

MATH UNIT

Corners and degrees

Grade 4

8 lessons

8 × 30 minutes

3 source books

240 minutes in all

THE QUESTION THIS UNIT FOLLOWS

A corner either fits the tester or it does not — so what is the number for, and what can you do with it that the tester cannot?

ABOUT THIS UNIT

The unit begins with a benchmark made by hand. A paper circle folded twice gives a right-angle corner, and every angle card in the first lesson is laid against it and sorted into narrower than ninety and wider than ninety, with the card's number said before the number ninety every time. The same tester is then turned on paper the children folded themselves: an edge-to-edge fold and a corner-to-corner fold, every corner of both tested, and the figures sorted by how many right angles each carries. A corner that merely looks square does not count, and the tester is what settles it.

Then the number arrives. Children write the numbers onto a blank circular scale themselves, checking that ninety lands a quarter of the way round and a hundred and eighty exactly opposite zero, and measure with three moves always in the same order: centre, zero, read. When two measures of one diagram disagree by more than five degrees, both scales go onto the diagram at once and the child names which of the three moves slipped before any number is changed. The next lesson joins two right angles point to point, measures the opening, and then asks for the argument with the scale covered — a partner may ask one question, and the answer has to contain a number.

The second half is what numbers let you do. Pattern pieces are laid round a marked dot and the angles touching it are measured and added, so a point is shown to close by its total rather than by how the arrangement looks — and a prepared card that totals three hundred and forty is measured too, with a finger put on where the gap is. Then the arithmetic runs backwards: add what is there, subtract from three hundred and sixty, cut a wedge to the difference, and hold the card up to the light. The unit ends on counting in the wild. A finished paper frog is searched

along its edges and at the places where folded paper meets, every right angle is recorded with a note saying where it was, and two honest counts that differ are settled by testing the disputed spot. The last lesson produces a total the book never prints — four rectangles, four right angles each — and names the sentence that supplied each factor.

THE MATHEMATICAL ARC

Each lesson does one job the lesson before it made possible.

- 1 Fold the benchmark, and sort everything against ninety
- 2 Turn the tester on paper you folded yourself
- 3 Centre, zero, read — in that order, every time
- 4 Two right angles make a straight angle, and you can argue it
- 5 A point closes when its angles add to three hundred and sixty
- 6 Subtract from three hundred and sixty, then cut the piece that closes it
- 7 Count a real figure, and say where you looked
- 8 Produce the total the book leaves out, and name what funded each factor

SOURCE BOOKS

Every lesson in this unit is already published under Math lessons. Nothing here asks you to teach anything you cannot open today.



Sir Cumference and the Great Knight of Angleland

3 lessons in this unit



Origami

3 lessons in this unit



Toads and Tessellations

2 lessons in this unit

HOW TO USE THIS GUIDE

Open the source lesson before you teach.

Each day names one lesson that already exists under Math lessons, with its book, its number and its title. This guide says what that lesson is doing in the sequence and what to collect from it; the lesson itself carries the steps, the printables and the answers.

Thirty minutes a day.

Five minutes to connect to yesterday, the twenty-minute source lesson, five minutes to close on something you can see. A day that runs long should lose the close, never the core.

Teach a lesson on its own if you need to.

Every day carries a one-sentence opening for a teacher who is using that lesson outside the sequence.

Stop after a checkpoint.

The unit holds together if you stop after either checkpoint and come back to it. Stopping between a checkpoint and the next one leaves a lesson without the evidence it was built on.

WHERE THIS FITS IN YOUR YEAR

When to teach it

Early in Grade 4 geometry, before work on triangles and quadrilaterals by angle. It needs no algebra and no multiplication beyond four fours.

What students need first

Children can fold accurately, subtract within a thousand, and read a scale marked in tens.

What this unit develops

A right angle as a testable thing; classifying angles against ninety; counting right angles in a physical figure and saying where they were found; measuring in whole degrees with centre, zero, read; two right angles making a straight angle; the angles at a point summing to three hundred and sixty; subtracting from three hundred and sixty to find a missing angle; producing a total from stated factors and citing the sentence for each.

What it prepares them for

Angle sums in triangles and quadrilaterals, tessellation work where a point has to close, and any later construction where an angle is set to a stated measure.

