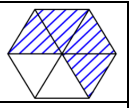
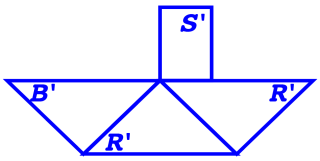
Most recent update: October 28, 2025

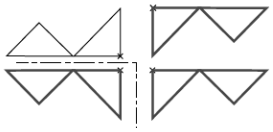
RightStart™ Mathematics

Corrections and Updates for Level G / Grade 6 Lessons and Worksheets, second edition

LESSON/WORKSHEET/SOLUTIONS	CHANGE DATE	CORRECTION OR UPDATE
Objectives	10/24/2023	Objectives were added to the Lesson book. See attached PDF.
Lesson 9	10/09/2018	Hexagram is a special six-point star based on a hexagon.
Worksheet 10-3 Solutions 10-3	10/09/2018	Hexagram's definition is a closed six-point figure.
Worksheet 15	10/10/2018	Measurements for the rectangles are off. See attached PDF.
Worksheet 27-1	11/20/2018	Lengths for the lines to measure for Questions 6-10 are off slightly. See attached PDF.
Worksheet 28	10/28/2025	Measurements of the rectangle and centimeter lines are off slightly. See attached PDF.
Solutions 32	12/17/2019	The second equation for Problem 1B should be $4 \times 4 - 1 = 15$, not $4 \times 4 = 16$. The second equation for Problem 1C should be $5 \times 5 - 1 = 24$, not $5 \times 5 = 25$.
Worksheet 33-2 Solutions 33-2	01/03/2019	Question 14 answer is Worksheet 32, not Worksheet 31. Question 15 has been added. See attached PDF.
Lesson 35	01/03/2019	The wording for the paragraph under Worksheet 35-1 has changed. It now reads, "This worksheet will have you measuring in hundredths. Your ruler only has markings for tenths, so you will be estimating the hundredths measurement. Use your best judgement to make your estimate. Complete the worksheet now."
Worksheet 35-1	11/20/2018	Question 4 gives the wrong width measurement. It should be 2.493, not 2.927. See attached PDF.
Solutions 35-1	01/03/2019	The second calculation in Problem 1 should be $A = 2 \times 1 = 2$ in^2, not $A = 3 \times 1 = 3$ in^2.
Lesson 37	01/03/2019	The list of materials needs to include the Casio Calculator fx-300MS.
Lesson 38	11/19/2018	In the first paragraph and the second to last paragrah, the worksheet referenced should be Worksheet 36, not 34 and 35.
Worksheet 39-1 Solutions 39-1	03/27/2019	Changed some of the matching terms and Questions 10 and 11. See attached PDFs.
Solutions 39-3	01/03/2019	Question 25 measurements should be 38 mm, not 39, and 48 mm, not 49. Area calculates to 1824 mm^2, not 1911 mm^2.
Solutions 39-4	01/03/2019	Question 31-33 measurement should be 74 mm, not 73. Area calculates to 4921 mm^2, not 4854.5 mm^2.
Worksheet 40-1 Solutions 40-1	08/01/2021	In Question 14, the figure is missing the marks indicating the two halves of the base of the triangle are the same. See attached pdf.
Worksheet 40-1 Solutions 40-1	11/07/2022	Question 14, choice "a" has been changed to perpendicular, not line of symmetry. Answer is still circled. See attached pdf.

	Solutions 40-3	11/10/2022	Question 31 should have 4 of the 6 triangles of the hexagon shaded as shown here, not 5 triangles shaded. 
	Solutions 41-3	01/03/2019	Question 32 measurements should be 52 mm, not 53, 33 mm, not 32, and 29 mm, not 28. Perimeter calculates to 230 mm, not 229 mm. Question 34 measurements should be 2.0 in., not 2.1. Perimeter calculates to 7.3 cm, not 7.4 cm.
Lesson 44		11/25/2019	In the second heading, third paragraph should read "Using symbols, the area of the hexagon is twice the area…" not octagon.
	Solutions 44-2	11/25/2019	The last solution, #6, should read "*A* (rectangle)", not *A* (square).
Worksheet 50-2	Solutions 50-2	01/03/2019	An additional question has been added. See attached PDFs.
Worksheet 50-2		05/20/2020	The solutions, rather than the worksheet itself, was included in the worksheets book and document See attached PDF.
Worksheet 53-1		01/03/2019	Changed the second definition listed to "quadrilateral with one and only one set of parallel lines", not "parallelogram with one and only one set of parallel lines. See attached PDF.
	Solutions 53-1	01/03/2019	Problem 10 measurement should be 2.4 in., not 2.5. Perimeter calculates to 6.1 in, not 6.2 in and 15.5 cm, not 15.7 cm.
	Solutions 53-2	01/03/2019	Problem 20 measurement should be 6.8 cm, not 6.9. Area calculates to 39.1 cm^2, not 39.6 cm^2.
Lesson 55		01/03/2019	The game for the day should use a target number of 180.
	Solutions 62	01/22/2019	Question 5 answer should read 3 mm, not 3 cm.
Worksheet 71-1	Solutions 71-1	04/17/2020	In Problem 2, the size of the television has been updated from 18" by 14.4" to 48" by 41.8" to make the measurements more realistic. Calculated height changed from 10.8" to 23.6". Problem 3 final answer should be 13.92, not 13.97, which both round to 14.0.
Worksheet 74-1	Solutions 74-1	04/17/2020	The definitions for Questions 1-8 had multiple errors. Wording as well as order have changed. See PDFs for the Worksheet as well as the Solutions.
Worksheet 75-1	Solutions 75-1	04/17/2020	The definition for trapezoid should be a quadrilateral with one and only one set of parallel lines, not parallelogram.
	Solutions 76-2	02/28/2019	Question 21 answer should read 122º, not 58º.
Worksheet 76-3	Solutions 76-3	04/04/2020	Problem 24 answer "a" should be 9.1, not 10.6 and answer "b" should be 10.6, not 9.1. The two answers were transposed. Question 31 should read "If the area of ΔTLG = 630 km^2, what is the area of ΔNGI? Answer is 1890 km^2. Question 32 should read "If line segments $GN + NA$ = 25 mm, what is line segments $TN + NI$?" Answer is 50 mm. There were a few incorrect and/or illogical variations of this question and answer in some of the printings.
Lesson 80		02/08/2022	The 4-in-1 ruler should be listed as a needed material.
Lesson 83		09/01/2025	The older Safe-T Compass is being replaced by the newer Slide N' Measure Compass. See the instructions for both compasses with the attached PDF.

Lesson 84	Worksheet 84	Solutions 84	08/15/2025	Worksheet has been modified for the new Slide N' Measure Compass. See attached PDFs.
	Worksheet 85	Solutions 85	08/15/2025	Worksheet has been modified for the new Slide N' Measure Compass. See attached PDFs.
	Worksheet 87-1	Solutions 87-1	03/27/2019	Order of the matching terms has been changed. The circles used for Questions 11 and 12 were off and have been corrected. See attached PDF.
Lesson 89	Worksheet 89-1	Solutions 89-1	08/15/2025	Worksheet has been modified for the new Slide N' Measure Compass. See attached PDFs.
	Worksheet 90-2	Solutions 90-2	06/03/2019	Question 9 uses the information from Problem 7, not Problem 6.
	Worksheet 93	Solutions 93	08/15/2025	Worksheet has been modified for the new Slide N' Measure Compass. See attached PDFs.
		Solutions 98-2	03/25/2020	Problem 7 is missing some of the formula (in printings from April 2019 to March 2020). Second line for the area of the small circle should read: A (sm) = π × $.9^2$. Also, r = 1.8 cm is missing.
		Solutions 99	04/17/2020	The perimeter for Problem 5 should be 41.1 m, not m^2.
		Solutions 102	04/04/2020	For Problem 2, the area for the 12" pizzas should be 113.1 in^2, not 113 in^2. The area for the 16" pizza should be 201.1 in^2, not 201 in^2. For Problem 7, the total cost for four 16" pizzas is $59.96, not $59.69.
	Worksheet 103-1	Solutions 103-1	04/10/2019	The third definition should read "formula for the perimeter of a rectange" not "formula for the perimeter of a parallellogram".
	Worksheet 103-2	Solutions 103-2	06/03/2019	The prices Problems 16 have been changed to MN 20 cm = $12.95, MN 25 cm = $13.55, ND 20 cm $12.53, and ND 25 cm $12.95. See attached PDFs.
		Solutions 104-1	04/04/2020	The answer for Question 8 should be 1:2, not 2:1. The answer for Question 9 should be 4:1, not 1:4. The second sentence in the second paragraph of the notes should say "The ratio of mdT to lgT, 1:2, is different than the ratio of lgT to mdT, 2:1."
	Worksheet 112	Solutions 112	04/28/2023	Problem 3c should read "Translate ΔBRG (3.5, 1.5) and rotate –90º about R'." not R". And directions for 3d should read "Translate ΔBRG (8, 3) and rotate 90° about R'." not R'". The solutions for the Problem 3 had mislabels. It should look like this: 
Lesson 113			04/22/2020	The figures in the middle of page were labeled wrong. The left figure is reflected vertically in place, not horizontally. The right figure is reflected horizontally in place, not vertically.
Lesson 120			10/10/2018	Under the Pool table game heading, second paragraph, the second sentence should read, "In the second and third figures, the ball is reflected at 30º, then at 60º."
		Solutions 121-2	06/03/2019	The answer for Question 20 Elipse for maximum number of lines of symmetry is ∞, not 2.

