Area of circles sectors and segments worksheets

A segment of a circle is the region that is bounded by an arc and a chord of the circle. When something is divided into parts, each part is referred to as a segment. In the same way, a segment is a part of the circle. But a segment is not any random part of a circle, instead, it is a specific part of a circle that is cut by a chord of it. Let us learn about the definition of a segment of a circle and the formula to find the area of a segment of a circle in detail here. What is the Segment of a Circle? A segment of a circle is the region that is bounded by an arc and a chord of the circle. Let us recall what is meant by an arc and a chord of the circle. An arc is a portion of the circle's circumference. A chord is a line segment that joins any two points on the circle's circumference. There are two types of segments, one is a minor segment, and the other is a major segment. A minor segment is made by a minor arc and a major segment is made by a major arc of the circle. Properties of Segment of Circle The properties of a segment of a circle are: It is the area that is enclosed by a chord and an arc. The angle subtended by the segment at the center of the circle is the same as the angle subtended by the corresponding arc. This angle is usually known as the central angle. A minor segment is obtained by removing the corresponding major segment from the total area of the circle. A major segment is obtained by removing the corresponding minor segment from the total area of the circle. A semicircle is the largest segment in any circle formed by the diameter and the corresponding arc. Area of a Segment of Circle An arc and two radii of a circle form a sector. These two radii and the chord of the segment together form a triangle. Thus, the area of a segment of a circle is obtained by subtracting the area of the triangle from the area of the sector. i.e., Area of a segment of circle = area of the sector - area of the triangle Let us use this logic to derive the formulas to find the area of a segment of a circle. Note that this is the area of the minor segment. Usually, a segment of a circle refers to a minor segment. Note: To find the area of the major segment of a circle, we just subtract the corresponding area of the minor segment from the total area of the circle. Area of a Segment of Circle Formula Let us consider the minor segment of the above circle that is made by the chord PQ of a circle of radius 'r' that is centered at 'O'. We know that every arc of a circle subtends an angle at the center which is referred to as the central angle of the arc. The angle made by the arc PQ is θ. We know from trigonometry that, the area of the triangle OPQ is (1/2) r2 sin θ. Also, we know that the area of the sector OPQ is: (θ / 360o) × πr2, if 'θ' is in degrees (1/2) × r2θ, if θ' is in radians Thus, the area of the minor segment of the circle is: (θ / 360o) × πr2 - (1/2) r2 sin θ (OR) r2 [πθ/360o - sin θ/2], if 'θ' is in degrees (1/2) × r2θ - (1/2) r2 sin θ (OR) (r2 / 2) [θ - sin θ], if 'θ' is in radians Perimeter of Segment of a Circle We know that the segment of a circle is made up of an arc and a chord of the circle. Consider the same segment as in the above figure. Perimeter of the segment = length of the arc + length of the chord We know that, the length of the arc is rθ, if 'θ' is in radians and πrθ/180, if 'θ' is in degrees. the length of the chord = 2r sin (θ/2) Thus, the perimeter of the segment formula is: The perimeter of the segment of a circle = rθ + 2r sin (θ/2), if 'θ' is in radians. he perimeter of the segment of a circle = πrθ/180 + 2r sin (θ/2), if 'θ' is in radians. Theorems on Segment of a Circle Mainly, there are two theorems based on the segment of a Circle. Angles in the same segment theorem Alternate segment theorem Angles in the Same Segment Theorem It states that angles formed in the same segment of a circle are always equal. Alternate Segment Theorem This theorem states that the angle formed by the tangent and the chord at the point of contact is equal to the angle formed in the alternate segment on the circumference of the circle through the endpoints of the chord. Related Topics Here are a few related topics to the segment of a circle, take a look. Chord of a Circle Geometry Circle Formulas Example 1: In a pizza slice, if the central angle is 60 degrees and the length of its radius is 4 units, then find the area of the segment formed if we remove the triangle part out of the pizza slice. Use π = 3.142. Round your answer to two decimals. Solution: The radius of pizza is, r = 4 units. The central angle is, θ = 60 degrees. The area of the segment is, r2 [πθ/360o - sin θ/2] = 42 [(3.142 × 60)/360 - sin 60/2] ≈ 1.45 square units. Answer: The area of the segment of the pizza = 1.45 square units. Example 2: If the area of a sector is 100 sq. ft and the area of the enclosed triangle is 78 sq. ft, what is the area of the segment? Solution: Area of the segment = area of the sector- area of the triangle = 100 sq. ft. - 78 sq. ft. = 22 sq. ft. Answer: The area of the segment is 22 sq. ft. Example 3: Find the area of the major segment of a circle if the area of the corresponding minor segment is 62 sq. units and the radius is 14 units. Use π = 22/7. Solution: Area of the major segment = area of the circle - area of the minor