

TEACHER AND STUDENT RESOURCE

Arc Length Radians and Sector Area



NC Math 3 • NC.M3.G-C.5

Circles

Seven instructional sections with 30 multiple-choice and 30 open or performance tasks, teaching scripts, original mathematical visuals, generous workspaces, and worked keys.

Free sample | Contents

NC.M3.G-C.5 | NC Math 3 mathematics

This sample contains 23 complete selected pages from the 116-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-17, 32-33, 65-66, 87-88

Representative activities

M01: sample PDF page(s) 18; original page(s) 17

M02: sample PDF page(s) 18; original page(s) 17

O01: sample PDF page(s) 19; original page(s) 32

O02: sample PDF page(s) 20; original page(s) 33

Selected teacher prompts and keys: original page(s) 65-66, 87-88

Using this sample

Read the preparation and access guidance before using a selected activity.
Keep teacher keys and private preparation pages separate from student copies.
Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

ALIGNMENT

Standard and learning targets

Using similarity, demonstrate that the length of an arc, s , for a given central angle is proportional to the radius, r , of the circle. Define radian measure of the central angle as the ratio of the length of the arc to the radius of the circle, s/r . Find arc lengths and areas of sectors of circles.

T1 Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

T2 Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

T3 Derive and apply arc-length and sector-area relationships, including inverse problems, complementary sectors and complete boundaries.

T4 Construct, compare and critique sectors by checking angle domains, dimensional consistency and simultaneous radius, arc, area and perimeter conditions.

Each item names its own target. The bank supports multiple sessions; do not assign all 60 tasks in one sitting.

NAVIGATION

Choose evidence deliberately

Warm-up: M01-M04 and O01-O04

I Do: M05-M08 and O05-O08

We Do: M09-M13 and O09-O13

Collaborative practice: M14-M18 and O14-O18

Independent practice: M19-M23 and O19-O23

Small-group reteach: M24-M27 and O24-O27

Exit ticket: M28-M30 and O28-O30

T1: M02, M05, M13, M24, M28, O03, O05, O15, O19, O24, O28

T2: M01, M06, M12, M17, M19, M25, O01, O02, O06, O17, O18, O20

T3: M03, M04, M07, M08, M09, M10, M11, M16, M21, M22, M26, M29, O04, O07, O09, O10, O11, O12, O23, O27, O29

T4: M14, M15, M18, M20, M23, M27, M30, O08, O13, O14, O16, O21, O22, O25, O26, O30

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1 Similarity and the meaning of radians

Learning target: Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

Learning target: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

Use Warm-up and I Do tasks. Construct the two quarter sectors in O03 and develop the scaling argument in O05 before introducing $s=r\theta$ as a rearranged definition. Use a flexible strip for the 1-radian model.

Session 2 Derive calculate and compare

Learning target: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

Learning target: Derive and apply arc-length and sector-area relationships, including inverse problems, complementary sectors and complete boundaries.

Use We Do and Collaborative items to derive area, distinguish boundary and region and solve inverse problems. Require an angle-unit declaration before substitution and a full-circle size check after it.

Session 3 Construct audit and transfer

Learning target: Derive and apply arc-length and sector-area relationships, including inverse problems, complementary sectors and complete boundaries.

Learning target: Construct, compare and critique sectors by checking angle domains, dimensional consistency and simultaneous radius, arc, area and perimeter conditions.

Use Independent tasks, targeted reteach and Exit items. Compare equal-arc, equal-area and equal-perimeter conditions; test every resulting root and distinguish a valid rotation from a single-sector design.

PLANNING

Materials, access and pacing

Materials

Pencil, compass, ruler, flexible strip or string, graph paper and a protractor for approximate drawing checks. Use exact π expressions in calculations; calculator approximations are checks, not substitutes for exact answers. Provide both blank grids whenever two constructions are requested.