Lesson 122	Worksheet 122-2	Solutions 122-2	05/23/2023	Lessons: Two paragraphs regarding order of rotational symmetry of 1 have been added to the top of page 138. See attached PDF. Worksheets and Solutions: Question 7-10, the last figure's order of rotation symmetry should be 1, not none. The coloring of the figure is correct. See attached PDF for the worksheet.
	Worksheet 123-2	Solutions 123-2	05/23/2023	08/01/21: Question 6 asking about the relationship between point symmetry and the order of rotation is now Question 5. A bonus question has been added. See attached PDF. 05/23/23: Solutions have changes in Order of Rotation Symmetry and Degrees of Rotation columns. See attached PDF.
		Solutions 125-2	06/04/2022	Regarding Question 18, a note has been added: Remember from Worksheet 121-2, an ellipse is considered to have two lines of symmetry; however, in the case when an ellipse is a circle, it has infinitely many lines of symmetry.
	Worksheet 126-3	Solutions 126-3	06/05/2020	Question 42 has been changed from "If area ΔMES = 97 km^2, what is the area of ΔSNI?" to "…what is the area of ΔNDA?" Answer is changed from 194 km^2 to 291 km^2.
		Solutions 126-6	06/03/2019	The answer for Question 67 should be 19 mm, not 21 mm.
		Solutions 126-8	01/22/2019	The graphic for Question 78 has an error in the top right drawing. It should be as shown here. 
		Solutions 126-9	03/22/2020	Question 81 should read "What is the angle of rotation between…" rather tha "What is the angle of reflection between…"
		Solutions 126-10	05/23/2023	Question 92, the last figure of the set, the quadrilateral, should have Order of Rot. Sym. answer of 1 with Degrees of Rotation of 360º, not 0 and 0º.
		Solutions 127-2	06/03/2019	Question 23, identification of a rhombus, should be *ABJF* and *CDEJ*. The polygons *FKLE* and *KBCL* are not rhombuses because the four sides are not equal.
	Worksheet 127-3	Solutions 127-3	06/05/2020	Question 42 has been changed from "If area ΔDIS = 82 cm^2, what is the area of ΔDSM?" to "…what is the area of ΔDMA?" Answer is changed from 164 cm^2 to 492 cm^2.
	Worksheet 127-6	Solutions 127-6	08/15/2025	Worksheet has been modified for the new Slide N' Measure Compass. See attached PDFs.
		Solutions 127-10	05/23/2023	Question 91, the last figure of the set, the quadrilateral, should have Order of Rot. Sym. answer of 1 with Degrees of Rotation of 360º, not 0 and 0º.

RIGHTSTART MATHEMATICS OBJECTIVES FOR LEVEL G

Name _____ Year _____

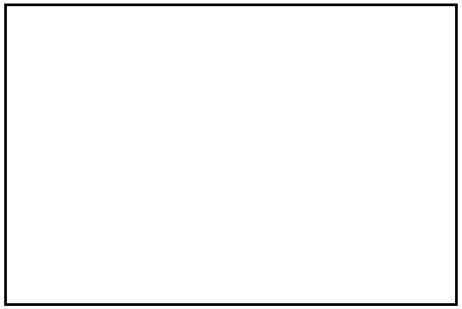
	Trimester 1	Trimester 2	Trimester 3
Numeration			
Solves problems involving whole numbers, fractions, percents, and decimals using the four operations			
Interprets and computes problems with exponents and square roots			
Rounds and compares whole numbers, fractions, and decimals			
Identifies, evaluates and applies advanced patterns, including numerical and frieze patterns			
Solving Equations			
Writes, reads, evaluates, and solves equations with an unknown (sometimes called a variable)			
Applies order of operations to expressions with unknown numbers (sometimes called variables) and exponents			
Applies distributive property	N/A		
Finds and calculates the percent of a part or finds a whole when given a part			
Calculates perimeter and area of triangles, quadrilaterals, and polygons, both regular & irregular			
Problem Solving			
Solves multi-step real-world and mathematical problems involving rational numbers			
Uses reasoning to write and solve real-world problems			
Finds multiple ways to solve problems			
Ratios			
Understands, calculates, and applies ratios to lines, shapes, and related quantities or measurements			
Finds missing values in a table by using ratio reasoning			
Solves unit rate problems involving measurement and pricing	N/A		
Measurement			
Uses appropriate techniques and tools to accurately measure and draw lines and shapes			
Converts between metric and U.S. Customary systems			
Identifies and measures angles of existing shapes and draws shapes with specific angle measurements	N/A		
Understands and applies four properties of angles, i.e., complementary, supplementary, vertical angles, and intersecting parallel lines	N/A		
Coordinate System			
Draws polygons in a coordinate system	N/A	N/A	
Translates, rotates, and reflects shapes in a coordinate system	N/A	N/A	
Uses midpoints to find new coordinates of transformed shapes	N/A	N/A	
Understands and plots positive and negative numbers on a line or grid	N/A	N/A	
Statistics and Probability			
Collects and plots data on a number line or coordinate system			
Evaluates and summarizes data plotted on a number line or coordinate system			
Geometry			
Understands and uses formulas to calculate perimeter and area			
Learns, applies, and develops informal proofs of the Pythagorean theorem	N/A		
Identifies and applies translations, reflections, and rotations	N/A	N/A	
Identifies, understands, constructs lines of symmetry and produces shapes with line symmetry and rotational symmetry			
Identifies and classifies shapes by number of sides, side lengths, and angle measurements			
Demonstrates understanding of four triangle congruence theorems (SSS, SAS, ASA, AAA) by drawing samples of each type	N/A		
Understands and applies pi, π	N/A		
Identifies and calculates the center, radius, diameter, circumference, chords, and area of a circle	N/A		
Experiences the joy and beauty of geometry in daily life			
Study Skills			
Understands and can explain geometric and other mathematical terms			
Explores historic and cultural influences in math			
Develops independent learning skills			
Understands the importance of using available resources for independent learning			

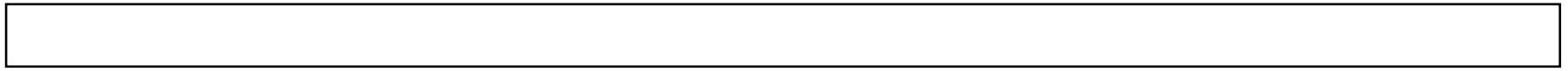
Name: _____

Date: _____

1. All these rectangles have the same area of 24 cm². Use a ruler to find the measurements of the sides.

2. Use a perimeter formula and your calculator to calculate the perimeters in cm. Show your work. Use each of the three formulas at least once.





3. Finding all the possible measurements of the rectangles should have reminded you of finding factors. List all the factors of 24.

_____

4. What pattern do you see in the perimeters as the rectangles become closer to a square?

_____

5. What is a formula for the perimeter of a square ($h = w$)?

_____

Worksheet 15, Scientific Calculator and Perimeter Formula

Name: _____

Date: _____

1–4. Match the following terms with the correct definitions.

Hatching	the number of parts in a fraction
Numerator	shading used by engineers and designers to represent area
Denominator	the number in a fraction naming the size of the part
Unit fraction	fractions with a numerator of 1

5. Create a ruler below dividing it into sixteenths. Using your drawing tools, bisect the horizontal line below. At that point draw a vertical line the height of line *m.* Then bisect the two halves; draw lines the height of line *a.* Continue by bisecting the four fourths; draw lines the height of line *t.* Finally, bisect the eight eighths and draw those lines the height of line *h.*

Write the fraction for each line. Use your drawing tools to determine the length.

6. _____ _____

7. _____ _____

8. _____ _____

9. _____ _____

10. _____ _____

11–12. Using your drawing tools, draw a horizontal line the length indicated by the fraction. Use the ruler above as your guide.

$\frac{5}{8}$ ×

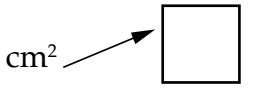
$\frac{5}{16}$ ×

Name: _____

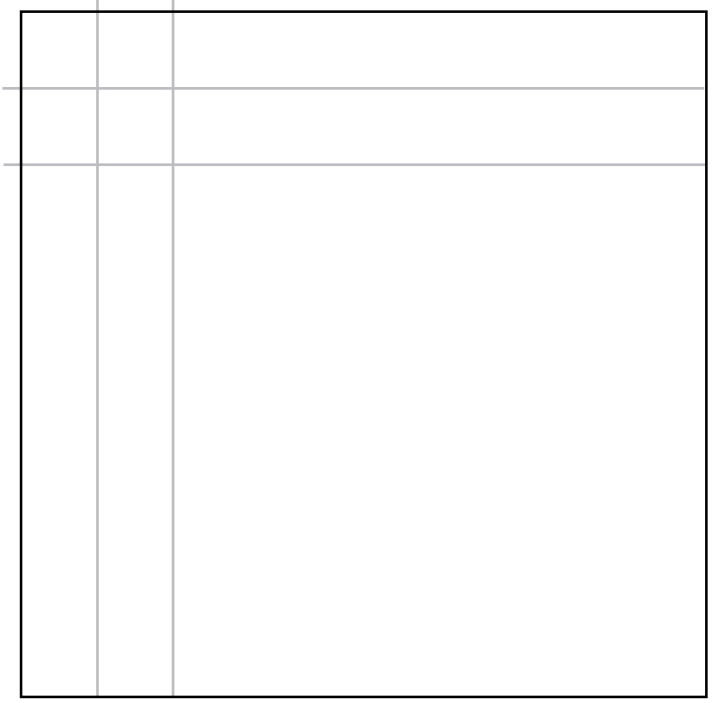
Date: _____

1. Before starting, guess which rectangle has the greater area. _____

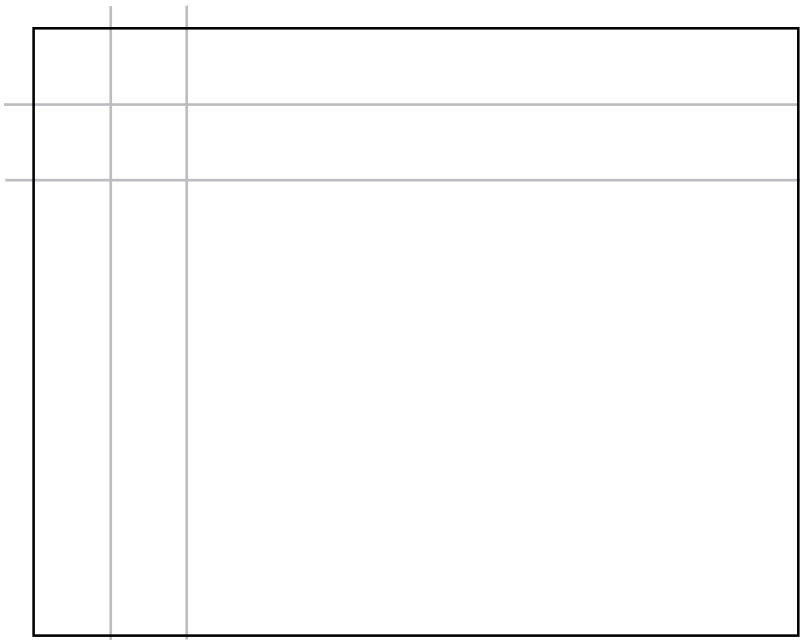
2. Fill the two rectangles below by drawing square centimeters.



A.



B.