CURRICULUM CONNECTIONS

None claimed. The lessons in this unit carry their own standards classifications on their own pages, checked lesson by lesson. A unit-level expectation is a different claim, and none has been verified for this unit, so none is printed here. Use the placement guide above to site the unit in your year, and the individual lesson pages for the codes.

UNIT AT A GLANCE

#	MATHEMATICAL MOVE	SOURCE LESSON	COLLECT
1	Fold the benchmark, and sort everything against ninety	Sir Cumference and the Great Knight of Angleland lesson 1, Smaller Than the Right Angle, Larger Than the Right Angle	Every card sorted onto the smaller-than and larger-than mats, with the card's number and then ninety said aloud before each card left a hand, and both mats counted.
2	Turn the tester on paper you folded yourself	Origami lesson 1, Testing paper folds for right angles	Two folds made and both figures entered on the chart with their shape names and their right-angle counts, each count said aloud before it was written.
3	Centre, zero, read — in that order, every time <i>Checkpoint after this lesson</i>	Sir Cumference and the Great Knight of Angleland lesson 2, Make the Medallion, Read the Angle	Four openings measured in whole degrees and recorded, with a pencil laid along any ray too short to reach the edge and no measure written that could not be lined up.
4	Two right angles make a straight angle, and you can argue it	Sir Cumference and the Great Knight of Angleland lesson 5, Double the Right Angle	The traced straight angle measured and all three numbers written as one sentence: ninety and ninety make one hundred eighty.
5	A point closes when its angles add to three hundred and sixty	Toads and Tessellations lesson 1, The Angles That Fill a Point	One built point with every touching angle measured and the total written, and the book's own name for a closed point written beside it.
6	Subtract from three hundred and sixty, then cut the piece that closes it <i>Checkpoint after this lesson</i>	Toads and Tessellations lesson 4, The Angle That Closes the Gap	Five missing angles found by subtraction, and one paper wedge cut to one of those measures and measured before it was placed.

#	MATHEMATICAL MOVE	SOURCE LESSON	COLLECT
7	Count a real figure, and say where you looked	Origami lesson 3, Counting the frog's right angles and saying where	A recording sheet with a note beside every right angle found, and a total written last.
8	Produce the total the book leaves out, and name what funded each factor	Origami lesson 5, The number the tower never prints	Four counters on each rectangle, the total reached without counting singly, the multiplication written beside it, and the sentence that gave each factor said aloud.

UNIT VOCABULARY

Words students say, not words they are taught to define.

right angle	The corner the tester fits exactly, with no gap and no overlap. Its measure is ninety degrees.
degree	The unit an angle is measured in. Lesson 3 is where the tester gets replaced by a number.
straight angle	Two right angles joined point to point. One hundred and eighty degrees, and lesson 4 argues it without measuring.
vertex	The point where two rays meet, and where the centre of the scale goes.
closed point	A point whose angles add to three hundred and sixty degrees. Lesson 5's test, and lesson 6 cuts the piece that closes one.
gap	What is left of a point when the angles round it fall short. It has a measure, and that measure can be cut.

MATERIALS

From the source lessons

Each day's materials are listed on that day's page below and on the source lesson itself. Nothing is duplicated here.

New for this unit

- Checkpoint 1 page, one per child

- Checkpoint 2 page, one per child
- Performance task set: a numbered circular scale, a folded paper right-angle tester, a prepared point card whose angles fall short of three hundred and sixty, paper and scissors, a finished folded figure, a recording sheet with a column for the measure and a column for where it was found, and a pencil, one set per pair
- Performance task page, one per child

ASSESSMENT PLAN

Daily evidence

Keep the recording sheet from lesson 7, the one with a note beside every right angle saying where it was found. It is the only page in the unit where a number has to come with an account of how it was reached, and two children with different totals and good notes are further on than two with the same total and none.

Checkpoint 1, after lesson 3: Measure it, and say what you did

Three drawn angles of about 40, 95 and 180 degrees, a numbered scale and a folded tester. The child measures each in degrees, says which side of ninety it falls, and names the three moves in order.

Book-free. Three drawn angles, a scale and a tester, no book.

Look for. The centre on the vertex and zero along one ray before any reading is taken. A measure that is out by ten or more is nearly always the centre slipping, and the child should be able to say which move went wrong.

Checkpoint 2, after lesson 6: Will this point close?