Prerequisites

Use similarity and dilation scale factors, circumference $2\pi r$ and disk area πr^2 ; simplify exact ratios, solve linear and quadratic equations and convert length units. Distinguish a central angle, an arc, a chord, a radius and a closed boundary.

Pacing

Use a short diagnostic warm-up, a model and shared task in one session; collaborative and independent reasoning in later sessions; then targeted reteaching and an exit task. Select two to four tasks at a time based on evidence. Each section's full bank is reusable, not mandatory in one lesson.

Neutral access

Read directions aloud without interpreting the graph, enlarge a page, supply a writing or pointing response method, and allow a learner to dictate an explanation. Keep axes, units, data and mathematical demand unchanged.

Separate instruction from evidence

Keep the learner's first response. Record answer-supplying cues separately from access supports. A completed teacher graph or worked key is for discussion after independent work, never a student construction template.

Review convention

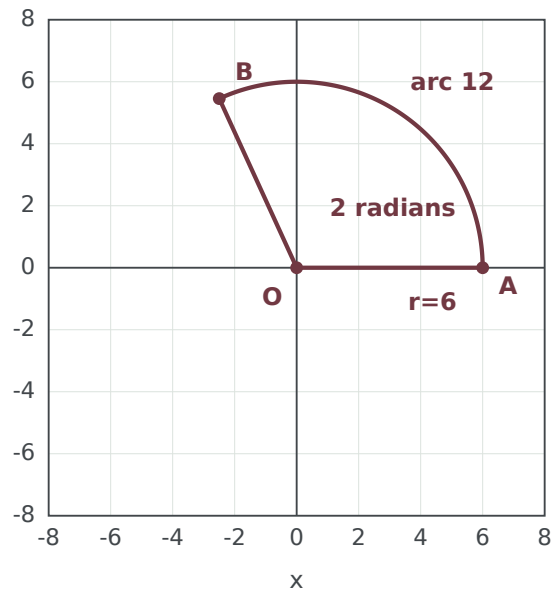
All radii are positive. Unless a task explicitly describes accumulated rotation, a sector is a non-full, non-overlapping portion of a disk with $0 < \theta < 2\pi$ radians. A minor sector has $0 < \theta < \pi$, a semicircular sector has $\theta = \pi$ and a major sector has $\pi < \theta < 2\pi$. Central angles may be given in degrees, but $s = r\theta$ and $A = (1/2)r^2\theta$ require radians. All lengths in a ratio must use the same unit. Arc length is curved boundary length; sector perimeter includes the two radii. A displayed drawing is not a source of unstated measurements. Construction diagrams are completed only in the teacher key. Equivalent exact forms and valid alternative reasoning earn credit.

TEACHER MODEL

Connect a scale argument to one consistent sector

A sector has radius 6 cm and angle 2 radians. Use the definition of radians to find its arc, area and perimeter. Then describe what changes when the radius doubles and the angle stays fixed.

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Because $\theta = s/r$, the arc is $s = r\theta = 6 \cdot 2 = 12$ cm. The fraction of the disk is $2/(2\pi) = 1/\pi$, so $A = (1/\pi)(36\pi) = 36$ cm², agreeing with $A = rs/2$. The full boundary is $P = s + 2r = 12 + 12 = 24$ cm. A center dilation of factor 2 produces a radius-12 sector with the same angle: its arc is 24 cm, area is 144 cm² and perimeter is 48 cm. Lengths double, areas quadruple and s/r remains 2. Both angles lie below 2π . Circle size changes the arc length but not the angle represented by the ratio.

VISUAL ANCHOR

Keep angle units and geometric measures distinct

Similarity at fixed angle: $r_2 = kr_1$ and $s_2 = ks_1$, so $s_2/r_2 = s_1/r_1$.

Radian definition: $\theta = s/r$ with matching length units.

One full revolution: 2π radians = 360 degrees.

Arc length: $s = r\theta$, or $s = (\text{degrees}/360)(2\pi r)$.