3. Which of the two rectangles, A or B, has the greater area? Explain your reasoning below.

_____

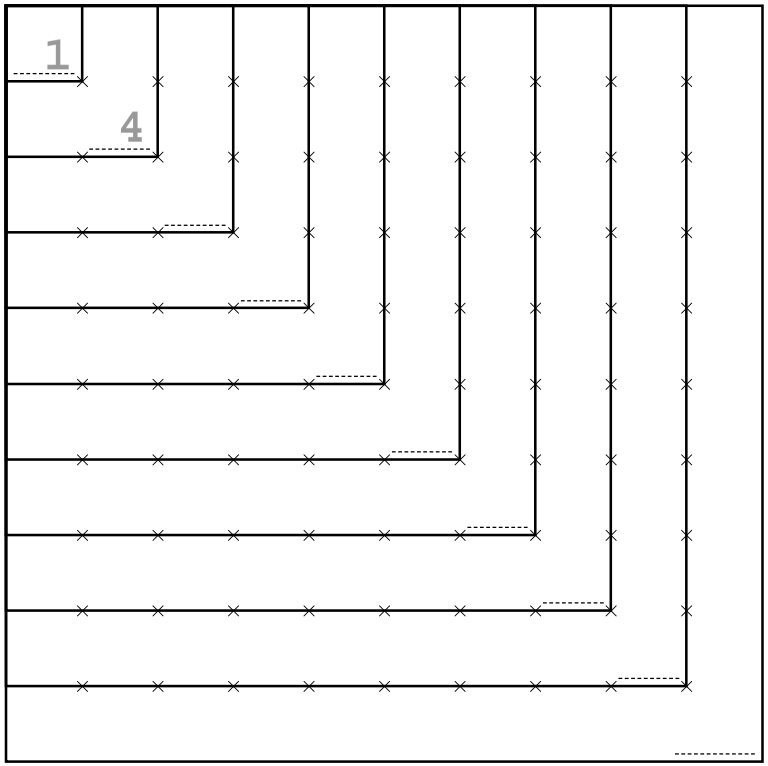
_____

_____

Name: _____

Date: _____

8. Below is a shortened version of the multiplication table. Find the area of each square and write the number on the dotted line.



9. What is special about the numbers? _____

_____

10. Does the results from the previous worksheet apply? _____

11. Find the difference between each two consecutive numbers that you wrote in the multiplication table above.

3, 5, _____

12. Below is another version of the multiplication table. Fill in the shaded squares and circles.

1	2	3	4	5	6	7	8	9	10
2									
3									
4									
5									
6									
7									
8									
9									
10									

13. See the two numbers in circles next to a square. How are they related to the number in the square?

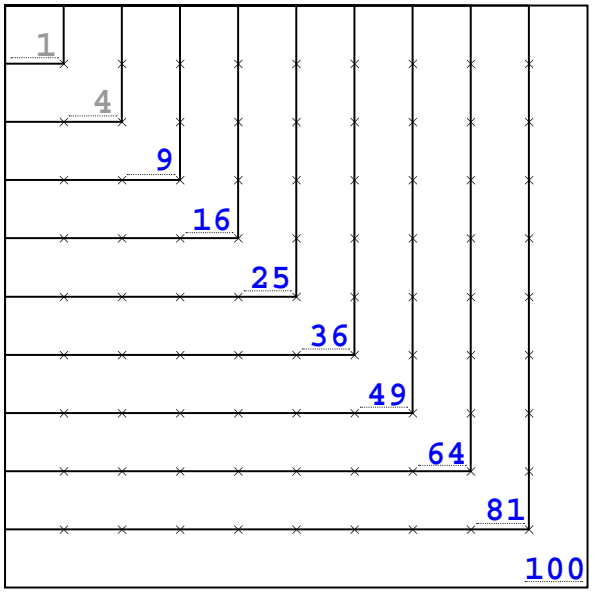
_____

14. On what worksheet did you work with that relationship?

_____

15. What is the formula? _____

8. Below is a shortened version of the multiplication table. Find the area of each square and write the number on the dotted line.



9. What is special about the numbers? They are squares.

10. Does the results from the previous worksheet apply? yes

11. Find the difference between each two consecutive numbers that you wrote in the multiplication table above.

3, 5, 7, 9, 11, 13, 15, 17, 19

12. Below is another version of the multiplication table. Fill in the shaded squares and circles.

	1	2	3	4	5	6	7	8	9	10
2		4		8						
3			9		15					
4		8		16		24				
5			15		25		35			
6				24		36		48		
7					35		49		63	
8						48		64		80
9							63		81	
10								80		100

13. See the two numbers in circles next to a square. How are they related to the number in the square?

Equal & one less than the square.

14. On what worksheet did you work with that relationship?

32

15. What is the formula? $(n+1)\times(n-1) = n^2-1$

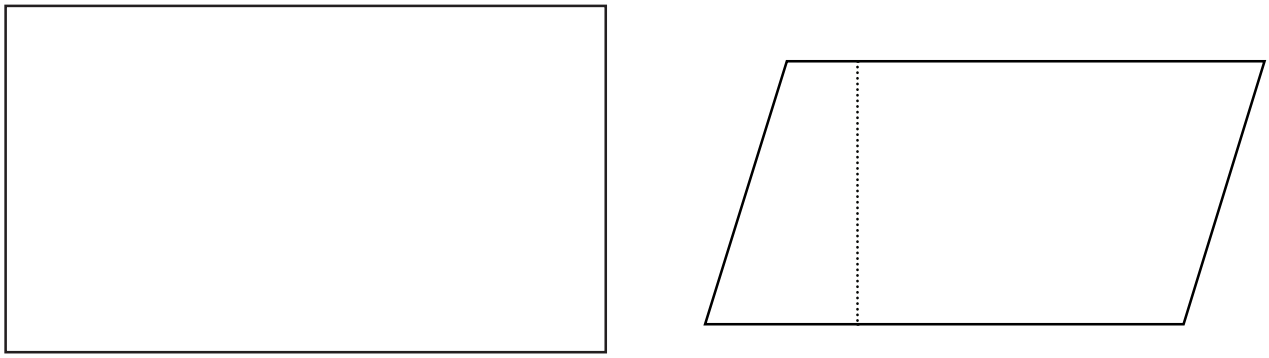
NOTES: Math is all about patterns. Being aware and able to find patterns will greatly help the student in their math education.

DICTIONARY TERMS: consecutive

Name: _____

Date: _____

Use these two quadrilaterals for the next four problems. Pay attention to the precision requested with the measurements.



1. Calculate the area of both quadrilaterals. **Measure to the nearest whole number** using inches.

2. Calculate the area of both quadrilaterals. **Measure to the tenths** using inches. Round the answers to the tenths.

3. Calculate the area of both quadrilaterals. **Measure to the hundredths** using inches. Round the answers to the hundredths.

4. Calculate the area of both quadrilaterals. The rectangle measures 3.139 inches wide and 1.817 inches tall. The parallelogram measures 2.493 inches wide and 1.383 inches tall. Round the answers to the thousandths.

CONTINUE READING THE LESSON.

Name: _____

Date: _____

1–7. Match the following terms with the correct definitions.

Formula	a general principle stated in mathematical symbols
Square inch	the number of units it takes to cover a surface
Altitude	a square measuring one inch by one inch used to measure area
Area	the line measured to give the height of a figure
Square millimeter	a square measuring one centimeter by one centimeter used to measure area
Square centimeter	a square measuring one millimeter by one millimeter used to measure area

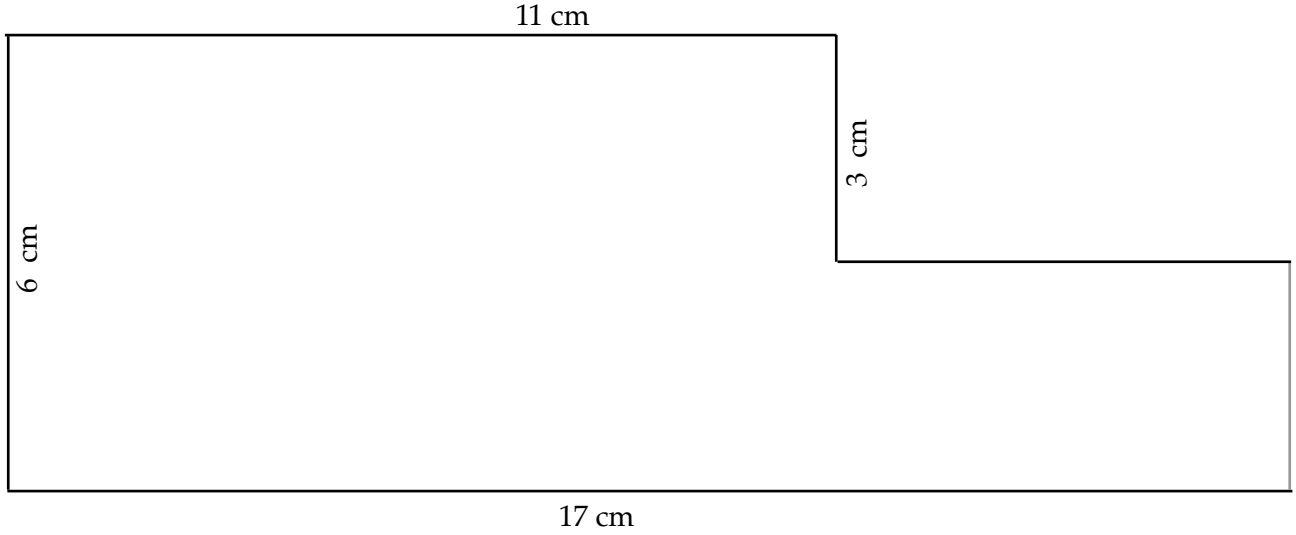
8. What is the symbol for square centimeters? _____

9. What is the symbol for square inches? _____

10. What is the formula for calculating area of a rectangle? _____

11. What is the formula for calculating perimeter of a rectangle? _____

12. What is the area for the shape below? Show your work below.



1-7. Match the following terms with the correct definitions

Formula	a general principle stated in mathematical symbols
Square inch	a square measuring one inch by one inch used to measure area
Altitude	the line measured to give the height of a figure
Area	the number of units it takes to cover a surface
Square millimeter	a square measuring one millimeter by one millimeter used to measure area
Square centimeter	a square measuring one centimeter by one centimeter used to measure area

