MATHEMATICS 1007
CONSTRUCTION AND LOCUS

CONTENTS

Author: **Milton R. Christen, M.A.**
Editor-in-Chief: Richard W. Wheeler, M.A.Ed.
Editor: Robin Hintze Kreutzberg, M.B.A.
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CONSTRUCTION AND LOCUS

In your previous LlFEPACs you have represented geometric figures by sketching them on your paper. You had no particular concern for the accuracy of the figures, as long as they did not give misleading information.

Some of you may have made accurate drawings using a ruler, compass, and protractor. You may be surprised to learn that in many situations you can make these figures with the same or greater accuracy using only the compass and an unmarked straightedge.

In this LIFEPAC® you will learn how to construct a variety of figures using only the compass and straightedge. You will also learn a technique to locate and describe sets of points that satisfy one or more given conditions.

OBJECTIVES

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC.

When you have finished this LIFEPAC, you should be able to:

1. Copy segments and angles.

2. Bisect angles, segments, and arcs.

3. Construct perpendiculars to a line.

4. Construct tangents to a circle.

5. Construct parallel lines.

6. Divide a segment into a given number of equal segments.

7. Construct a fourth proportional.

8. Construct a geometric mean.

9. Divide a segment into a given ratio.

10. Construct triangles.

11. Construct special circles.

12. Construct certain polygons.

13. Define locus.

14. Solve locus problems.

15. Construct figures using locus concepts.

Survey the LIFEPAC. Ask yourself some questions about this study. Write your questions here.

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I. BASIC CONSTRUCTION

OBJECTIVES

When you have completed this section, you should be able to:

1. Copy segments and angles.
2. Bisect angles, segments, and arcs.
3. Construct perpendiculars to a line.
4. Construct tangents to a circle.
5. Construct parallel lines.
6. Divide a segment into a given number of equal segments.
7. Construct a fourth proportional.
8. Construct a geometric mean.
9. Divide a segment into a given ratio.

You will learn five basic constructions in this section: copying figures, bisecting figures, constructing perpendiculars, constructing parallels, and constructing with measurements. Each of these constructions will be done using only the compass and the straightedge. With these five basic constructions you can then construct other geometric figures such as triangles, rectangles, and parallelograms.

COPYING FIGURES

To copy a figure means to duplicate it on your paper so that the segments and angles of the copy are exactly the same size as the original. Copying is done with just two tools: a compass and an unmarked straightedge.

DEFINITION

Straightedge: an instrument used only to draw lines through one given point and draw the unique line through two given points.


We can use many items to draw lines, if they are straight. The edge of a book, the edge of a piece of cardboard, a piece of plastic, or a ruler will all serve. We can use the ruler so long as we do not use the numbers on it for measuring.
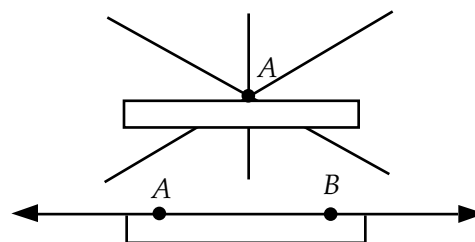
DEFINITION

Compass: an instrument used only to draw circles or arcs of a circle having a given center and to draw the unique circle having a given center and a given radius.


A compass can take many forms, but the two main parts of any compass are its points. One point is a fixed sharp metal point that you stick into your paper at the center of the circle. The other point contains the writing tool, usually a pencil. The pencil point is adjustable up and down. The compass should be adjusted so that the tip of the pencil is the same length as the tip of the center point. The distance between the two points will be the radius of the circle you are drawing.
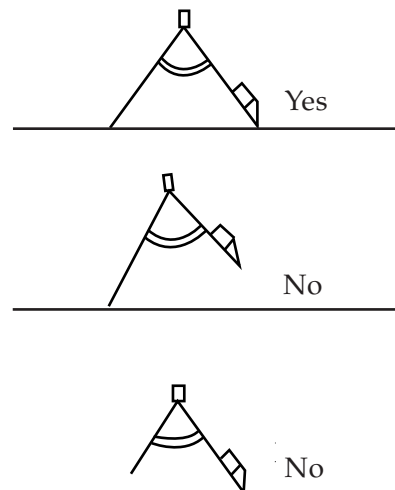
When using a compass, you may wish to back your paper with some thin cardboard so that the center point of the compass will stick in and not slide off your paper.

When drawing a circle, hold the compass at the top. Do not hold the legs of the compass, or you may change the radius of your circle.

Tip the compass slightly in the direction you are drawing so that it is not perpendicular to the paper and pull the compass through your circle. Never push the compass, because pushing may tear your paper.
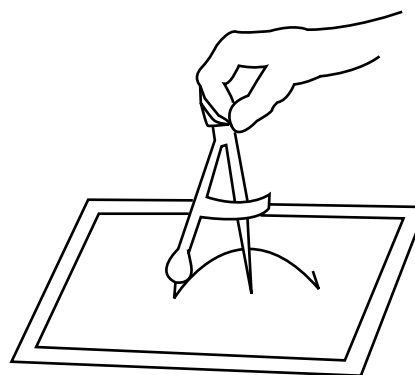
Use your straightedge to construct lines through the given points. Use your compass to construct circles.

B

1.1 $\overline{AB}$

A

1.2 $\overrightarrow{BC}$

C

1.3 $\overleftrightarrow{DC}$

1.4 $\overleftrightarrow{BD}$

D

1.5 $\overline{AD}$

1.6 $\overrightarrow{AC}$

1.7 Circle *A*, any radius

1.8 Circle *B*, any radius

1.9 Circle *C*, same radius as circle *B*

1.10 Circle *D*, same radius as circle *A*