Sector area: $A = (1/2)r^2\theta = (1/2)rs$, or $A = (\text{degrees}/360)\pi r^2$.

Non-full sector perimeter: $P = s + 2r$; annular boundaries include both arcs.

One non-full sector: $0 < \theta < 2\pi$, $0 < s < 2\pi r$ and $0 < A < \pi r^2$.

VISUAL ANCHOR CONTINUED

Keep angle units and geometric measures distinct

Multi-turn rotation can repeat paths and areas; distinguish total travel from the set of points covered.

Choose the requested measure before calculating. The formulas must agree for the same radius, arc and angle; a correct isolated calculation does not establish a feasible design.

REUSABLE REASONING GUIDE

Represent, justify, interpret

Name: _____ Date: _____

Givens, quantities and restrictions**Representation and calculation****Justification or check****Conclusion, domain and units**

WARM-UP

Teaching script

Core: 001 • T2: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

Optional bank: M01–M04; O01–O04. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 5–8 minutes. Adjust for access and evidence; this is not a speed criterion.

Start O01 before presenting arc formulas: ask “Which path do your fingers follow, and which straight segment joins the endpoints?” For M01 and O02 ask learners to say the units aloud before dividing. In O03 keep both grids at the same scale, name the center dilation and ask why equal angles do not mean equal arcs. On O04 ask whether an answer can exceed the entire disk before discussing the unit error.

Core task

Draw the upper semicircular arc of a radius-4 circle and a horizontal diameter AB joining its endpoints. Mark the central angle in radians. Find both the arc length and the straight-line distance AB. Explain why the two lengths are different even though the endpoints agree.

Teacher solution and discussion

Place $O=(0,0)$, $A=(4,0)$ and $B=(-4,0)$. Draw the upper semicircle and diameter AB; the central angle is π radians. The arc is $s=r\theta=4\pi$ units and the straight distance is the diameter $AB=8$ units. Since $\pi>2$, $4\pi>8$. The chord is a straight path, while the arc follows the circle, so common endpoints do not force equal lengths.

Evidence and response

Require a completed semicircle and diameter with radius and angle labels, both exact lengths with linear units, and a valid comparison using $\pi>2$. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M01 to compare all alternatives after evidence is collected.

I DO

Teaching script

Core: 005 • T1: Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

Optional bank: M05–M08; O05–O08. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–12 minutes. Adjust for access and evidence; this is not a speed criterion.

Model O05 with two equal-angle sectors. Approximate each arc with a short polygonal path, dilate the corresponding segments and explain that increasingly fine paths preserve the same length scale. Only then name s/r as the invariant angle in radians. Use O06 to derive 2π for a full revolution from circumference. In O07 keep $\theta/(2\pi)$ visible until π cancels; derive $A = rs/2$ by substitution rather than introducing a disconnected rule. Ask what hypotheses justify dividing by r .

Core task

Without starting from the formula $s = r\theta$, use similarity to explain why s/r is constant among circles with the same central angle. Include how a curved arc length scales, and explain why the conclusion does not say all arcs of one circle have equal lengths.

Teacher solution and discussion

Place equal-angle sectors with a common center and corresponding initial rays. A dilation with factor $k = r_2/r_1$ maps the first circle and sector to the second and preserves the angle.

Approximate the first arc by inscribed polygonal paths. Every segment in each corresponding path scales by k , so each whole path length scales by k ; taking increasingly fine approximations gives $s_2 = ks_1$ for the arc lengths. Since $r_2 = kr_1$, $s_2/r_2 = s_1/r_1$. Different angles intercept different fractions of a circle, so the fixed-angle hypothesis cannot be dropped. For example, a semicircle has twice the arc length of a quarter circle of the same radius.

Evidence and response

Require a similarity map, a defensible extension from straight-segment scaling to arc-length scaling, ratio cancellation and an explicit counterexample when the angle changes. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M05 to compare all alternatives after evidence is collected.