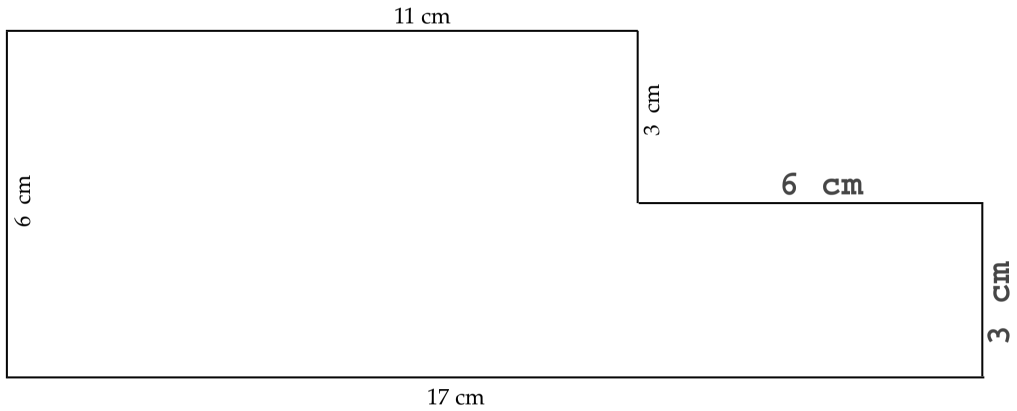
8. What is the symbol for square centimeters? cm^2

9. What is the symbol for square inches? in^2

10. What is the formula for calculating area of a rectangle? $A = w \times h$ or $A = wh$

11. What is the formula for calculating perimeter of a rectangle? $P = 2(w + h)$ or $P = 2w + 2h$ or $P = w + h + w + h$

12. What is the area for the shape below? Show your work below.



$A = 84\ cm^2$

[CALCULATION METHODS WILL VARY.]

NOTES: Problem 12 can be solved a number of different ways. If the shape is divided vertically into two rectangles, one 11 cm by 6 cm and the other 6 cm by 3 cm, the calculation will look like this:

$A = wh$ (left rectangle) + wh (right rectangle)
$A = 11 \times 6 + 6 \times 3$
$A = 66 + 18$
$A = 84\ cm^2$

If the shape is divided horizontally into two rectangles, one 11 cm by 3 ft cm the other 17 cm by 3 cm, the calculation will look like this:

$A = wh$ (upper rectangle) + wh (lower rectangle)
$A = 11 \times 3 + 17 \times 3$
$A = 33 + 51$
$A = 84\ cm^2$

Or, if the shape is made into a whole rectangle, then subtract the added rectangle, the calculation will look like this:

$A = wh$ (whole rectangle) – wh (added rectangle)
$A = 17 \times 6 - 6 \times 3$
$A = 102 - 18$
$A = 84\ cm^2$

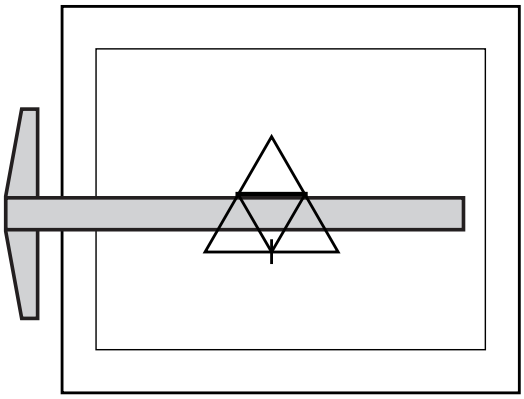
Name: _____

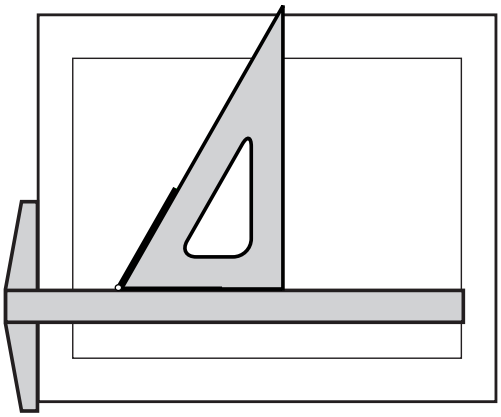
Date: _____

1–11. Match the following terms with the correct definitions

Vertex	the distance around a figure
Midpoint	a point where the lines meet in a polygon
Perimeter	the number of units it takes to cover a surface
Area	middle
Numerator	a closed figure with straight line segments
Parallelogram	the number of parts in a fraction
Polygon	a quadrilateral with two sets of parallel lines
Altitude	the height of a figure
Square inch	the number in a fraction that names the sizes of the parts
Denominator	a square measuring one inch by one inch used to calculate area
Formula	a shortcut for stating a mathematical relationship using math symbols

12–13. What is wrong with these pictures?



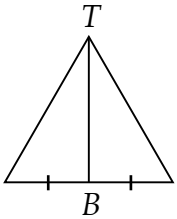


_____ _____

_____ _____

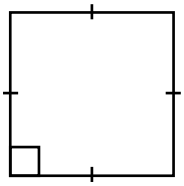
14. Circle all that describe the line *TB*.

a. Perpendicular
b. Horizontal
c. Altitude of triangle
d. Bisects the triangle



15. Circle all that describe the figure.

a. Parallelogram
b. Rectangle
c. Quadrilateral
d. Trapezoid



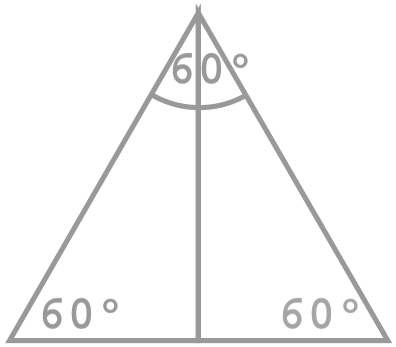
Name: _____

Date: _____

Worksheet 50-2, Measuring Angles

Use the two paper 30-60 triangles and arrange them to make the following figures. Then draw them with your drawing tools below. Make the shortest side of the 30-60 triangles 2.5 cm or 1 inch. For each figure, measure and write the angle of the vertices.

1. Equilateral triangle.



2. Isosceles triangle that is not equilateral.

3. Rectangle.

4–5. Two parallelograms that are neither rectangles nor mirror images of each other.

6. Quadrilateral that is not a parallelogram.

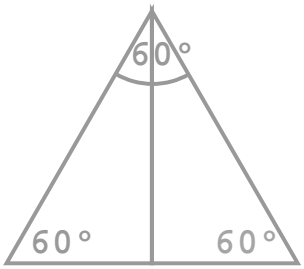
7. Which figure has the greatest area? _____

8. Which figures have the least perimeter? _____

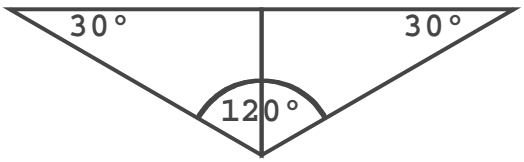
9. Which figures have the greatest perimeter? _____

Use the two paper 30-60 triangles and arrange them to make the following figures. Then draw them with your drawing tools below. Make the shortest side of the 30-60 triangles 2.5 cm or 1 inch. For each figure, measure and write the angle of the vertices.

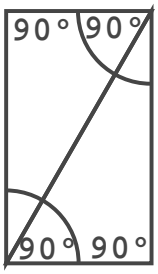
1. Equilateral triangle.



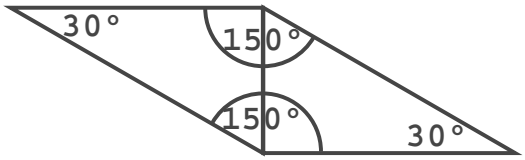
2. Isosceles triangle that is not equilateral.

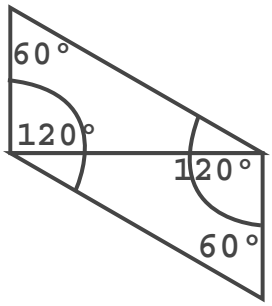


3. Rectangle.

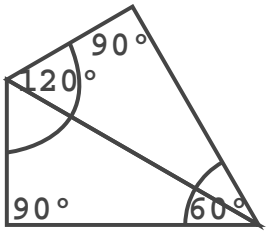


4–5. Two parallelograms that are neither rectangles nor mirror images of each other.





6. Quadrilateral that is not a parallelogram.



[ORIENTATIONS WILL VARY.]

7. Which figure has the greatest area? all the same

8. Which figures have the least perimeter? rectangle, quadrilateral

9. Which figures have the greatest perimeter? isosceles triangle, parallelogram with shortest sides of the triangle touching

NOTES: Some students may struggle creating the figures with their paper triangles. Help them realize that they can flip their triangles over as well as rotate the triangles. Once the figure is discovered with the paper triangles, drawing it is made easier.

Check that the shortest side of each 30-60 triangle drawn is 2.5 cm or 1 inch. One student, Draeke, chose to write "2.5 cm" on his paper triangles to help with the construction of the figures on the worksheet.

DICTIONARY TERMS: goniometer

Name: _____

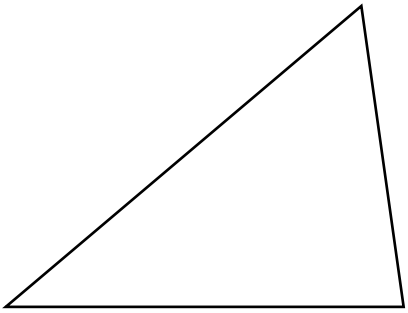
Date: _____

1–8. Match the following words with the correct definitions.

Straightedge	shape with four sides
Octagon	quadrilateral with one and only one set of parallel lines
Trapezoid	eight sided polygon
Quadrilateral	tool for drawing a straight line
Hexagon	polygon with six sides
Distributive Property	quadrilateral with two sets of parallel lines
Parallelogram	two equal sides
Isosceles	when multiplying or dividing some numbers all by the same number, you can add the numbers first and multiply the total

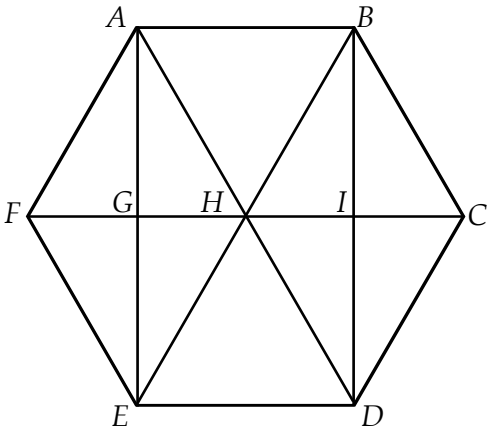
9. How many centimeters are in 1 inch? _____

10. Find the perimeter of the triangle below to the nearest tenth of an inch.



11. Calculate the perimeter of the same triangle in centimeters using the calculator. P = _____

Use letters to identify the following shapes.



