

# 10.7 Locus

- Goals**
- Draw the locus of points that satisfy a given condition.
  - Draw the locus of points that satisfy two or more conditions.

## VOCABULARY

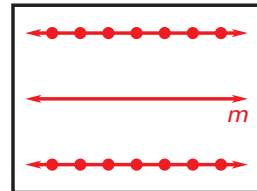
**Locus** A locus in a plane is the set of all points in a plane that satisfy a given condition or a set of given conditions.

### Example 1 Finding a Locus

Draw a line  $m$ . Draw and describe the locus of all points that are 1 centimeter from the line.

#### Solution

1. Draw a line  $m$ . Locate several points 1 centimeter from  $m$ .
2. Recognize a pattern: the points lie on two lines.
3. Draw the lines.



**Answer** The locus of points that are 1 centimeter from  $m$  are two lines parallel to  $m$ .

✓ **Checkpoint** Complete the following exercise.

1. Describe the locus of points equidistant from the vertices of an equilateral equiangular triangle.

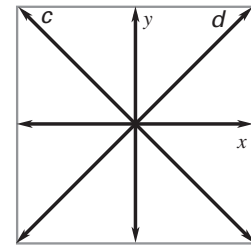
The locus of points is the intersection point of the perpendicular bisectors of the three sides.

**Example 2** A Locus Satisfying Two Conditions

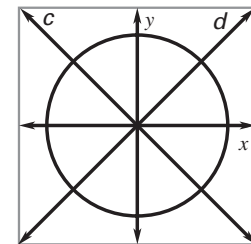
Lines  $c$  and  $d$  are in a plane. What is the locus of points in the plane that are equidistant from  $c$  and  $d$  and within  $x$  units from the origin?

**Solution**

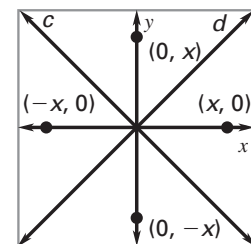
The locus of all points that are equidistant from  $c$  and  $d$  are the lines  $x = \underline{0}$  and  $y = \underline{0}$ .



The locus of all points that are a distance of  $x$  units from  $c$  and  $d$  is a circle centered at the origin with a radius of  $x$ .



The intersection of the loci, or locus points, are the line segments from  $(\underline{0}, \underline{-x})$  to  $(\underline{0}, \underline{x})$  and  $(\underline{-x}, \underline{0})$  to  $(\underline{x}, \underline{0})$ .

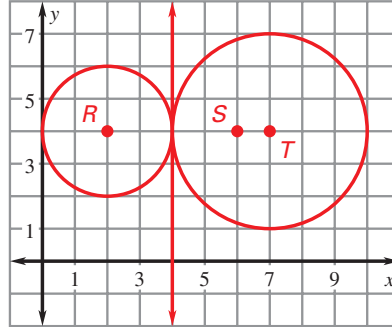


**Example 3** A Locus Satisfying Three Conditions

Points  $R(2, 4)$ ,  $S(6, 4)$ , and  $T(7, 4)$  lie in a plane. What is the locus of points in the plane equidistant from  $R$  and  $S$ , 2 units from  $R$  and 3 units from  $T$ ?

**Solution**

The locus of points equidistant from  $R$  and  $S$  is the perpendicular bisector of  $\overline{RS}$ . The locus of points 2 units from  $R$  is a circle. The locus of points 3 units from  $T$  is a circle. Draw the circles and perpendicular bisector in the coordinate plane.



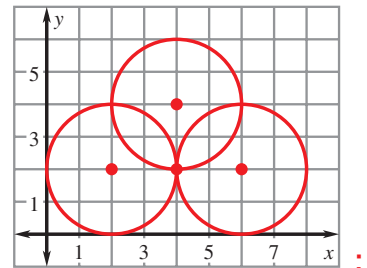
**Answer** The locus is at  $(4, 4)$ .

✔ **Checkpoint** Complete the following exercises.

2. Points  $V$  and  $W$  lie in a plane. What is the locus of points 3 centimeters from  $V$  and equidistant from  $V$  and  $W$ ?

The locus of points 3 centimeters from  $V$  is a circle with center  $V$  and radius 3 centimeters. The locus of points equidistant from  $V$  and  $W$  is a line halfway between  $V$  and  $W$ . The locus can be 0, 1, or 2 points.

3. Three circles with centers at  $(2, 2)$ ,  $(6, 2)$ , and  $(4, 4)$  each have a radius of 2 units. Draw the locus of points and find the point of intersection of the three circles.



$(4, 2)$