WE DO

Teaching script

Core: 009 • T3: Derive and apply arc-length and sector-area relationships, including inverse problems, complementary sectors and complete boundaries.

Optional bank: M09–M13; O09–O13. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–15 minutes. Adjust for access and evidence; this is not a speed criterion.

On O09 have one learner trace the curved edge and another trace the complete boundary; label each before calculating. In O10 physically indicate both concentric arcs and both radial thicknesses so neither perimeter component is lost. For O11 and O12 work backward from the requested quantities, then substitute the recovered pair into the original constraints. Use O13 to require two distinct failure checks: a one-turn bound and an area identity.

Core task

A garden is a sector of radius 8 m and angle 135 degrees. A border will cover the full sector boundary, while paving covers its interior. Find the exact border length and paving area. A 2-m gate replaces part of one straight radius edge; determine the remaining border length and explain why the paving area is unchanged.

Teacher solution and discussion

The angle is $3\pi/4$ radians. The curved edge is $s=8(3\pi/4)=6\pi$ m. The full boundary is $6\pi+16$ m, including both radii. The paving area is $A=(1/2)(64)(3\pi/4)=24\pi$ m². Replacing 2 m of one radius edge with a gate leaves border length $6\pi+14$ m. Because only the boundary material changes and no part of the region is removed, the paving area remains 24π m²; the 2-m gate fits within an 8-m edge.

Evidence and response

Separate curved edge, full boundary and area; subtract the gate from the correct linear measure and explain why boundary replacement does not alter the region. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M09 to compare all alternatives after evidence is collected.

COLLABORATIVE PRACTICE

Teaching script

Core: O14 • T4: Construct, compare and critique sectors by checking angle domains, dimensional consistency and simultaneous radius, arc, area and perimeter conditions.

Optional bank: M14–M18; O14–O18. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 15–20 minutes. Adjust for access and evidence; this is not a speed criterion.

Give the group constructor, ratio checker and skeptic roles after private predictions. O14 needs two separate completed sectors, not two radii in one unfinished sketch. Ask the skeptic to explain how changing the angle offsets the squared radius. On O15 require matching length units before a scale factor is stated. O16 should end with a general argument plus a valid counterexample. For O17 and O18 separate accumulated wheel rotation from one-radian measurement along a circumference.

Core task

Construct two sectors on separate grids: one with radius 3 units and angle π radians, the other with radius 6 units and angle $\pi/4$ radians. Show that their areas are equal, compare their arc lengths, and explain how the angle change compensates for the change in radius.

Teacher solution and discussion

Use a radius-3 semicircle for the first and a radius-6 45-degree sector for the second. $A_1 = (1/2)(9)\pi = 9\pi/2$ and $A_2 = (1/2)(36)(\pi/4) = 9\pi/2$ square units. The arcs are $s_1 = 3\pi$ and $s_2 = 6(\pi/4) = 3\pi/2$, so the second arc is half as long. Doubling radius multiplies r^2 by 4, while dividing theta by 4 preserves $r^2\theta$ and therefore area. The angles differ, so the equal-area sectors are not similar.

Evidence and response

Require two completed accurately oriented sectors, both exact area checks, the correct arc comparison and the inverse-square compensation explanation. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M14 to compare all alternatives after evidence is collected.

INDEPENDENT PRACTICE

Teaching script

Core: O19 • T1: Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

Optional bank: M19–M23; O19–O23. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 15–20 minutes. Adjust for access and evidence; this is not a speed criterion.

Use O19–O23 without naming the needed formula. Collect ratio evidence before accepting a graph-slope claim. In O20 assess both the unit mismatch and the wrong geometric pairing. In O21 require two different counterexamples and positive one-turn angles. For O22 check both proposed signs against the original perimeter, not just the area comparison. In O23 the given arc is major; a student who uses the minor angle must diagnose that mismatch rather than receive a guessed correction.

