

Module 11: Constructions

Topic 2 Content: Constructing an Angle Congruent to a Given Angle Transcript

Hey, guys. Welcome to Geometry. In this topic, we're going to focus on how to construct and angle congruent to a given angle by using a compass and a straight edge. Now, your knowledge of circles is going to come in handy for you during this topic. You ready to get started? Let's go.

Okay. Here we've been given an angle. What we're going to do is we're going to construct an angle that's congruent to our given angle. Now, if you're not already given a ray when you're asked to perform this type of construction, you're just going to want to make sure to also sketch a ray for yourself. That's where you're going to build your congruent angle, okay?

All right, here we go. Get my pen ready here. The first thing that we're going to do is we're going to take our compass. We're going to line up the center of our circle on the end with the vertex of our given angle. I'm going to set this width just a little bit wider. It really doesn't matter where you set that compass width to, as long as when you envision yourself making that arc, that you see that you will hit both sides of your angle. I see that I will. I'm going to go ahead. I'm going to swing my compass up to the top. I'm going to arc.

Notice that I intersected my angle at two points. I'm just going to darken those. I'm going to keep my compass set to the same width. Going to come down to the ray right here underneath. Going to swing my compass up, just like I swung it up at the angel at the top. I'm going to arc. Right, I see I've intersected the ray one time. I'll darken that.

Now, what we're going to do is we're going to set the width of our compass equal to the width of our angle. I'm actually going to flip the compass upside down. I'm going to line up the center right here at the end, on that end point or on that point on the bottom. I'm going to line up the compass width with that point on the top. Basically, the width of my compass is open to the width of my angle, right here. Make sure that those match.

Now, I'm going to come down to my ray. I'm going to line up my compass right on top of that point. My compass is still upside down. Then I'm going to arc. Notice that the new arc that I drew intersected that first arc. I'm going to darken that point. Now, I'm going to take my compass and I'm going to make sure the line up the straight edge so that I can envision myself drawing a line that passes through the vertex of my angle and that point of intersection. Basically, what I'm going to do is I'm going to sketch the top ray, the top side of this angle, okay? Let's just make sure we've got that lined up as good as we can. If it's not perfect, it's okay. Make sure it's as accurate as you can make it. Let's go ahead and get our ray.

We're all done. Okay? See how we've used the compass and that straight edge to construct and angle that's congruent to our given angle? All right. Okay.

Now, what we're going to do is we're going to walk through the steps that justify this construction. We're going to see, what's the geometry, what's the math behind all these steps that guarantees that this construction is true? Okay, let's take a few minutes and let's walk through that.

Okay. Take a look at what we have here. We have a given angle and then we have the completed construction of constructing an angle congruent to that given angle. Now, if you

Module 11: Constructions

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think back to the steps that we took and completed in this construction, we set our compass to open to a point. We used the end point first. Lined our compass up there. Then we opened the width just to any point, but as long as we made that arc, it intersected both sides of the given angle. Then we came to what was at first just our ray and we copied that arc. Then we opened our compass up to width of that given angle and we came back down and we made this arc, open to that same width. Then we came in and we added in what's represented by that red ray. There, once we completed all those steps, we had our construction of an angle congruent to a given angle.

Now, I want you to think back to what you know about circles and radii and a little bit about congruent triangles. That's going to help us get through this justification here. Okay? Now, look at this next slide.

Now, the first thing I want you to do I just want to focus on just the blue parts here. I'm just going to slide this red segment out of the way for a little bit. I'm going to slide that red arc and this red segment just for a second. Now, look here and just focus on this blue arc and this one and these blue segments and then these. Now, recall that when we made this arc, we set our compass to a width, we made that arc and we kept that same width when we made this one. Recall that an arc is just a part of a circle.

When we took those steps, really what we did is we copied this circle down here. These circles are congruent. They're copies of one another. That means that these two segments are radii of this circle and these two segments are radii of this circle and because these circles are congruent, that means that all of the radii are congruent. That tells us that these segments are congruent to these. I'm going to go ahead and just add in some congruent marks there.

Now, focus for a second on the red pieces. I'm going to drop that red segment back in there. Line that up as best as I can to exactly where it was. I'll bring back in this red segment and then this arc here. Okay.

Now, think back to the steps that we took when we made this arc. We set our compass open to the width of this angle. We kept that setting. We came down and we made this arc. What that tells us here is that this segment must be congruent to this segment. We didn't actually draw the circle here. We just set the compass open to that width, which is really the length of the radius of the circle that we're not seeing right here. This radius has to be congruent to this one. When we drew this arc, like I said, this arc was set to that same width. Basically the circle that we're not seeing here is congruent to the circle that this arc is a part of. I'm going to use that fact to go ahead and add in some more congruent marks.

If you notice, we've created a couple of triangles here. Now is when we're going to pull back to what we know about congruent triangles in order to justify the rest of this construction.

Take a look at this. Let's reveal what's behind number one. That's going to be the first thing we have to do. We're going to want to show that triangle ABC is congruent to triangle DEF by side side side. Let's think about some of those relationships that we just established on the

Module 11: Constructions

Topic 2 Content: Constructing an Angle Congruent to a Given Angle Transcript

previous slide. Make sure I've got my pen. Okay. Now we showed that AB and AC , that these segments are congruent to these segments because they are radii of congruent circles. What that tells us, we can confirm here is that AB is congruent to AC and DE and DF . We know that all of those segments are congruent to each other because they are radii of congruent circles. Okay? We also know that BC is congruent to EF because if you recall, we set our compass to this width when we made this arc. We know for sure that these segments are also congruent.

What I'm going to do now is I'm going to roughly sketch these triangles that we've created here. I'm going to pull them out of the construction right there, just get a rough sketch. It's not going to be perfect, it's just to look at those triangles separately. All right. We have BAC , DEF . Okay. We've shown here, I'm going to switch colors, that AB is congruent to DE , AC is congruent to DF , and BC is congruent to EF . If you look, we've done it. We've shown that we have three pair of corresponding sides congruent in these two triangles. We know for sure that triangle ABC is congruent to triangle DEF by side side side. Okay?

Let's look at the second thing that we need to show here in order to justify this construction. Let me switch to my pointer tool. Get this out of our way. Okay. The next thing that we want to show is that angle BAC is congruent to angle EDF . Let's look at where those angles are in our triangles. Here we have angle BAC , right here is the vertex of that angle, and angle EDF . There's the vertex of that one. If we look, we actually have a pair of corresponding angles. Because we know that these triangles are congruent, we know that their corresponding parts also have to be congruent, because corresponding parts of congruent triangles are congruent.

Now, if we look at where these angles are in regards to our construction, let's get these congruent marks out of our way just so that we don't get too crowded. Here we have angle BAC and here we have angle EDF . Now, if you look, we've actually justified the construction. We've shown that these angles must be congruent, by showing how they relate to the congruent triangles that we have here. We're all done with this one. We've justified this construction by showing that these angles must be congruent, because they are corresponding parts of congruent triangles. All right? Good job pulling together all those properties of circles and congruent triangles to justify this construction.

All right, guys. You've reached the conclusion of this topic on how to use a compass and a straight edge to construct an angle congruent to a given angle. I hope you saw how your knowledge of circles came in handy for you during this topic. Bye.