A card with three angles meeting at a dot, measuring 120, 90 and 60 degrees, and paper and scissors. The child measures, totals, says whether the point closes, and finds and cuts the angle that would.

Book-free. A prepared point card, a scale, paper and scissors, no book.

Look for. The subtraction from three hundred and sixty, and a wedge cut to ninety and then measured before it is laid in. A child who eyeballs the wedge has done the geometry and skipped the check.

Culminating task: One point closed, one figure counted, both with the working shown

Each pair does two jobs. First they take a prepared point card whose angles fall short, measure every angle touching the dot, total them, subtract the total from three hundred and sixty, cut a wedge to that measure, measure the wedge before placing it, and hold the closed card to the light. Second they take a finished folded figure and count its right angles with a tester, recording beside each one where it was found, searching the outside edges and the places where folded paper meets, and naming one place they tested and rejected. They then compare totals with another pair and settle any disagreement by testing the disputed spot rather than recounting.

Collect. The point card with the measures, the total, the subtraction and the fitted wedge; the recording sheet with a note beside every right angle; the rejected place named; and a record of how the disagreement with the other pair was settled.

What it assesses. A missing angle produced by arithmetic and checked physically, and a count of a real figure that comes with the account of where the things counted were — the two things a number does for a corner that a tester cannot.

DAILY LESSON PAGES

Lesson 1 Fold the benchmark, and sort everything against ninety**SKILL LESSON** Sir Cumference and the Great Knight of Angleland (/math-library/77.html) · lesson 1,

Smaller Than the Right Angle, Larger Than the Right Angle · Grade 4 · 20 minutes

Classifying angles as smaller than, equal to, or larger than a right angle

I CAN

I can test an angle against a right angle I folded and say which side of ninety it falls.

BIG IDEA

A right angle is not a matter of opinion. It is a corner a folded tester either fits or does not, and ninety degrees is its number.

SUCCESS

The child folds a right-angle corner, tests every angle card against it, sorts them onto the two mats saying the card's number and then ninety, and states the sorting rule in a sentence containing ninety.

CONNECT | 5 MIN

First lesson. Hold up two angle cards, one at 85 and one at 95 degrees, and ask which is the right angle. Take the votes, then fold the tester.

TAUGHT ON ITS OWN

The story hands over four exact measures and one benchmark: a hallway that measured only 55, one that measured 120, the smallest tunnel angle at 40, and the right angle at 90 that a character keeps testing everything against.

SOURCE CORE | 20 MIN

Children fold a paper circle in half and in half again so the corner where the creases meet is a right angle, press it into a table corner and a book corner to feel where it fits exactly, then lay it into each angle card with one folded edge on one edge of the card and the points touching, and say whether the card opens narrower, the same, or wider.

COLLECT

Every card sorted onto the smaller-than and larger-than mats, with the card's number and then ninety said aloud before each card left a hand, and both mats counted.

CLOSE | 5 MIN

Children state the one rule that sorted every card with the number ninety in the sentence, write it on the strip, circle the two words that decide the mat, and read it to another pair — fixing it if one of their cards breaks it.

From the source lesson: Paper circles, one per student; Angle cards labeled 40, 55, 90 and 120 degrees, one set per pair; Two sorting mats, one labeled SMALLER THAN A RIGHT ANGLE and one labeled LARGER THAN A RIGHT ANGLE, one set per pair; Recording strips, one per student; Pencils; Word cards: degrees, right angle

Watch for: A tester laid on the card rather than into it. The points have to touch and one edge has to lie along one edge, or every card looks wider.

Lesson 2 Turn the tester on paper you folded yourself

SKILL LESSON **Origami** (/math-library/450.html) · lesson 1, Testing paper folds for right angles ·

Grade 4 · 20 minutes

Identifying right angles and classifying figures by them

I CAN	I can test every corner of a figure I folded and say how many right angles it has.
BIG IDEA	A figure can be described by counting its right angles, and the count comes from testing every corner — including the one that looks least likely.
SUCCESS	The child folds both ways, tests all the corners of each figure, records both counts, and says which corner of the triangle is the right angle and where it sits relative to the fold line.
CONNECT 5 MIN	Yesterday the tester sorted cards somebody else drew. Today it goes on paper you fold, where nobody has told you what the answer should be.
TAUGHT ON ITS OWN	The book defines a right angle by its measure and then hands over a figure that is nothing but folded paper.
SOURCE CORE 20 MIN	Children fold a scrap twice to build their own tester and keep only the desk and book corners it fits exactly, fold one square in half edge to edge and test all four corners of the shape in their hand, then fold a fresh square corner to corner and test all three corners of the triangle, checking the corner opposite the fold line last.
COLLECT	Two folds made and both figures entered on the chart with their shape names and their right-angle counts, each count said aloud before it was written.
CLOSE 5 MIN	Children put the rectangle, the right triangle and the untouched square side by side, test the untouched square and add it to the chart, then sort all three from most right angles to fewest and say which two tie and how the tester proved it.