12. Two rhombuses: _____

13. Three rectangles: _____

14. Four trapezoids: _____

15. Six equilateral triangles: _____

_____

16. Four isosceles triangles: _____

17. Twelve right triangles: _____

_____

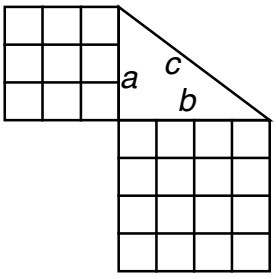
Name: _____

Date: _____

1–8. Match the following terms with the correct definitions

Oblique	the side opposite the right angle of a triangle
Legs	a line that is not parallel or perpendicular
Perfect square	the two sides of a triangle opposite the hypotenuse
Hypotenuse	when the square root of a number is a whole number
Pythagorean theorem	a set of logical reasons for learning if a statement is true
Proof	a number multiplied by itself gives the quantity
Square root	the special relationship between the squares of the sides of a right triangle

9. In the triangle on the right, how many squares



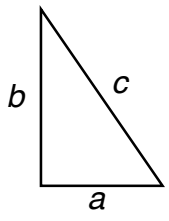
are on side *a*? _____

How many on side *b*? _____

How many on both sides? _____

How many squares will there be on the hypotenuse? _____

10. Draw the squares onto the sides of the triangle on the right using your drawing tools. Measure to the tenths of a cm, then give the answers to the hundredths.



a = _____ a^2 = _____

b = _____ b^2 = _____

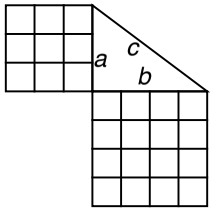
c = 2.884 cm c^2 = _____

11. Does $c^2 = a^2 + b^2$? _____

1–8. Match the following terms with the correct definitions

Oblique	a line that is not parallel or perpendicular
Legs	the two sides of a triangle opposite the hypotenuse
Perfect square	when the square root of a number is a whole number
Hypotenuse	the side opposite the right angle of a triangle
Pythagorean theorem	the special relationship between the squares of the sides of a right triangle
Proof	a set of logical reasons for learning if a statement is true
Square root	a number multiplied by itself gives the quantity

9. In the triangle on the right, how many squares



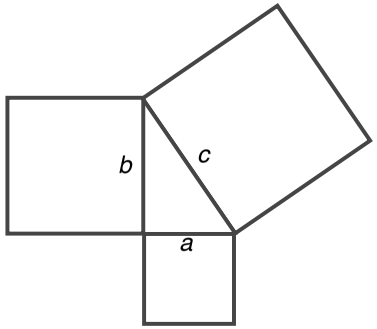
are on side a? 9

How many on side b? 16

How many on both sides? 25

How many squares will there be on the hypotenuse? 25

10. Draw the squares onto the sides of the triangle on the right using your drawing tools. Measure to the tenths of a cm, then give the answers to the hundredths.



a = 1.6 cm a^2 = 2.56 cm^2

b = 2.4 cm b^2 = 5.76 cm^2

c = 2.884 cm c^2 = 8.32 cm^2

11. Does $c^2 = a^2 + b^2$? yes

NOTES: Make sure the student is understanding the difference between the measurements a, b, and c and the square of the numbers, a^2, b^2, and c^2.

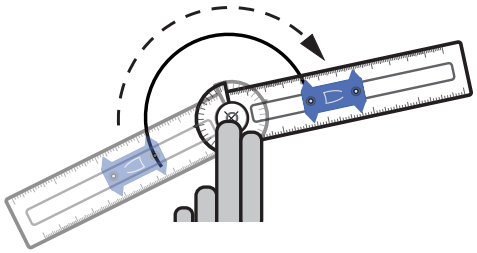
SLIDE N' MEASURE COMPASS

NEW effective August 2025; used in RightStart Mathematics Levels E, F, G, and H

** measures in inches and centimeters **

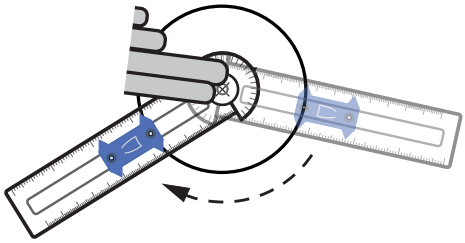
The Slide N' Measure Compass will draw circles with radii from 1.3 to 12 cm and 1/2 inch to 4-11/16 inches.

Align the center of the circle part of the compass with the center mark of your circle and hold it with your non-writing hand. Place the radius arm to the left. See the first figure on the right.



Position the slide to point to the desired radius. Put your pencil in the hole for that radius, then draw the circle in a clockwise direction. If you are left-handed, start the radius arm on the right side and draw the circle counterclockwise.

When your circle is almost complete, raise the heel of your hand, and continue drawing the circle until you have completed it. See the second figure.



To make more accurate circles, keep your pencil perpendicular to the paper. Also, keep light pressure against the outside of the hole while drawing.

A demonstration on using the Slide N' Measure Compass can be found at RightStartMath.com/geometry.

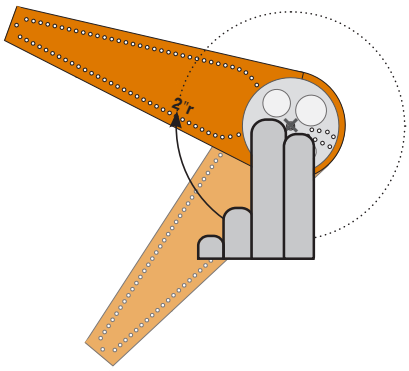
8/25

SAFE-T COMPASS®

used prior to September 2025 in Levels E and F

** measures in inches **

Start by aligning the center of the white rotator over the center of the circle being drawn and hold it with your non-writing hand. Find the hole marked with the desired radius measurement and insert the pencil.



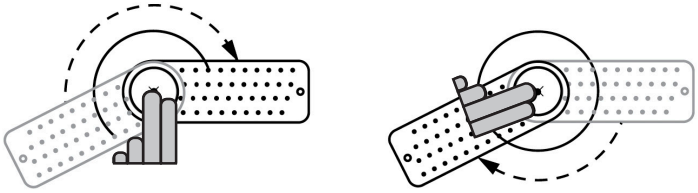
Keep the white rotator still and move the radius arm in an arc to draw the circle.

mmARC COMPASS

used prior to August 2025 in Levels G and H

** measures in millimeters **

Align the center of the movable part of the compass, the rotator, with the center of your circle and hold it with your non-writing hand. Place the radius arm to the left.



Put the pencil in the hole for the desired radius, then draw the circle in a clockwise direction. When the circle is almost complete, raise the heel of the hand. See the second figure above.

If you are left-handed, start on the right side and draw the circle counterclockwise.

To make more accurate circles, keep your pencil perpendicular to the paper. Also, press against the outside of the hole while drawing.

A demonstration on using this compass can be found at RightStartMath.com/geometry.

Lesson 84: Rounding Edges with Tangents

OBJECTIVES:

1. To learn the term *tangent arc*
2. To learn to construct rounded corners using tangents
3. To draw rounded corners for traffic signs

MATERIALS:

1. Math Dictionary
2. Worksheet 84, Rounding Edges With Tangents
3. Drawing board, T-square, and 45 triangle
4. 4-in-1 ruler and Slide N' Measure Compass
5. *Math Card Games* book, D6

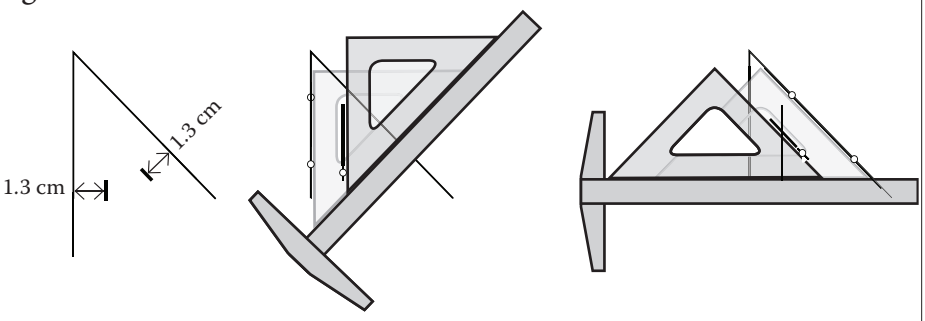
ACTIVITIES:

Rounded corners. You, no doubt, have seen instances where two edges meet with a curve instead of straight lines. For example, look at the corners of your Slide N' Measure Compass or inside your triangle. These are *tangent arcs*. The arc, part of a circumference, is tangent to a line or another arc, touching at exactly one point. Sometimes these tangent arcs are called "rounded corners."

For this lesson you will construct several tangent arc corners. Here is an **example** of rounding a 45° vertex like the one inside your 45 triangle. It may be helpful to draw this figure on another sheet of paper or on the back of your worksheet.

Step 1. Draw lines inside the angle that are 1.3 cm away and parallel to the sides. Start by making tick marks that are 1.3 cm away from the sides. See the first figure below.

Next align the triangle and T-square (upside down) so the triangle is parallel to the vertical line. Then slide the triangle along the T-square to the tick mark. Draw the parallel line. See the middle figure below.



The right figure above shows aligning and drawing the line parallel to the oblique line. Make sure your lines intersect. This will be the center of the arc.

EXTRAS:

Sundogs on a cold day in ND.

You may need to push the compass slider towards the 1.3 cm position until you hear it snap into place.

Sign in Florida.

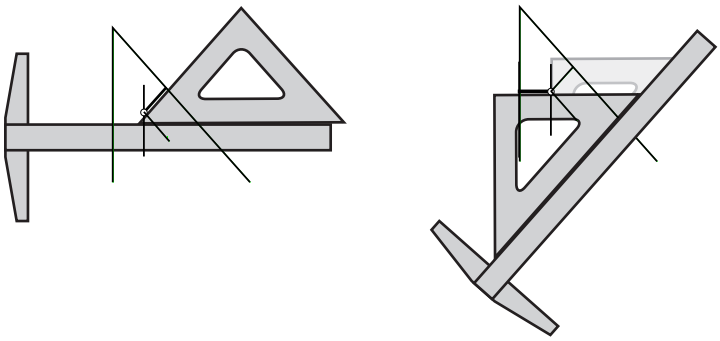
If you don't remember the term *oblique*, refer to your dictionary.