Segment = πr2 − 62 = (22/7) × 14 × 14 − 62 = 554 sq. units Answer: The area of the major segment 554 sq. units. Show Solution > go to slidego to slidego to slide Breakdown tough concepts through simple visuals. Math will no longer be a tough subject, especially when you understand the concepts through visualizations with Cuemath. Book a Free Trial Class FAQs on Segment of a Circle A segment of a circle is the region that is bounded by an arc and a chord of the circle. There are two types of segments, one is a minor segment (made by a minor arc) and the other is a major segment (made by a major arc). What Is the Difference Between Chord and Segment of a Circle? A chord of a circle is a line segment that joins any two points on its circumference whereas a segment is a region bounded by a chord and an arc of the circle. What Is the Difference Between Arc and Segment of a Circle? An arc is a portion of a circle's circumference whereas a segment of a circle is a region bounded by an arc and a chord of the circle. What Is the Difference Between a Sector of a Circle and a Segment of a Circle? A sector of a circle is the region enclosed by two radii and the corresponding arc, while a segment of a circle is the region enclosed by a chord and the corresponding arc. What Is the Formula for Area of the Segment of a Circle? The area of the segment of the circle (or) minor segment of a circle is: (θ / 360o) × πr2 - (1/2) r2 sin θ (OR) r2 [πθ/360o - sin θ/2], if 'θ' is in degrees (1/2) × r2θ - (1/2) r2 sin θ (OR) (r2 / 2) [θ - sin θ], if 'θ' is in radians Here, 'r' is the radius of the circle and 'θ' is the angle subtended by the arc of the segment. How To Find the Area of a Segment of a Circle? Here are the steps to find the area of a segment of a circle. Identify the radius of the circle and label it 'r'. Identify the central angle made by the arc of the segment and label it 'θ'. Find the area of the triangle using the formula (1/2) r2 sin θ. Find the area of the sector using the formula (θ / 360o) × πr2, if 'θ' is in degrees (or) (1/2) × r2θ, if θ' is in radians Subtract the area of the triangle from the area of the sector to find the area of the segment. How To Find the Area of a Major Segment of a Circle? The area of a major segment of a circle is found by subtracting the area of the corresponding minor segment from the total area of the circle. Are the Angles in the Same Segment of a Circle Equal? Yes, the angles formed by the same segment of a circle are equal. i.e., the angles on the circumference of the circle made by the same arc are equal. What Is the Alternate Segment Theorem of a Circle? The alternate segment theorem states that the angle formed by the tangent and the chord at the point of contact is equal to the angle formed in the alternate segment on the circumference of the circle through the endpoints of the chord. Is a Semicircle a Segment of the Circle? We know that a diameter of a circle is also a chord of the circle (in fact, it is the longest chord of the circle). Also, we know that the semicircle's circumference is an arc of the circle. Thus, a semicircle is bounded by a chord and an arc and hence is a segment of the circle. If you're seeing this message, it means we're having trouble loading external resources on our website. If you're behind a web filter, please make sure that the domains *.kastatic.org and *.kasandbox.org are unblocked. Slices There are two main "slices" of a circle: The "pizza" slice is called a Sector. And the Segment, which is cut from the circle by a "chord" (a line between two points on the circle). Try Them! Common Sectors The Quadrant and Semicircle are two special types of Sector: Half a circle is a Semicircle. Quarter of a circle is a Quadrant. You can work out the Area of a Sector by comparing its angle to the angle of a full circle. Note: we are using radians for the angles. This is the reasoning: A circle has an angle of 2π and an Area of:πr2 A Sector has an angle of θ instead of 2π so its Area is : θ2π × πr2 Which can be simplified to:θ2 × r2 Area of Sector = θ 2 × r2 (when θ is in radians) Area of Sector = θ × π 360 × r2 (when θ is in degrees) Area of Segment The Area of a Segment is the area of a sector minus the triangular piece (shown in light blue here). There is a lengthy reason, but the result is a slight modification of the Sector formula: Area of Segment = θ − sin(θ) 2 × r2 (when θ is in radians) Area of Segment = (θ × π 360 − sin(θ)2) × r2 (when θ is in degrees) Arc Length The arc length (of a Sector or Segment) is: L = θ × r (when θ is in radians) L = θ × π180 × r (when θ is in degrees) Copyright © 2017 MathsIsFun.com Problem 1 :Find the area of the circle shown below. Problem 2 :If the area of a circle is 96 square centimeters, find its diameter. Problem 3 :Find the area of the sector shown at the right. Problem 4 :A and B are two points on a ⊙P with radius 9 inches and ∠APB = 60°. Find the areas of the sectors formed by ∠APB.Problem 5 : Find the area of the shaded region shown below. Problem 6 :You are cutting the front face of a clock out of wood, as shown in the diagram. What is the area of the front of the case ? Detailed Answer Key Problem 1 :Find the area of the circle shown below. Solution : Formula area of a circle is given by A = πr2Plug r = 8.A = π(8)2A = 64πUse calculator. A ≈ 201.06So, the area is 64π, or