From the source lesson: Square origami paper, six inches by six inches, several sheets per student; A paper right-angle tester made by folding a scrap twice, one per student; Class chart headed Fold, Shape Formed, Right Angles; Sentence strips of the book's two shape rules, cut apart; Word cards: angle, right angle, rectangle, right triangle

Watch for: A corner tested twice because the paper moved. Keep it flat on the desk and work round in one direction.

Lesson 3 Centre, zero, read — in that order, every time

SKILL LESSON **Sir Cumference and the Great Knight of Angleland** (/math-library/77.html) · lesson

2, Make the Medallion, Read the Angle · Grade 4 · 20 minutes

Measuring an angle in whole degrees with a circular scale

I CAN

I can measure an angle in whole degrees and say which move went wrong when two measures disagree.

BIG IDEA

Measuring is a procedure with three moves in a fixed order. A wrong measure is almost always one of the three slipping, and naming which one is how it gets fixed.

SUCCESS

The child numbers the scale so that ninety lands a quarter of the way round and one hundred eighty opposite zero, measures four openings, and where a partner's number differs by more than five degrees names the move that slipped before changing anything.

CONNECT | 5 MIN

The tester has answered every question so far with yes or no. Ask how much wider than ninety the 120 card is, and let the class find that the tester cannot say.

TAUGHT ON ITS OWN

A character carries a circle with numbers around its edge and uses it exactly the way a protractor is used: centre on the vertex, zero on one ray, read where the second ray crosses.

SOURCE CORE | 20 MIN

Children write zero on the tick at the right edge of a blank circular scale and number their way round in tens, checking with a partner that ninety landed a quarter of the way round and one hundred eighty exactly opposite zero, then set the centre on the vertex, turn the scale until zero lies along the lower ray, and follow the other ray to the edge — saying centre, zero, read while their hands do it.

COLLECT

Four openings measured in whole degrees and recorded, with a pencil laid along any ray too short to reach the edge and no measure written that could not be lined up.

CLOSE | 5 MIN

Children trade strips and remeasure a partner's four diagrams; wherever two numbers differ by more than five degrees both scales go on that diagram at once and the child says whether the centre slipped or zero slipped before either number is changed.

From the source lesson: Paper circle medallions printed with tick marks every ten degrees and no numbers, one per student; Pencils; Junction cards showing two rays meeting at a marked center, one set per pair; Hallway diagrams drawn at 40, 55, 120 and 180 degrees, one set per pair; Recording strips, one per student; Word cards: center, degrees

Watch for: A number written from a reading that could not be lined up. Say it out loud as a rule: no line-up, no measure.

Checkpoint after this lesson: Measure it, and say what you did. The page is at the end of this guide.

Lesson 4 Two right angles make a straight angle, and you can argue it

SKILL LESSON **Sir Cumference and the Great Knight of Angleland** (</math-library/77.html>) · lesson

5, Double the Right Angle · Grade 4 · 20 minutes

Joining two right angles to make a straight angle

I CAN	I can join two right angles, measure what I made, and say why it has to be one hundred eighty degrees.
BIG IDEA	Angles add. Two ninety-degree corners joined at a point make one hundred and eighty degrees, and that can be argued from the corners themselves once the number is known.
SUCCESS	The child joins two right angles point to point, traces and measures the opening, then argues the result with the scale covered and answers a partner's question with a number in the answer.
CONNECT 5 MIN	Two lessons have measured single angles. Put two right-angle corners together on the desk and ask what has been made, before anybody measures it.
TAUGHT ON ITS OWN	A character calls out one instruction in the riding ring — double the right angle to make a straight angle — and the book closes by giving both numbers, ninety and one hundred eighty.
SOURCE CORE 20 MIN	Children set two right-angle corners so their points touch at one dot with one straight edge of each lying along the other, trace right around the outside opening, then measure it with the centre of the scale on the dot and write that measure above the two they started with.
COLLECT	The traced straight angle measured and all three numbers written as one sentence: ninety and ninety make one hundred eighty.
CLOSE 5 MIN	With the scale covered, children say why two right angles joined this way have to make a straight angle using only the corners in their hands, answer one question from a partner with a number in the answer, then fold the traced angle in half along the dot and measure one half to test whether every half of a straight angle is a right angle.

