

## Module 10: Circles

### Topic 4 Content: Calculating the Area of a Sector Transcript

Hi, guys, welcome to Geometry. In this topic we're going to focus on how to calculate the area of a sector. Your knowledge of circles and your algebra skills is going to come in handy for you during this topic. You ready to get started? Let's go.

Okay. I know during middle school, you covered the area of a circle. You know that the area is the space in the interior of the circle, when you want to calculate that measure. If you think about a circle like a pizza pie, a sector is like a slice of pizza. A sector is a portion of the circle. It's formed by a central angle and then it's intercepted arc. When we want to calculate the area of a sector, we want to calculate a portion of the area of a circle. Again, if you think about it like a piece of pizza pie, area of a sector will be the area of that piece of pizza. Okay.

Here, we're given the circle,  $P$ , and we are given the length of the radius, the measure of the central angle. This area here in yellow, that's the area that we're going to calculate. That's the sector we're going to focus on. Here's the formula that we use to calculate the area of a sector. In this case, we have sector  $MPN$ . The area of that sector over  $\pi r^2$ . If you remember that's the formula for the area of the circle, equals the measure of the central angle over 360. Okay? The ratio of the central angle to 360 is proportional to the ratio of the area of the sector to the area of the whole circle. Okay? They have like a part/whole relationship. Part of the circle, whole circle, part of the circle, whole circle, you kind of think about it like that. Okay?

Let's work through this one, figure out what this is and get you a little warmed up about how to calculate the area of a sector. Make sure I have my pen here. Okay. Area of sector  $MPN$ , right now I don't know what that distance is or I don't know what that measure is, that area, I should say. I'm going to represent it as  $X$ . I'm just going to put a little  $X$  here, so that you know the area of the sector, I'm referring to it as  $X$ .  $X$  over  $\pi$ . Our radius is eight. Eight squared equals the measure of the central angle, which is 100 over 360, okay? Like I said, that area, I don't know what it is yet, so I'm going to refer to it as  $X$  for right now.  $X$  over  $\pi$  times eight squared equals 100 over 360, okay?

Let's go ahead and cross-multiply here so we can solve this proportion. All right.  $X$  times 360. That is  $360X$ . I'm going to carry along  $\pi$  for right now as I cross-multiply the other side. I'm just going to multiply eight squared times 100. Okay? Let me go to my calculator. Eight squared times 100, that is 6400. Let's go back to the work. That would be 6400  $\pi$  on the right side, remember, we're carrying along that  $\pi$ . Divide both sides by 360. Let's cancel that out there, get a little more space here. I'm still carrying along that  $\pi$ . For right now, I'm just going to divide 6400 by 360. Okay? Back to the calculator. 6400 divided by 360. That is 17.7. The calculator's rounding that all the way off to eight because those sevens repeat. Now, what I'm going to do is I'm going to let the calculator change this decimal value to a fraction, okay? Like I said before, you've learned how to do that in Algebra 1, right? How to really do that by hand, but because we're in Geometry now. I know you know how to do it. I'm going to show you how you can use the tools and the calculator to change any decimal to a fraction.

I'm going to press math, right underneath that Alpha key. Math, and right here, this first option is what I want. I'm going to press enter and enter one more time. I have 160 over

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nine, go back to my work. Let's go full screen again.  $X$  equals  $160\pi$  over nine. I believe our units were centimeters? Because this is area, we have square units, centimeters squared.

Like I mentioned before in one of our earlier topics, we don't generally talk in terms of  $\pi$  when we're talking about measures.  $160\pi$  over nine centimeters squared, it's kind of hard to get a grasp of how much is that exactly. How large is that area? What we're going to do is we're going to use the fact that we know that  $\pi$  is approximately 3.14, and we're going to approximate what this area is. Okay? To do that, I'll do that right off to the side, get the work going. You can see what I'm doing. We're actually going to use the calculator. We're going to calculate  $160 \times 3.14$ . Then we'll divide that by nine. That will give us an approximation of what exactly, how large is that area really.

$160 \times 3.14$  divided by nine. Let's go to our calculator.  $160 \times 3.14$ . Then let's divide that by nine. Then let's round to the nearest whole number here. Let's say this is approximately 56, okay? Let's go back to our work. We'll full screen here.  $X$  is approximately 56 centimeters squared okay? In terms of  $\pi$ ,  $160\pi$  over nine square centimeters, which is approximately 56 square centimeters, okay? You're all done with this one.

Let me just kind of recap, though, just to pull it all together before we move on. We used our rule, after I said I was going to let  $X$  represent the area of that sector. We used our rule to set up our proportion.  $X$  over  $\pi$  times eight squared, so our radius squared, equals 100, which was our central angle, over 360.

We cross-multiplied, carrying  $\pi$  along the way. We found that  $X$  equaled  $160\pi$  over nine, which we approximated using the fact that we know that  $\pi$  is approximately 3.14, that  $X$  or the area of that sector is approximately 56 square centimeters. Okay? All right. Good job pulling all of that together. Now I want you to go ahead and try this one. Press pause. Take a few minutes. Work your way through this one. Press play when you're ready to check your work.

All right. Let's see how you did here. You were given this information here. A garden is modeled by the circle given below. Sector ABC represents the portion of the garden when roses will be planted. Find the area of the sector ABC, round to the nearest whole number. Okay. We've got the formula here. That will help us get our proportion going.

The area of the sector, right now I don't know what it is. Again, I'm just going to call it  $X$ . Let  $X$  represent that.  $X$  equals  $\pi$  times our radius squared. Our radius is 12 feet.  $12^2$  squared, equals the measure of the central angle. That's 120 over 360. Let's go ahead and cross-multiply so we can figure out what  $X$  is here.  $X$  times 360, that is, get a little more space,  $360X$ . For right now I'm going to carry  $\pi$  along. I'm going to multiply  $12^2$  times 120. Let's go to the calculator for that. Let's clear this a little bit here.  $12^2$  times 120. That is 17,280. 17,280. Okay. 17,280  $\pi$ . Let's divide each side by 360. 17,280 divided by 360. Let's go to the calculator. 17,280 divided by 360. That is 48, all right. Let's go to our work. That means the area of this sector, in terms of  $\pi$ , it is 48  $\pi$  and I believe our units were feet. Okay, so feet squared.

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We were asked to round to the nearest whole number, right? We're going to use the fact that we know that Pi is approximately 3.14, okay, that's its approximation. We need to calculate 48 times 3.14. Okay? Then we'll round that to the nearest whole number. 48 times 3.14. That is 150.72. Round to the nearest whole number, that's approximately 151. Okay? Back to our work. Let's go full screen here. X is approximately 151 square feet. Okay? Let's recap. Let's take that back up to our word problem here.

We used our rule to set up our proportion to find the area of the sector. X times, or X over, I should say, Pi 12 squared equals 120 over 360. We set up our proportion. We used our algebra skills. We solved for X in terms of Pi at first. We found that X equals 48 Pi squared. We approximated Pi's value at 3.14.

We used that to figure out that X was approximately 151 square feet. What that tells us, taking it back to our word problem, is the area of sector ABC, which right in here, we can even highlight it just to make it stand out. The area of that part of the garden, where those roses will be planted is approximately 151 square feet. Okay? Good job on that one. Great job pulling all of that together.

All right. You've reached the conclusion of this topic of how to calculate an area of a sector. I hope you saw how your knowledge of circles and your algebra skills came in handy during this topic. Bye.