about 201.06, square inches.Problem 2 :If the area of a circle is 96 square centimeters, find its diameter. Solution :Formula area of a circle is given by A = πr2Plug A = 96.96 = πr2Divide each side π.96/π = πr2/π96/π = r2Use calculator.30.56 ≈ r2Take square root on each side. 5.53 ≈ rSo, the diameter of the circle is about 2(5.53), or about 11.06, centimeters.Problem 3 :Find the area of the sector shown at the right. Solution : Sector CPD intercepts an arc whose measure is 80°. The radius is 4 feet. Formula for area of a sector is given byA = [m∠arc CD / 360°] · πr2Plug m∠arc CD = 80° and r = 4.A = [80° / 360°] · π(4)2A = (2 / 9) · 16πUse calculator.A ≈ 11.17So, the area of the sector is about 11.17 square feet.Problem 4 :A and B are two points on a ⊙P with radius 9 inches and ∠APB = 60°. Find the areas of the sectors formed by ∠APB.Solution : Draw a diagram of ⊙P and ∠APB. Shade the sectors. Label a point Q on the major arc. Find the measures of the minor and major arcs. Because m∠APB = 60°, we havem∠arc AB = 60° and m∠AQB = 360° - 60° = 300°Use the formula for the area of a sector. A = [m∠arc CD / 360°] · πr2Plug m∠arc CD = 80° and r = 4.A = [80° / 360°] · π(4)2A = (2 / 9) · 16πUse calculator.A ≈ 11.17So, the area of the sector is about 11.17 square feet. Area of Smaller SectorA = 60°/360° · π(9)2A = 1/6 · π · 81A ≈ 42.41 square inches Area of Larger SectorA = 300°/360° · π(9)2A = 5/6 · π · 81A ≈ 212.06 square inches Problem 5 : Find the area of the shaded region shown below. Solution : The diagram shows a regular hexagon inscribed in a circle with radius 5 meters. The shaded region is the part of the circle that is outside of the hexagon.Area of shaded region = Area of circle - Area of hexagonArea of shaded region = πr2 - 1/2 · a · pRadius of the circle is 5 and the apothem of a hexagon is = 1/2 · side length · √3= 1/2 · 5 · √3= 5√3/2So, the area of the shaded region is= [π · 52] - [1/2 · (5√3/2) · (6 · 5)]= 25π - 75√3/2Use calculator. ≈ 13.59So, the area of the shaded region is about 13.59 square meters.Problem 6 :You are cutting the front face of a clock out of wood, as shown in the diagram. What is the area of the front of the case ? Solution : The front of the case is formed by a rectangle and a sector, with a circle removed. Note that the intercepted arc of the sector is a semicircle.So, the required area is = Area of rectangle + Area of sector - Area of circle= [6 · 11/2] + [180°/360° · π · 32] - [π · (1/2 · 4)2]= 33 + 9/2 · π - 4πUse calculator. ≈ 34.57The area of the front of the case is about 34.57 square inches. Apart from the stuff given above, if you need any other stuff in math, please use our google custom search here. If you have any feedback about our math content, please mail us : v4formath@gmail.comWe always appreciate your feedback. You can also visit the following web pages on different stuff in math. WORD PROBLEMSHCF and LCM word problemsWord problems on simple equations Word problems on linear equations Word problems on quadratic equationsAlgebra word problemsWord problems on trainsArea and perimeter word problemsWord problems on direct variation and inverse variation Word problems on unit priceWord problems on unit rate Word problems on comparing ratesConverting customary units word problems Converting metric units word problemsWord problems on simple interestWord problems on compound interestWord problems on types of angles Complementary and supplementary angles word problemsDouble facts word problemsTrigonometry word problemsPercentage word problems Profit and loss word problems Markup and markdown word problems Decimal word problemsWord problems on fractionsWord problems on mixed fractrionsOne step equation word problemsLinear inequalities word problemsRatio and proportion word problemsTime and work word problemsWord problems on sets and venn diagramsWord problems on agesPythagorean theorem word problemsPercent of a number word problemsWord problems on constant speedWord problems on average speed Word problems on sum of the angles of a triangle is 180 degreeOTHER TOPICS Profit and loss shortcutsPercentage shortcutsTimes table shortcutsTime, speed and distance shortcutsRatio and proportion shortcutsDomain and range of rational functionsDomain and range of rational functions with holesGraphing rational functionsGraphing rational functions with holesConverting repeating decimals in to fractionsDecimal representation of rational numbersFinding square root using long divisionL.C.M method to solve time and work problemsTranslating the word problems in to algebraic expressionsRemainder when 2 power 256 is divided by 17Remainder when 17 power 23 is divided by 16Sum of all three digit numbers divisible by 6Sum of all three digit numbers divisible by 7Sum of all three digit numbers divisible by 8Sum of all three digit numbers formed using 1, 3, 4Sum of all three four digit numbers formed with non zero digitsSum of all three four digit numbers formed using 0, 1, 2, 3Sum of all three four digit numbers formed using 1, 2, 5, 6 Enjoy this page? Please pay it forward. Here's how... Would you prefer to share this page with others by linking to it? Click on the HTML link code below. Copy and paste it, adding a note of your own, into your blog, a Web page, forums, a blog comment, your Facebook account, or anywhere that someone would find this page valuable.