From the source lesson: Right angle corner cutouts, two per student; Plain paper, one sheet per student; Pencils; Paper circle medallions printed with a scale numbered to 360, one per student; Word cards: double, half

Watch for: An argument that is a restatement — because it is one hundred eighty. Ask what the two corners are worth, and wait for the addition.

Lesson 5**A point closes when its angles add to three hundred and sixty****SKILL LESSON****Toads and Tessellations** (</math-library/119.html>) · lesson 1, The Angles That Fill a

Point · Grade 4 · 20 minutes

Measuring the angles that meet at one point and testing whether they sum to 360 degrees

I CAN

I can measure the angles that meet at a point, add them, and say whether the point closes.

BIG IDEA

Whether a point closes is decided by a total, not by how the arrangement looks. Three hundred and sixty degrees is what all the way round comes to.

SUCCESS

The child measures every angle touching the dot, adds the measures, says what the total came to, and locates the gap on a prepared arrangement that falls short.

CONNECT | 5 MIN

Yesterday two angles were added to make a straight angle. Ask what would happen if pieces were laid all the way round a point, and mark a dot.

TAUGHT ON ITS OWN

A character states the rule in one sentence and the book then has the others use it: the internal angles of every shape meeting at a point add up to three hundred and sixty degrees.

SOURCE CORE | 20 MIN

Children measure every corner of a paper triangle and a paper rectangle and write each measure on the piece, checking the rectangle's four corners against each other, then mark a dot and lay pieces round it so their corners meet with no overlap, measure every angle touching the dot and add the measures.

COLLECT

One built point with every touching angle measured and the total written, and the book's own name for a closed point written beside it.

CLOSE | 5 MIN

Children take the prepared arrangement card, measure the angles at its dot and add them, say how far the total is from a closed point, and put a finger on where the gap is.

From the source lesson: A set of paper pattern pieces per pair: four triangles, three rectangles and two trapezoids, all with straight sides; An angle scale marked in whole degrees, per child; A pencil; A plain sheet with one marked dot, per pair; The two sentences about the angles at a point, enlarged; A prepared arrangement card per pair whose angles at the dot sum to 340 degrees; Word cards: internal angle, degrees, perigon, point

Watch for: A total reported without every touching angle measured. Count the pieces at the dot and check there is a measure for each.

Lesson 6

Subtract from three hundred and sixty, then cut the piece that closes it

SKILL LESSON

Toads and Tessellations (/math-library/119.html) · lesson 4, The Angle That Closes the Gap · Grade 4 · 20 minutes

Subtracting a sum of angles from 360 to find the angle that closes a point

I CAN	I can find the missing angle at a point and cut a piece to that measure.
BIG IDEA	The missing angle is arithmetic: add what is there, take it from three hundred and sixty, and the difference is the measure of the piece still needed. The light behind the card is the check.
SUCCESS	The child totals and subtracts for five prepared points, cuts a wedge to one of the differences, measures the wedge before placing it, and holds the card to the light.
CONNECT 5 MIN	Yesterday a point came out forty degrees short and somebody put a finger on the gap. Today the gap gets a number and then gets cut.
TAUGHT ON ITS OWN	Once a closed point measures three hundred and sixty degrees, the arithmetic follows: add what is there, subtract from three hundred and sixty, and the difference is the piece still needed.
SOURCE CORE 20 MIN	Children measure the angles at each of five prepared points and write all five totals before subtracting anything, then write three hundred and sixty at the head of the second column, subtract each total, and say what the number in the third column is the measure of.
COLLECT	Five missing angles found by subtraction, and one paper wedge cut to one of those measures and measured before it was placed.
CLOSE 5 MIN	Children lay the wedge into the gap and hold the card up to the light; if light shows they measure the wedge and the gap again and say which of the two was wrong.