LESSON CONTINUES ON THE NEXT PAGE.

ACTIVITIES:

Step 2. At the point of intersection of the lines just drawn, you need to draw **perpendicular** lines so that you can find the points of tangency.

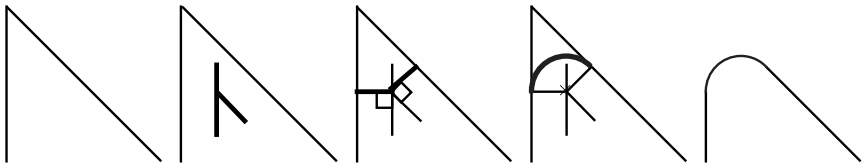
Your T-square and triangle are already in position for the oblique line. Just slide the triangle to the right. See the left figure below.



To draw the point of tangency for the vertical line, align the tools as shown in the right figure above.

Step 3. Draw the arc using the Slide N' Measure Compass. You will need to find the center of the arc. You have the radii that is perpendicular to the point of tangency. The radius of the arc is 1.3 cm. Knowing the radius is necessary so you will know where to begin and end the arc.

Summary. The first figure below shows the 45° angle with two lines, one vertical and one oblique. The next three figures show the constructions and the tangent arc. The last figure shows the arc without the constructions. It matches the inside arc of your 45 triangle.



Worksheet 84. The lines for the signs on the worksheet are not drawn to their full lengths. This means the final step is to extend the lines to the points of tangency, where the lines touch the arc.

Problem 1 will use the T-square aligned to the drawing board for the rounded rectangles. Problem 2 will use the T-square upside down for the rounded pentagons. Problem 3 will use the T-square both ways—aligned to the drawing board and upside down.

Today's game. Play the Equal Quotients game, found in the *Math Card Games* book, D6.

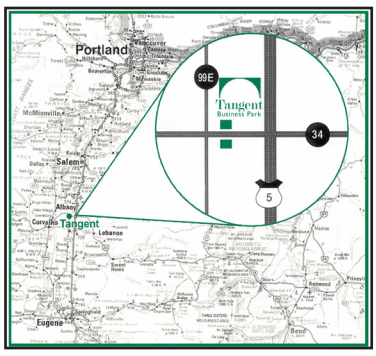
EXTRAS:

If you don't draw the perpendicular lines, you can still draw the arcs, but the points of tangency will often be inaccurate.

Signs in Teesside, England.

Japanese computer keyboard with rounded corners.

Bridge in Des Arc, Arkansas.



Interesting that the inset image for Tangent, Oregon has tangent segments!

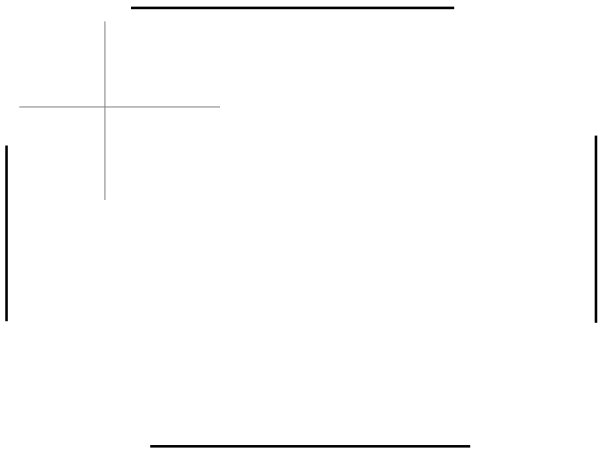
Name: _____

Date: _____

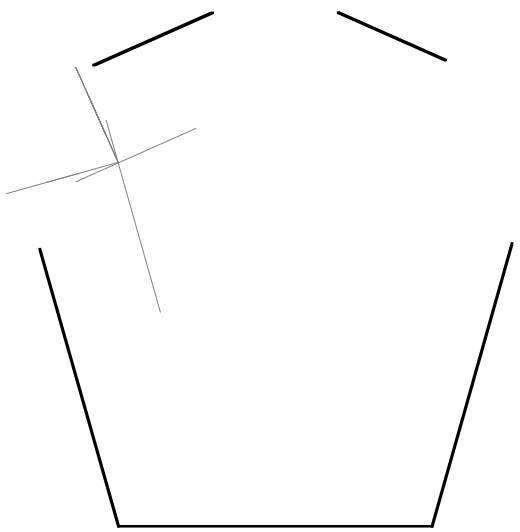
Worksheet 84, Rounding Edges with Tangents

Draw the rounded corners and extend the lines to the points of tangency for the following traffic signs. Show your construction lines.

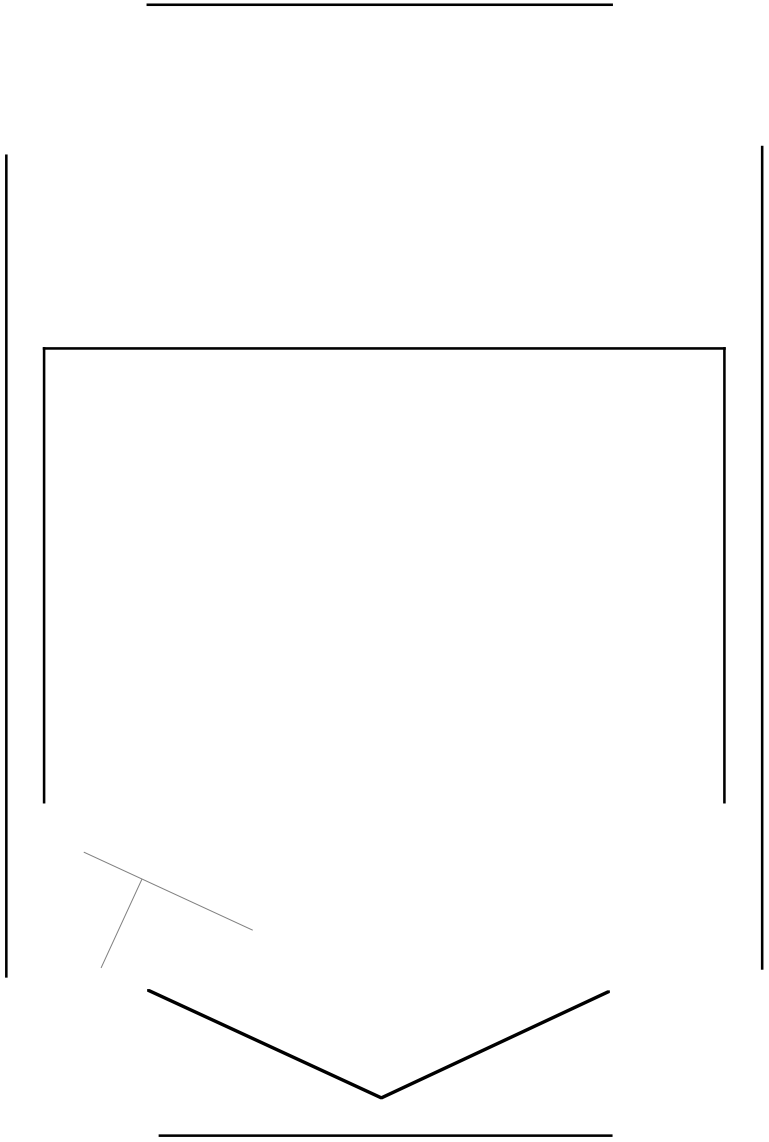
1. This U.S. interstate sign has a radius of 1.3 cm.



2. This U.S. county road sign has a radius of 1.5 cm at the top and 1.3 cm at the top "corners."



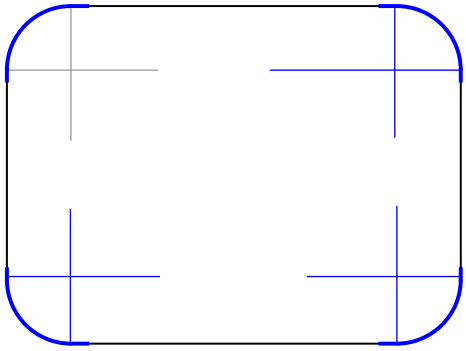
3. This Canadian road sign has a radius of 1.6 cm on the rectangle and 1.3 cm on the inside pentagon.



Draw the rounded corners and extend the lines to the points of tangency for the following traffic signs. Show your construction lines.

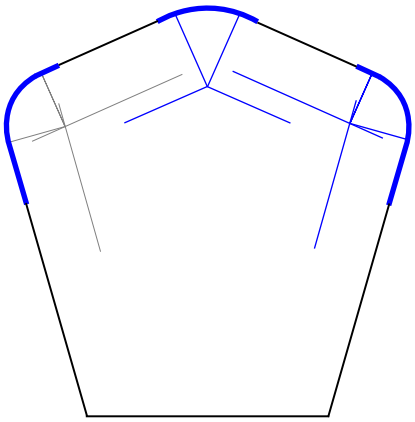
1. This U.S. interstate sign has a radius of 1.3 cm.

Circle, MT
Tangent, OR
Des Arc, AR



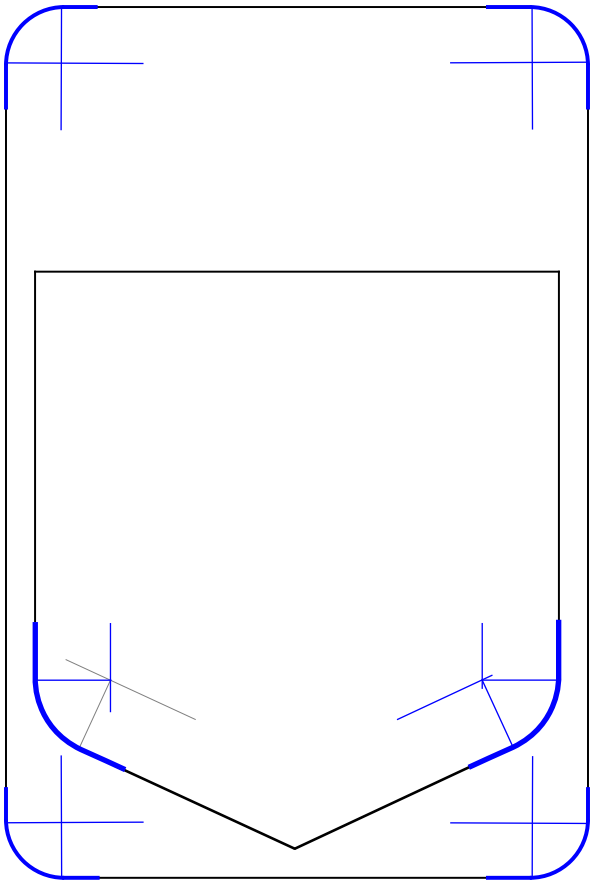
2. This U.S. county road sign has a radius of 1.5 cm at the top and 1.3 cm at the top "corners."