Core task

Measurements from three circles give radius-arc pairs $(3, 2\pi)$, $(6, 4\pi)$, and $(9, 6\pi)$, with all lengths in centimeters. Determine whether they can come from one fixed central angle. Find that angle in radians and degrees, predict the arc for radius 10, and explain the slope if arc length is graphed against radius.

Teacher solution and discussion

Each ratio s/r equals $2\pi/3$, so the measurements can represent one fixed angle, $2\pi/3$ radians = 120 degrees. For radius 10, the predicted arc is $s = 10(2\pi/3) = 20\pi/3$ cm. A graph of arc length vertically against radius horizontally follows $s = (2\pi/3)r$ for $r > 0$; its slope is $2\pi/3$, the radian measure. The proportional line extends to the origin, although radius zero is a degenerate limiting case rather than one of the circles.

Evidence and response

Compare all three exact ratios, perform the degree conversion, give the new arc and interpret the slope and positive-radius domain. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M19 to compare all alternatives after evidence is collected.

SMALL-GROUP RETEACH

Teaching script

Core: O24 • T1: Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

Optional bank: M24–M27; O24–O27. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–15 minutes. Adjust for access and evidence; this is not a speed criterion.

Select O24 for additive-versus-multiplicative scaling, O25 for confusing equal arc with equal area, O26 for overlapping sweep area, or O27 for omitting radial boundaries. Preserve the first response. Rebuild only the missing representation: a ratio, two separately drawn sectors, a full-turn plus quarter-turn diagram described in words, or a labeled three-part boundary. Remove that support and ask for a new explanation using the related MC item; do not credit a formula copied without its conditions.

Core task

A fixed-angle table contains radius values 2, 5 and 8 cm and arc lengths 3, 7.5 and 12 cm. A student predicts radius 10 will have arc length 14 because the last radius increased by 2. Diagnose the strategy, find the correct prediction, and use similarity to explain the constant of proportionality.

Teacher solution and discussion

The student adds the radius change directly to the arc, assuming slope 1 without evidence. Every listed ratio is $s/r=3/2$ radians: $3/2=7.5/5=12/8$. Therefore $s=(3/2)r$ and at $r=10$ the arc is 15 cm, not 14. A dilation from radius 2 to radius 10 has factor 5, so the corresponding arc scales from 3 to 15. The factor $3/2$ is the fixed central angle in radians.

Evidence and response

Identify the unjustified additive rule, confirm all ratios, compute 15 and connect the proportional constant and a dilation to the fixed angle. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M24 to compare all alternatives after evidence is collected.

EXIT TICKET

Teaching script

Core: O28 • T1: Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

Optional bank: M28–M30; O28–O30. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 5–8 minutes. Adjust for access and evidence; this is not a speed criterion.

In O28 require the slope to be interpreted as an angle and address why $r=0$ is excluded geometrically. O29 deliberately has two valid designs: collect both algebraic roots and both feasibility checks before revealing the key. O30 must show the intended major arc and reconcile angle, arc and area totals. Ask why adding the two sector perimeters does not yield the circumference. Use the actual missing check, not merely the selected option, to decide the next lesson.

Core task

A family of sectors has arc length $s=(7/4)r$ for every positive radius r . Explain geometrically what $7/4$ represents. Derive the family's area as a function of radius, predict the effect of multiplying radius by 5, and say whether a zero-radius point belongs to the original geometric family.

Teacher solution and discussion

The invariant ratio $s/r=7/4$ is the shared central angle in radians. It lies between 0 and 2π , so each positive-radius sector is valid. $A=(1/2)r^2(7/4)=7r^2/8$. Multiplying radius by 5 multiplies arc length by 5 and area by 25. The algebraic relations extend to $r=0$, but the original family requires positive radius; a zero-radius point is degenerate and does not have an angle defined by s/r .

Evidence and response

Interpret the proportional coefficient as an angle, derive the area relation, distinguish length and area scaling and address the excluded zero-radius case without dividing by zero. Ask the learner to point to the calculation or representation supporting the claim. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M28 to compare all alternatives after evidence is collected.