From the source lesson: Five prepared point cards per pair, with gaps of 30, 45, 60, 90 and 120 degrees; An angle scale marked in whole degrees, per child; A five-row recording sheet ruled for three columns, per pair; A pencil; Paper and scissors per pair; A window or lamp to hold cards against; Word

cards: difference, degrees, gap

Watch for: A wedge cut by eye to fill the gap. Insist the difference is computed and the wedge measured first; the fit is the test, not the method.

Checkpoint after this lesson: Will this point close?. The page is at the end of this guide.

Lesson 7 Count a real figure, and say where you looked

SKILL LESSON **Origami** (</math-library/450.html>) · lesson 3, Counting the frog's right angles and saying where · Grade 4 · 20 minutes

Counting right angles in a figure and justifying where they were found

I CAN

I can count the right angles on a folded figure and record where I found each one.

BIG IDEA

A count of a physical figure is only as good as the account of where the things counted were. Two honest counts differ because they searched different places, and that is settled by testing a spot rather than recounting.

SUCCESS

The child searches the outside edges and the places where folded paper meets, writes a note beside every right angle saying where it was, and settles a disagreement by testing the disputed spot.

CONNECT | 5 MIN

The tester has been used on cards, on folds and on a scale. Hand out the finished frogs and ask how many right angles are on one.

TAUGHT ON ITS OWN

The book asks how many right angles a half-built frog shows, answers ten, and then tells the reader to count again on the finished frog — warning them to include the edges as well as the places where folded paper meets.

SOURCE CORE | 20 MIN

Children write the book's own count at the top of the sheet labelled as the book's, then test the finished frog recording every right angle with a short note saying where it was, working round the outside edges first and then the places where folded paper meets, and writing the total only once every line is filled.

COLLECT

A recording sheet with a note beside every right angle found, and a total written last.

CLOSE | 5 MIN

Children trade sheets with a partner whose total differs, find the first row where the sheets disagree, put the frog between them with a finger on the spot, decide together whether the tester fits there, and

say which of them had searched a place the other had not.

From the source lesson: Recording sheet with a column for a count and a column for where it was found; A finished origami frog per pair; A paper right-angle tester made by folding a scrap twice, one per student; Word cards: count, edge, because

Watch for: A total written first and the notes filled in to match. Ask for the sheet before the number.

Lesson 8

Produce the total the book leaves out, and name what funded each factor

MATH THROUGH THE READING

Origami (/math-library/450.html) · lesson 5, The number the tower never prints · Grade 4 · 20 minutes

Students establish from three sentences how many rectangles a tower section has and how many right angles each carries, then produce the total the book leaves out and say which sentence gave them each factor.

I CAN

I can find a total from two facts the text gives and say which sentence gave me each one.

BIG IDEA

A book can say enough without saying everything. Two stated facts — how many rectangles and how many right angles each carries — are enough for a total, and each factor has a sentence behind it.

SUCCESS

The child folds and verifies the four rectangles, reaches the total by multiplying rather than counting singly, and names the sentence that supplied each factor before writing the product.

CONNECT | 5 MIN

Yesterday a count had to be searched for. Today the count is not in the book at all, but two of its sentences are enough to produce it.

TAUGHT ON ITS OWN

Three sentences about a tower section say how many pieces it takes, how many become rectangles and how many become triangles, and the total number of right angles is never printed.

SOURCE CORE | 20 MIN

Children underline every number in the three sentences and write how many pieces a section takes, how many become rectangles and how many become triangles, then fold four squares in half and test one rectangle's corners with the tester, checking the count of four against the book's sentence before continuing.

COLLECT

Four counters on each rectangle, the total reached without counting singly, the multiplication written beside it, and the sentence that gave each factor said aloud.

CLOSE | 5 MIN

Pairs state in one sentence why the book could leave the total out and still have said enough, pointing at the two sentences as they speak.

From the source lesson: Square origami paper, six inches by six inches, four sheets per pair; A paper right-angle tester made by folding a scrap twice, one per student; Counters or unit cubes, sixteen per pair; Recording sheet with a column for a count and a column for where it was found; The three constraining sentences of the tower section shown together; A finished tower section built ahead of time by the teacher

Watch for: Sixteen counters counted one at a time. The lesson is the multiplication; ask for the two factors and where each came from.