County
15



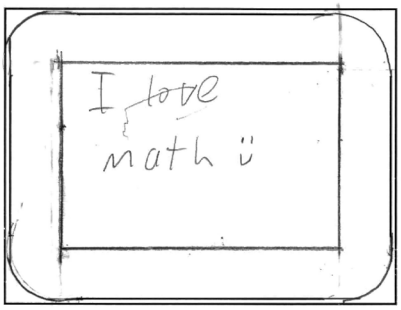
3. This Canadian road sign has a radius of 1.6 cm on the rectangle and 1.3 cm on the inside pentagon.

Province
401



NOTES: Problem 1 uses a radius of 1.3 cm, therefore parallel lines are needed 1.3 cm from the sides. These can be easily drawn with the T-square and triangle. At the point of intersection, draw the arc with the Slide N' Measure® Compass using the radius for 1.3 cm. The sides will need to be extended to the tangent arc.

Ben, age 13, from California, did the sign shown on the right.



Problem 2 uses two different radii. The side corners each have a radius of 1.3 cm. The top has a radius of 1.5 cm. As shown in the solutions, the top two sides will need two parallel lines; 1.3 cm and 1.5 cm. Make sure the radii are perpendicular (90°) to the parallel lines and the sides.

Problem 3 is a combination of Problems 1 and 2.

DICTIONARY TERMS: tangent arc

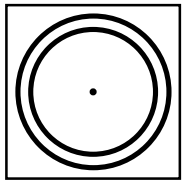
Name: _____

Date: _____

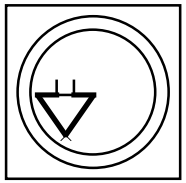
Worksheet 85, Making a "No U-Turn" Sign

Construct the "No U-Turn Sign" in the square on the right. Follow the instructions using the figures as a guide.

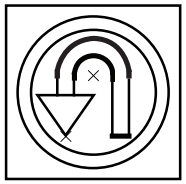
1. Find the center of the square. Draw two concentric circles in the center of the square. The radius of one circle is 4.5 cm. The other radius is 3.8 cm.



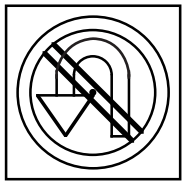
2. Draw the arrow by making an isosceles triangle. The angle at the lowest vertex, at the ×, is 70°. (Hint: use your goniometer.)



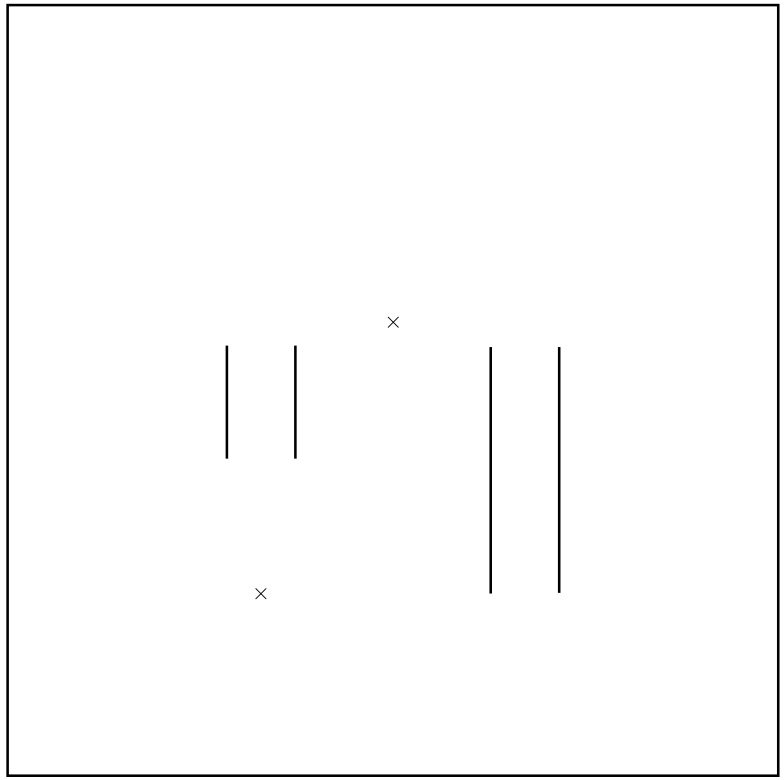
3. The upper × is the center of the two semicircles that are tangent to the four vertical lines. Draw the semicircles. Extend the lines so they are tangent to the semicircles.



4. Draw the two oblique lines at 45°. They are .7 cm apart and are the same distance from the center of the circle.

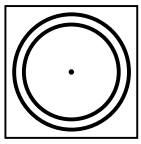


5. Color the appropriate areas. The circle and "cross out" rectangle are red. The U-turn symbol and arrow are black.

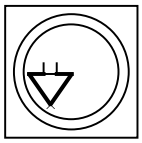


Construct the "No U-Turn Sign" in the square on the right. Follow the instructions using the figures as a guide.

1. Find the center of the square. Draw two concentric circles in the center of the square. The radius of one circle is 4.5 cm. The other radius is 3.8 cm.



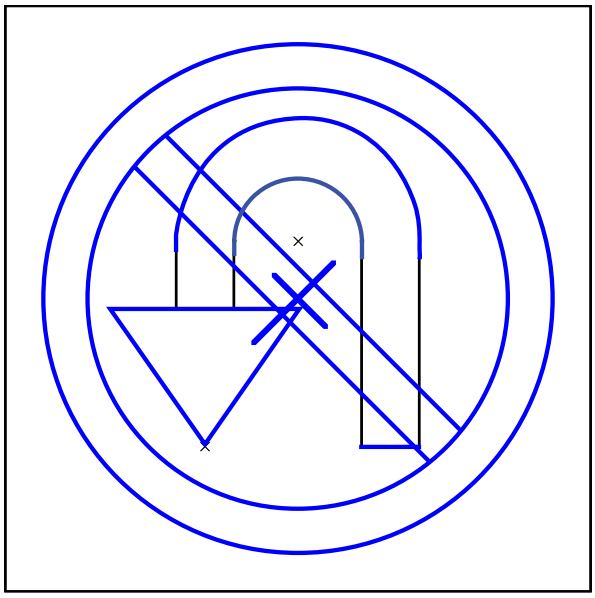
2. Draw the arrow by making an isosceles triangle. The angle at the lowest vertex, at the ×, is 70°. (Hint: use your goniometer.)



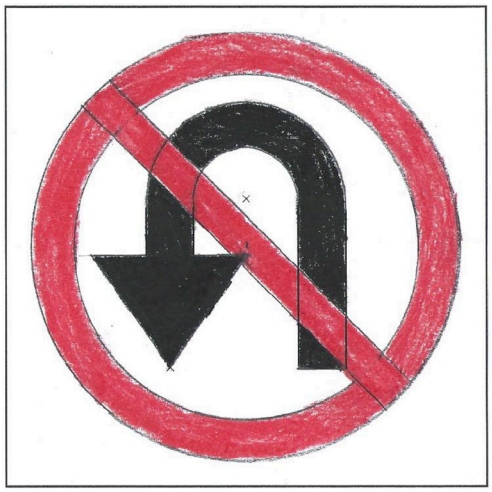
3. The upper × is the center of the two semicircles that are tangent to the four vertical lines. Draw the semicircles. Extend the lines so they are tangent to the semicircles.

4. Draw the two oblique lines at 45°. They are .7 cm apart and are the same distance from the center of the circle.

5. Color the appropriate areas. The circle and "cross out" rectangle are red. The U-turn symbol and arrow are black.



NOTES: Wesley, age 13, created a splendid U-turn sign.



DICTIONARY TERMS: concentric, semicircle

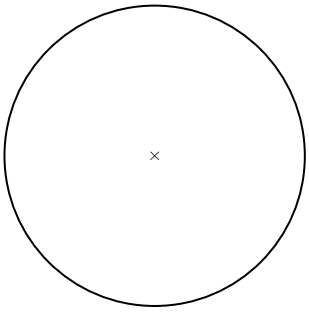
Name: _____

Date: _____

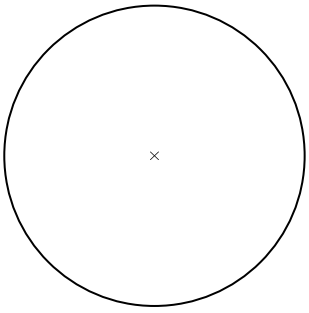
1–10. Match the following terms with the correct definitions

Circumference	when one circle is inside the other and they are tangent at the same point
Inscribed polygon	the distance around a circle
Tangent	when all of the vertices of a polygon lie on a circle
Internally tangent circles	the exact point where a line segment touches a circle
Line	a line measuring across the middle of a circle
Diameter	the ratio of the circumference to the diameter of a circle
Pi	a polygon drawn around a circle so that each of its sides is tangent to a circle
Circumscribed polygon	a path made by points that extends forever
Radius	an exact place, with no width, depth or height
Point	a line segment with one end at the center and the other on the circle

11. Using your drawing tools, draw an 8 sided inscribed regular polygon.



12. Using your drawing tools, draw an 8 sided circumscribed regular polygon.



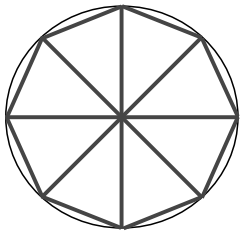
13–14. For each polygon, measure the length of a side in millimeters. Find the perimeter. Calculate the ratio of P, the perimeter of the polygon, to *D,* the diameter of the circle. Complete the chart below.