MULTIPLE-CHOICE BANK

M01 / M02 • Select and justify**M01 | Warm-up | T2**

A central angle cuts off an arc of length 9 cm in a circle of radius 6 cm.

What is the radian measure of this angle?

- A. $\frac{3}{2}$ radians.
- B. 3 radians.
- C. $\frac{2}{3}$ radians.
- D. 54 radians.

Reasoning: _____

M02 | Warm-up | T1

Two sectors have the same central angle. Their radii are 4 cm and 10 cm.

The smaller sector has arc length 6 cm. What is the larger arc length?

- A. 37.5 cm.
- B. 15 cm.
- C. 2.4 cm.
- D. 12 cm.

Reasoning: _____

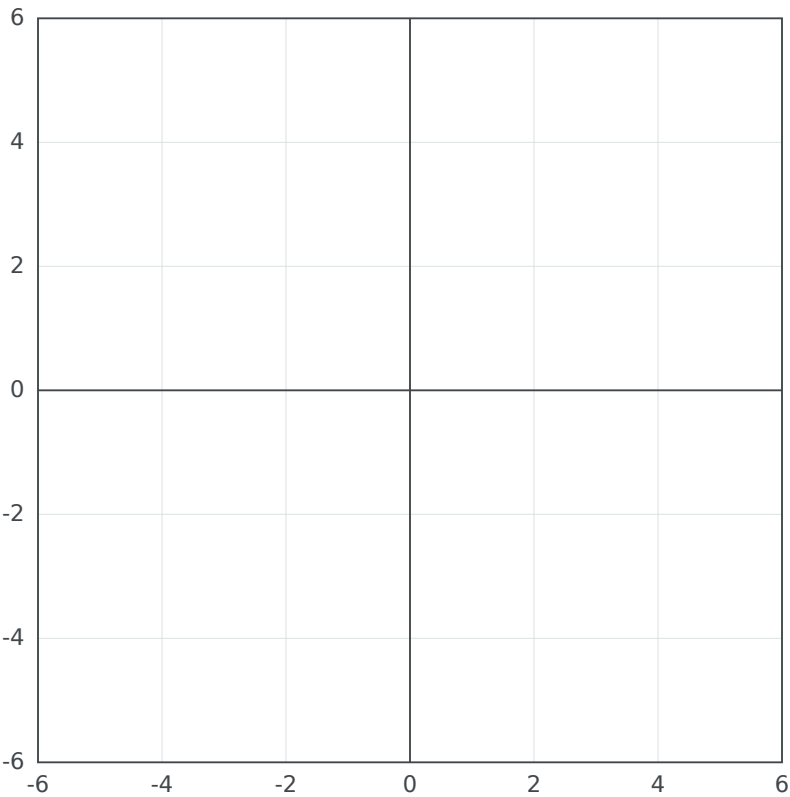
WARM-UP

001 • Show your reasoning

T2: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

Draw the upper semicircular arc of a radius-4 circle and a horizontal diameter AB joining its endpoints. Mark the central angle in radians. Find both the arc length and the straight-line distance AB. Explain why the two lengths are different even though the endpoints agree.

vertical axis: _____



horizontal axis: _____

Explanation and check

WARM-UP

002 • Show your reasoning

T2: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

A flexible strip of length 14 cm is laid along a circle of radius 5 cm without overlapping itself. Determine the angle it subtends in radians. Decide whether its endpoints determine the minor or major arc represented by the strip, and verify that the strip fits within one revolution.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01

M01 • T2: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

Answer: A. $3/2$ radians.

By definition, $\theta = s/r = 9/6 = 3/2$ radians. The cm units cancel. Since $0 < 3/2 < 2\pi$, this is a valid single non-full sector angle.

Check each alternative

A. Correct. By definition, $\theta = s/r = 9/6 = 3/2$ radians. The cm units cancel. Since $0 < 3/2 < 2\pi$, this is a valid single non-full sector angle.

