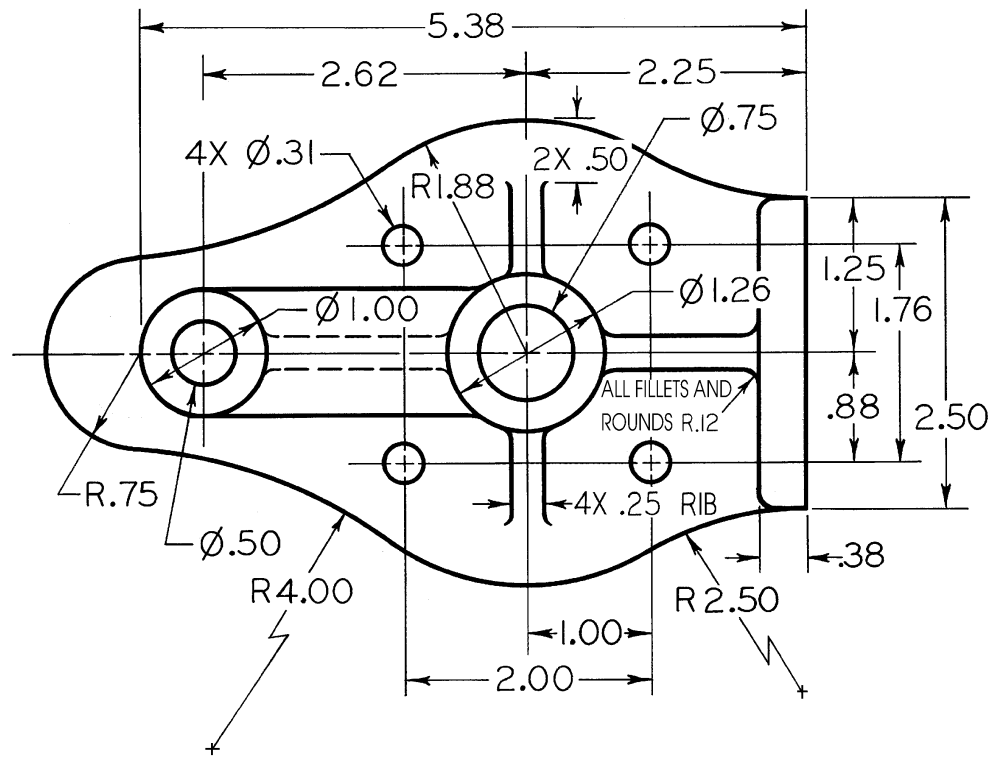


Figure 4-78
(Prob. 4.61) Press Base.

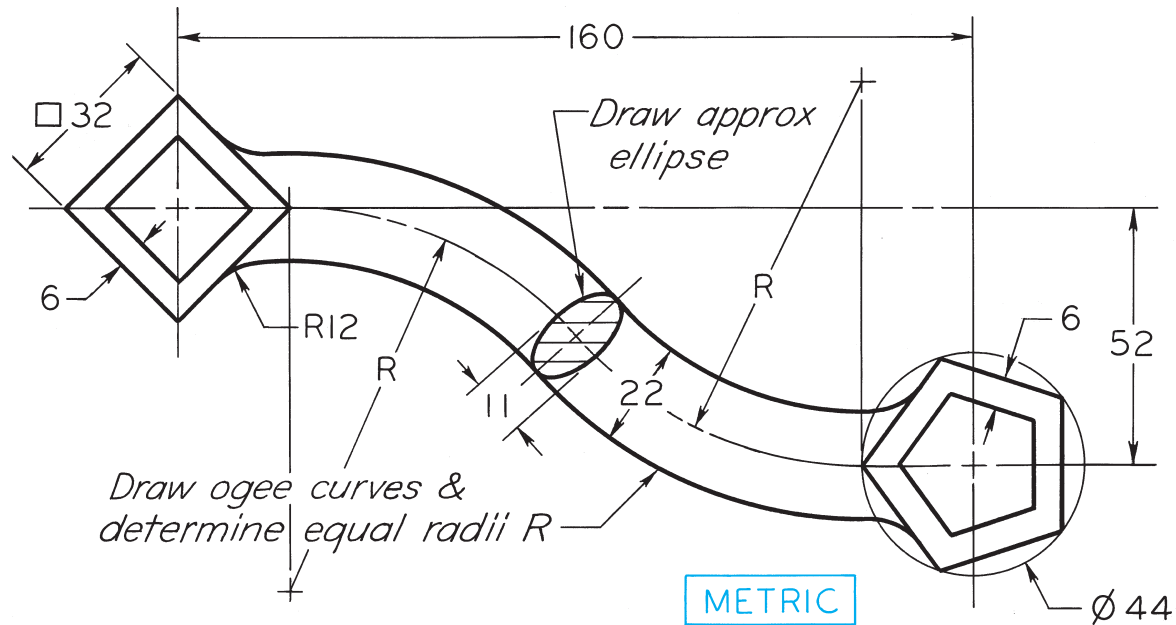


Figure 4-79

(Prob. 4.62) Special S-Wrench.

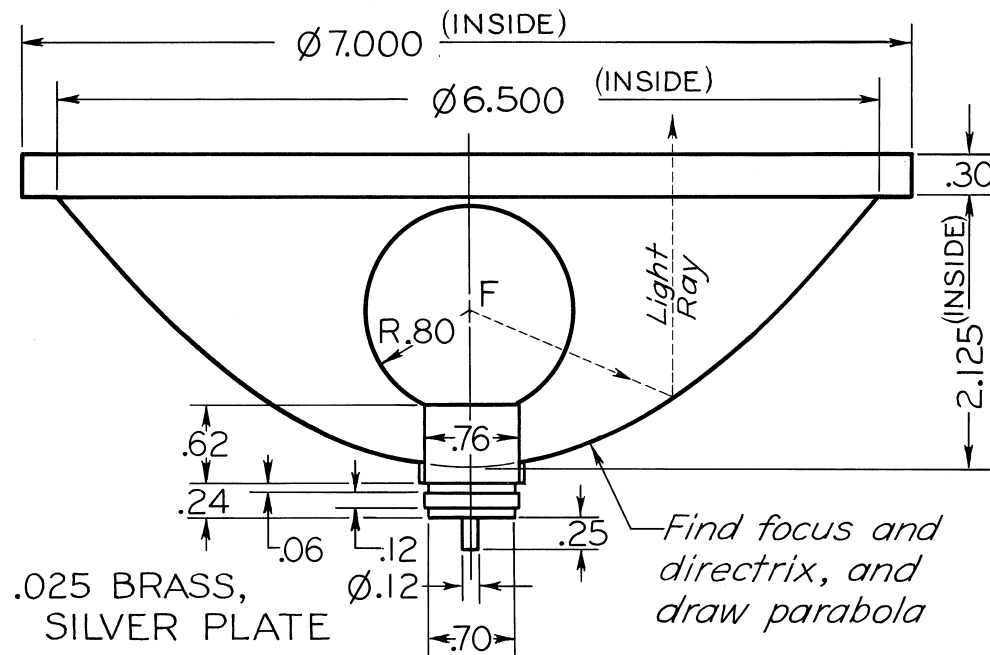


Figure 4-80

(Prob. 4.63) Photo Floodlight Reflector.