CULMINATING PERFORMANCE TASK

One point closed, one figure counted, both with the working shown

Each pair does two jobs. First they take a prepared point card whose angles fall short, measure every angle touching the dot, total them, subtract the total from three hundred and sixty, cut a wedge to that measure, measure the wedge before placing it, and hold the closed card to the light. Second they take a finished folded figure and count its right angles with a tester, recording beside each one where it was found, searching the outside edges and the places where folded paper meets, and naming one place they tested and rejected. They then compare totals with another pair and settle any disagreement by testing the disputed spot rather than recounting.

Collect. The point card with the measures, the total, the subtraction and the fitted wedge; the recording sheet with a note beside every right angle; the rejected place named; and a record of how the disagreement with the other pair was settled.

What it assesses. A missing angle produced by arithmetic and checked physically, and a count of a real figure that comes with the account of where the things counted were — the two things a number does for a corner that a tester cannot.

TEACHER KEY AND RUBRIC

Key

- Checkpoint 1: about 40, about 95 and 180 degrees. Anything within five degrees of the drawn measure is a good reading at this age; what matters is the three moves and the comparison with ninety.

- Checkpoint 2: 270 degrees at the dot, so the point is 90 short and does not close. Cut the wedge before saying it fits.
- Task: build the point card yourself at 310 or 320 degrees so the missing angle is not a familiar one — a gap of forty or fifty stops the answer being recognised instead of computed. Count the folded figure yourself first, edges and folds, so you know what an honest range of totals looks like.

Rubric

STRAND	SECURE LOOKS LIKE	DEVELOPING	NOT YET
Representation	The tester is pressed fully into a corner and the scale is set centre on vertex with zero along a ray, so a measure or a count is produced by the instrument rather than by the eye.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Calculation	Angles at a point are added correctly, a missing angle is found by subtracting from three hundred and sixty, and a total of right angles is reached by multiplying stated factors rather than by counting one at a time.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Meaning	Ninety degrees and the tester are treated as the same fact in two forms, and a point is said to close or not on the strength of its total rather than its appearance.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Explanation	A claim about an angle carries its number, a count of a figure carries where each one was found, and a produced total names the sentence that supplied each factor.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.

PRINT-READY STUDENT PAGES

CHECKPOINT 1 · GRADE 4

Measure it, and say what you did

Name

Date

Measure each of these in degrees. Tell me the three moves you make, in order. For each one, is it smaller or larger than a right angle, and by how much?

CHECKPOINT 2 • GRADE 4

Will this point close?

Name

Date

Does this point close? Show me how you know. What angle would close it? Cut one and measure it before you lay it in — then hold it up to the light.

CULMINATING TASK • GRADE 4**One point closed, one figure counted, both with the working shown**

Name _____

Date _____

Measure every angle at this dot and add them up. How far short is the point? Cut the wedge that closes it, measure your wedge, then fit it and hold the card to the light. Now count the right angles on this figure and write down where you found each one, edges and folds both. Name one place you tested that turned out not to be one. Then compare with another pair — if your totals differ, test the spot you disagree about.

TEACHER PLANNING AND HANDOFF

- A tester pressed only part way into a corner passes almost everything. Watch for it in lesson 2 and again in lesson 7, where it inflates the frog count.
- The commonest measuring error is the centre slipping off the vertex, and it is invisible in the answer. Lesson 3's habit — both scales on the diagram, name the move that slipped — is the one to keep.

- Sir Cumference and the Great Knight of Angleland has two lessons this unit could not take: a timed round finding how far each measure sits from ninety, and a labyrinth where each door is chosen by measuring and defended with both numbers. The labyrinth is the better of the two and makes a good extra day.
- Toads and Tessellations goes on to test whether a repeated shape covers a surface with no gap and no overlap, which is where the angles at a point pay off. It is the natural sequel to this unit rather than a part of it.

Known gaps in this unit

- Angles inside a shape. Nothing among the candidates asks for the angles of a triangle or a quadrilateral to be measured and added, so the two famous sums — one hundred and eighty and three hundred and sixty inside a figure — have to come from elsewhere. What is here is the angle at a point, which is a different fact that happens to share a number.
- Drawing an angle to a stated measure. Every lesson measures an angle that already exists or cuts a wedge to a difference; none asks a child to construct, say, a fifty-five degree angle from nothing.

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