B. This subtracts the lengths, which does not define an angular measure.

C. This reverses the ratio; radian measure is arc length divided by radius, not radius divided by arc length.

D. This multiplies two lengths; the dimensionless radian ratio is $9/6$.

Evidence to assess

Set up s/r in the given order, cancel the common length unit and simplify the ratio; do not label the result in cm.

WORKED TEACHER KEYS

M02

M02 • T1: Use similarity to justify fixed-angle arc-length proportionality, interpret the invariant s/r and distinguish length and area scale factors.

Answer: B. 15 cm.

A dilation from the common center with scale factor $10/4=5/2$ maps the radius-4 sector to a congruent copy of the radius-10 sector and multiplies arc lengths by $5/2$. The new arc is $6(5/2)=15$ cm; both ratios s/r equal $3/2$.

Check each alternative

- A. This multiplies 6 by the square of the scale factor, appropriate for area rather than arc length.
- B. Correct. A dilation from the common center with scale factor $10/4=5/2$ maps the radius-4 sector to a congruent copy of the radius-10 sector and multiplies arc lengths by $5/2$. The new arc is $6(5/2)=15$ cm; both ratios s/r equal $3/2$.
- C. This uses the inverse scale factor $4/10$ even though the radius increases.
- D. This adds the radius difference $10-4$ to the arc length; a dilation multiplies corresponding lengths.

Evidence to assess

Identify the multiplicative scale factor for equal-angle sectors and check equality of the two s/r ratios.

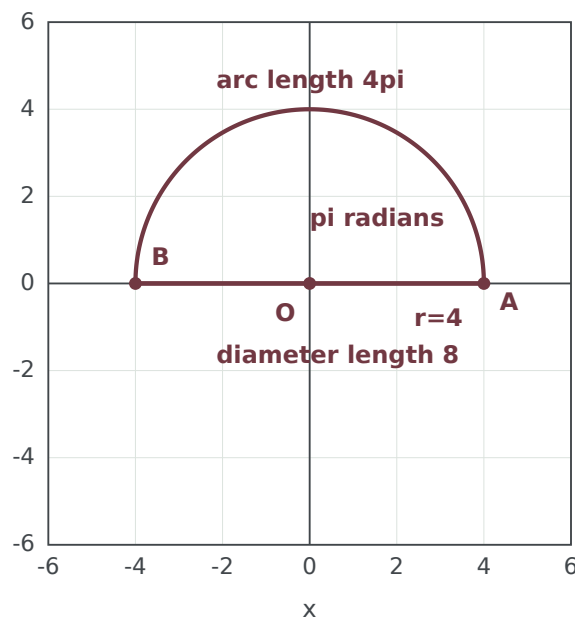
WORKED TEACHER KEYS

001

001 • T2: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

Place $O=(0,0)$, $A=(4,0)$ and $B=(-4,0)$. Draw the upper semicircle and diameter AB ; the central angle is π radians. The arc is $s=r\theta=4\pi$ units and the straight distance is the diameter $AB=8$ units. Since $\pi > 2$, $4\pi > 8$. The chord is a straight path, while the arc follows the circle, so common endpoints do not force equal lengths.

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**Evidence to assess**

Require a completed semicircle and diameter with radius and angle labels, both exact lengths with linear units, and a valid comparison using $\pi > 2$.

WORKED TEACHER KEYS

002

002 • T2: Define radian measure as s/r , use consistent length units, connect radians to degrees and distinguish a single sector from accumulated rotation.

$\theta = s/r = 14/5 = 2.8$ radians. Since $0 < 14/5 < \pi$, the strip follows the minor arc. Its length is less than the circumference 10π cm, equivalently $14/5 < 2\pi$, so it fits without one-turn overlap. It must be laid along the circumference, not straight across the disk.

Evidence to assess

Form the exact ratio, compare it separately with π and 2π , and connect those comparisons to minor-arc classification and one-turn feasibility.