



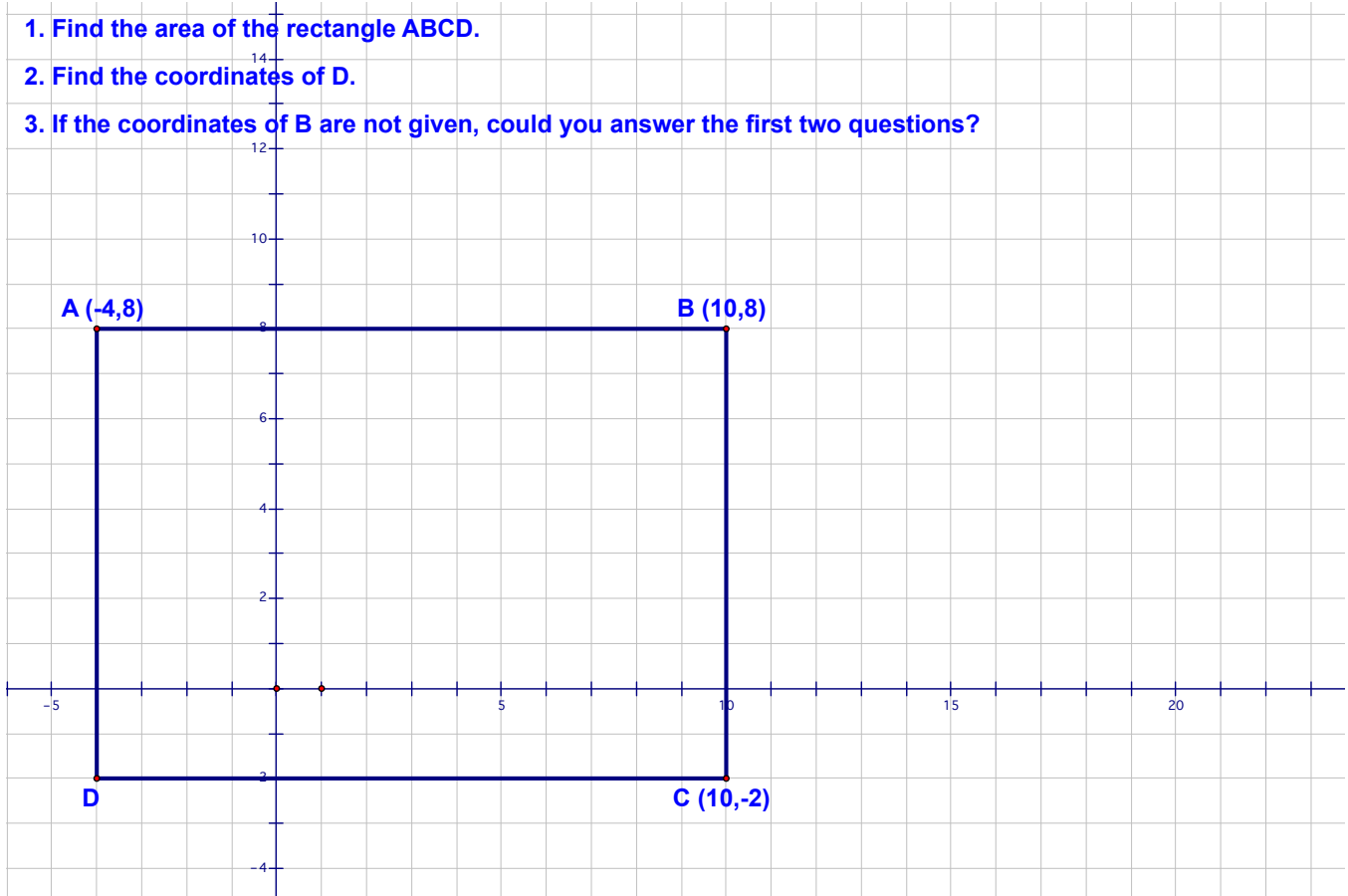
## Perpendicularity - Lesson 2-1

Here's a warmup!

1. Find the area of the rectangle ABCD.

2. Find the coordinates of D.

3. If the coordinates of B are not given, could you answer the first two questions?



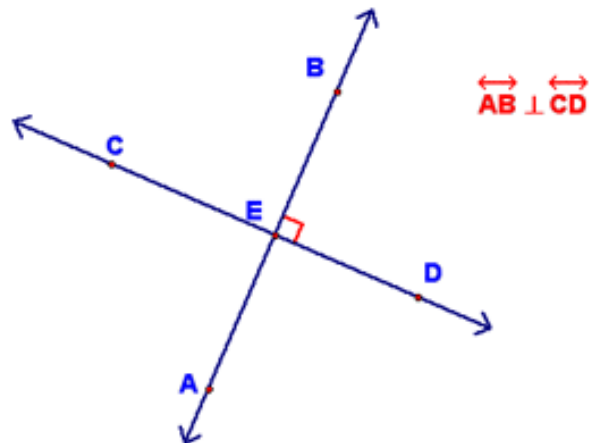
Today, let's start by defining what it means for two lines to be perpendicular:

**Lines, rays, or segments that intersect at right angles are *perpendicular*.**

**Note that since this is a definition and definitions are biconditional, we can conclude that both of the following statements are true:**

**If 2 lines, rays, or segments intersect at right  $\angle$ s, then they are  $\perp$**

**If 2 lines, rays, or segments are  $\perp$ , then they intersect at right  $\angle$ s**

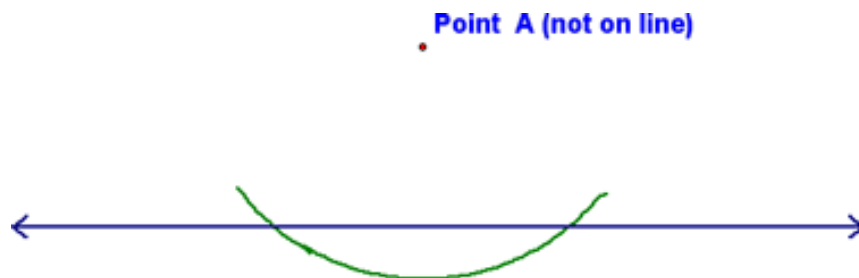


Now, we're going to learn how to construct perpendiculars to a given line from a point not on the line. Let's start with a line and a point not on that line:

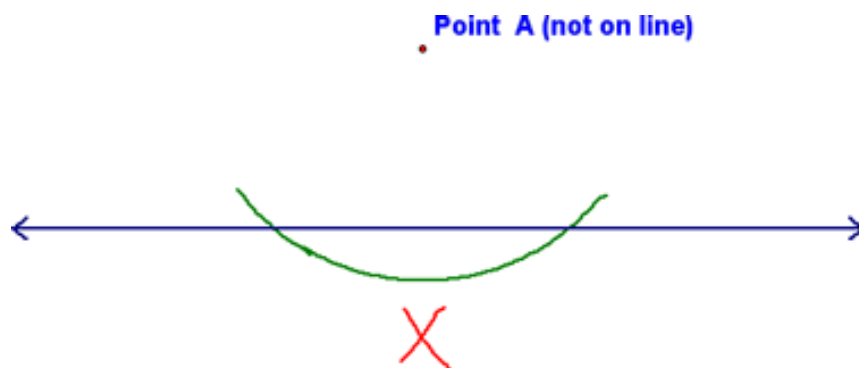
**Point A (not on line)**



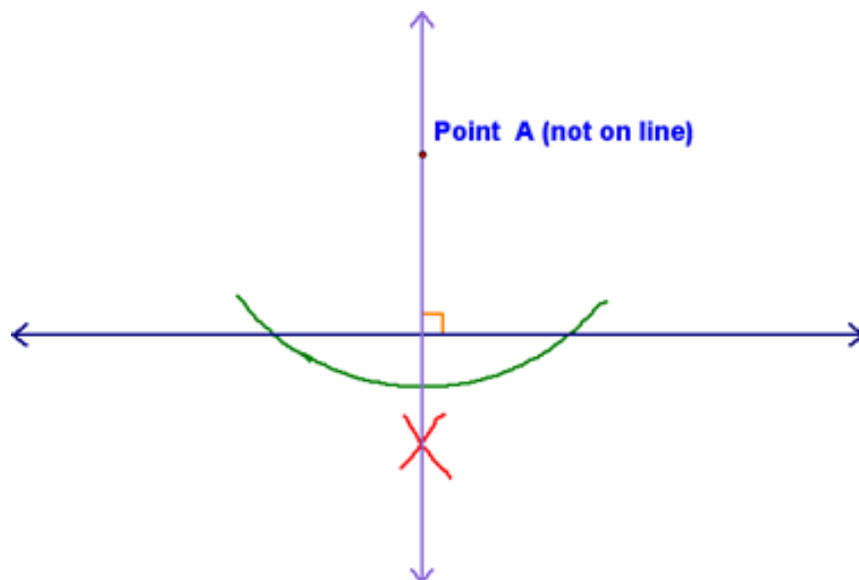
Next, we should center our compass at point A (the point not on the line), make our radius be bigger than the distance from that point to the given line, and construct a "smiley face" arc:



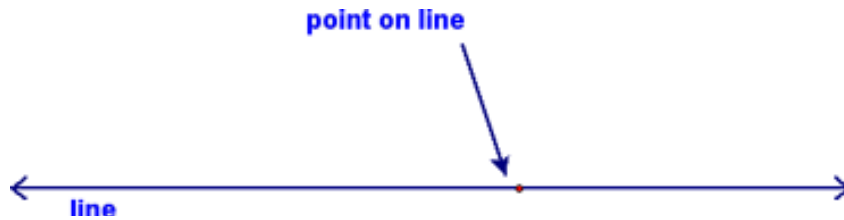
We can then create an "X marks the spot" by centering the compass at the points where the first arc intersects the given line and constructing arcs like the red ones below:



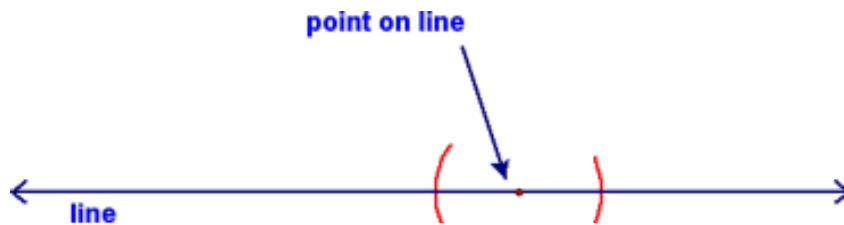
From here, we can simply use the "X" and the given point to construct our perpendicular. Make sure to mark it correctly!



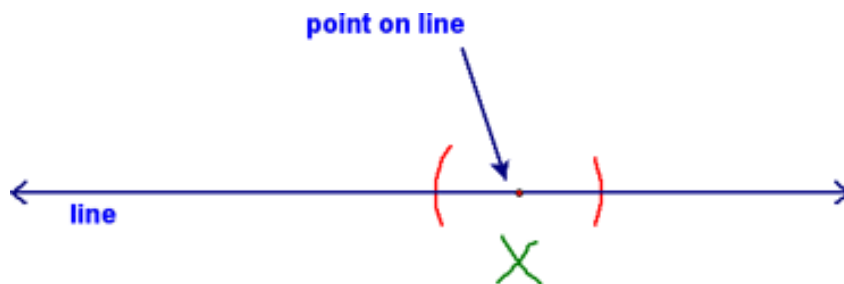
Next, we'll learn how to construct a perpendicular to a line from a point on that line. Start with a line and a point on it:



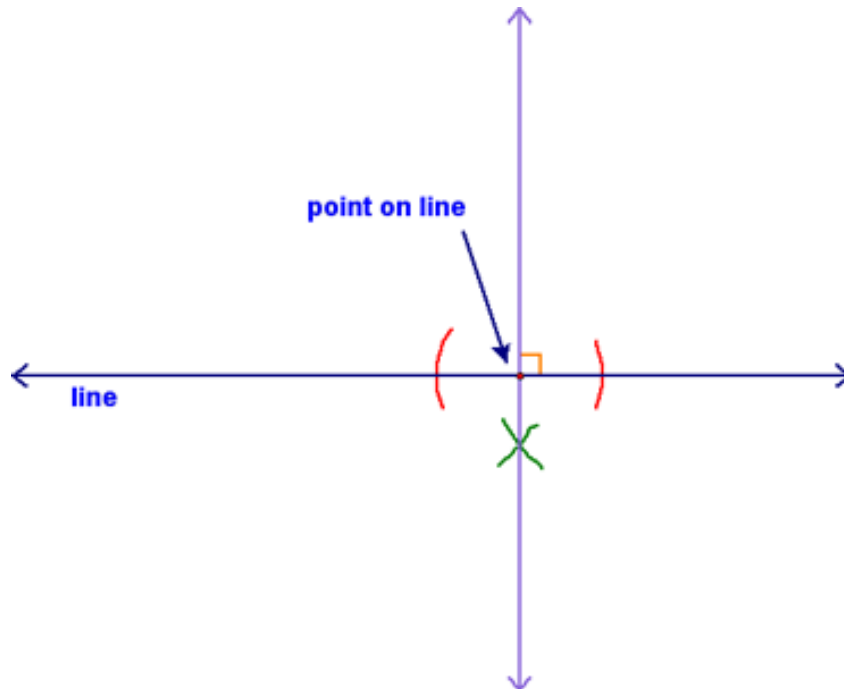
Now center your compass at the point and construct two arcs (with the same radius) that intersect the line on either side of the point:



At this point, the construction becomes similar to the previous one. You should be able to follow the two steps shown below! The first is to make the "X marks the spot":



And the second is to construct the perpendicular and mark it correctly!



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So, at this point, you should know the following constructions:

1. Perpendicular bisector
2. Angle bisector
3. Equilateral triangle (60 degree angle)
4. Perpendicular to a line from a point not on the line
5. Perpendicular to a line from a point on the line

You should also be able to combine these to construct angles of certain measure (e.g.,  $90^\circ$ ,  $105^\circ$ ,  $135^\circ$ ,  $75^\circ$ , etc). Remember that construction means using only a straight edge and a compass...no rulers or protractors!!

Practice these things until you have them down pat!!