Number of Sides	**Length, Side of Polygon in mm**	***P* (perimeter) of Polygon in mm**	***D* (diameter) of Circle in mm**	**Ratio of *P* to *D* (hundredths)**
8 Inscribed				
8 Circumscribed				

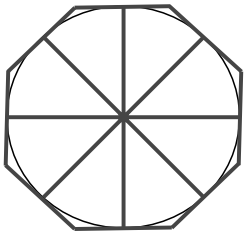
1–10. Match the following terms with the correct definitions

Circumference	the distance around a circle
Inscribed polygon	when all of the vertices of a polygon lie on a circle
Tangent	the exact point where a line segment touches a circle
Internally tangent circles	when one circle is inside the other and they are tangent at the same point
Line	a path made by points that extends forever
Diameter	a line measuring across the middle of a circle
Pi	the ratio of the circumference to the diameter of a circle
Circumscribed polygon	a polygon drawn around a circle so that each of its sides is tangent to a circle
Radius	a line segment with one end at the center and the other on the circle
Point	an exact place, with no width, depth or height

11. Using your drawing tools, draw an 8 sided inscribed regular polygon.



12. Using your drawing tools, draw an 8 sided circumscribed regular polygon.



13–14. For each polygon, measure the length of a side in millimeters. Find the perimeter. Calculate the ratio of P, the perimeter of the polygon, to *D*, the diameter of the circle. Complete the chart below.

Number of Sides	Length, Side of Polygon in mm	*P* (perimeter) of Polygon in mm	*D* (diameter) of Circle in mm	Ratio of *P* to *D* (hundredths)
8 Inscribed	15 mm	120 mm	40 mm	3.00
8 Circumscribed	16 mm	128 mm	40 mm	3.20

NOTES: On Problems 13 and 14, if needed remind the student that the ratio of *P*, perimeter, to *D*, diameter, is found by dividing the perimeter by the diameter, 120 ÷ 40 and 128 ÷ 40. If the student's measurements vary, check that their ratio is accurate.

If the student uses tickmarks, rather than line segments as shown in Problems 11 and 12, that is acceptable.

Lesson 89: Inscribed Circles

OBJECTIVES:

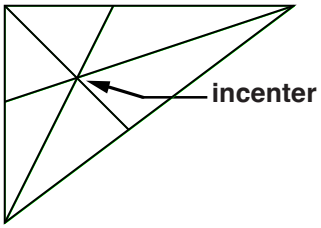
1. To learn the term *incenter*
2. To practice bisecting angles using a compass
3. To discover some special things about inscribed circles

MATERIALS:

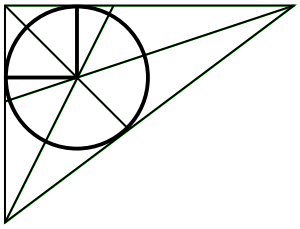
1. Math Dictionary
2. Worksheets 89-1 and 89-2, Inscribed Circles
3. Drawing board, T-square, and 45 triangle
4. 4-in-1 ruler
5. Slide N' Measure Compass
6. *Math Card Games* book, D7

ACTIVITIES:

Inscribing a circle in a triangle. The point at which all the angle bisectors intersect is called the *incenter.* See the first figure below. Its claim to fame is that it's the center of the inscribed circle. See the second figure below. The name is easier to remember if you think of it as the *center* of the circle *in* the triangle.



A triangle with angle bisectors.



An inscribed circle and radii.

Notice that the radii are not the same as the angle bisectors. The radii must be **perpendicular** to the triangle **sides**. See the second figure above.

Worksheet 89-1. Here you will practice your skills at constructing angle bisectors using the Slide N' Measure Compass. There is something special about these triangles as well as the radii of the inscribed circles. Measure the inscribed circle before drawing it.

Although the circle for Problem 1 is drawn for you, find the angle bisectors and measure the radius for the inscribed circle and record.

For Problems 2 and 3, draw the angle bisectors and the inscribed circles, then record the radii.

Worksheet 89-2. This triangle is a big one. The radii might surprise you.

If you need help with Question 5, refer back to Lesson 71.

Today's game. Play the Quotient and Remainder game, found in the *Math Card Games* book, D7.

EXTRAS:

Unless it's an equilateral triangle, the incenter, which bisects the angles, is not the same as the centroid, which bisects the sides.

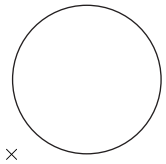
Name: _____

Date: _____

Draw the given right triangle in the boxes. Construct the angle bisectors and inscribed circles.

1. Sides: 3, 4, 5 cm

$r =$ _____



2. Sides: 5, 12, 13 cm

$r =$ _____

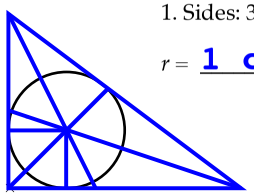
3. Sides: 8, 15, 17 cm

$r =$ _____

Draw the given right triangles in the boxes. Construct the angle bisectors and inscribed circles.

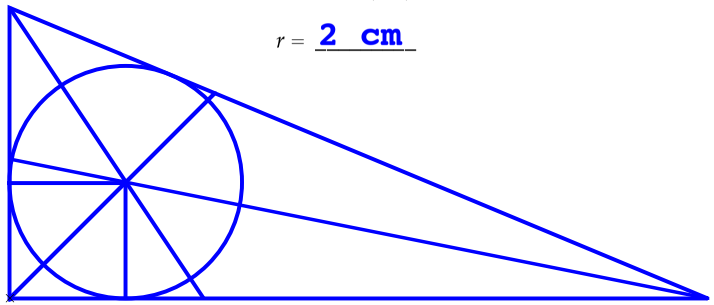
1. Sides: 3, 4, 5 cm

$r =$ 1 cm



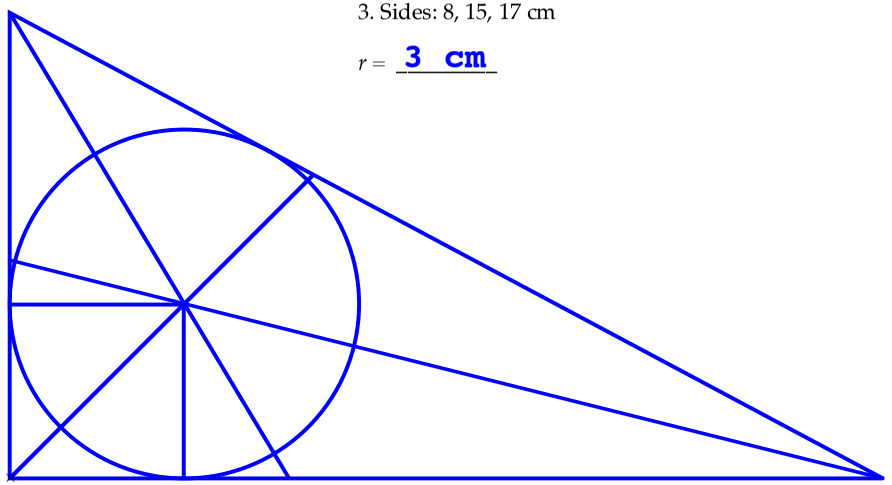
2. Sides: 5, 12, 13 cm

$r =$ 2 cm



3. Sides: 8, 15, 17 cm

$r =$ 3 cm



NOTES: When the tick marks to bisect the angle are made close to the vertex, accuracy decreases. When the marks are made further away, say 3 cm for the first triangle and 7 cm for the larger triangle, accuracy in bisecting the angles will increase. Yes, this will make the work a bit messier with all the tick marks (not shown here), but the gain in accuracy will be well worth it.

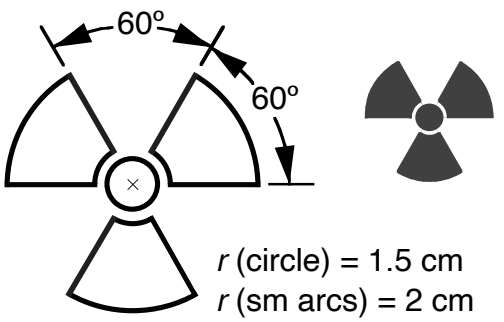
Check that the student constructed the angle bisectors for Problem 1. Also, make sure the radii are perpendicular to the triangle sides. The angle bisectors are not the radii.

Name: _____

Worksheet 93,
More Drawing Arcs

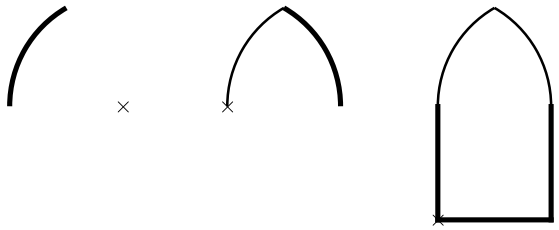
Date: _____

1. Draw the radiation warning symbol as shown below. You decide in what order to draw the lines and arcs.

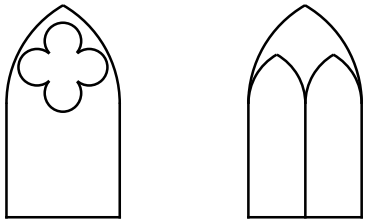


r (circle) = 1.5 cm
r (sm arcs) = 2 cm
r (large arcs) = 5 cm

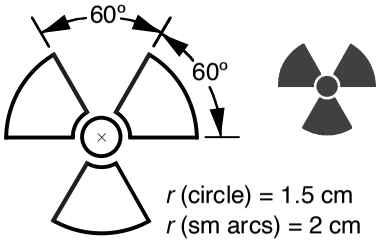
2. Create the basic double 60° arc using your own dimensions. Use the space to the left.



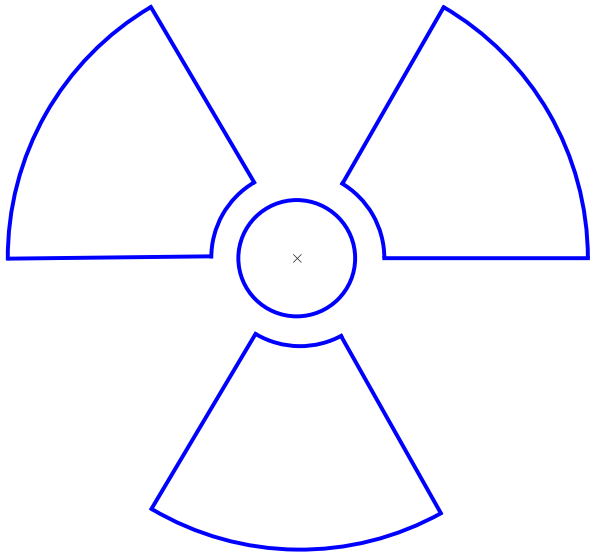
3. Add your own design. Here are some ideas.

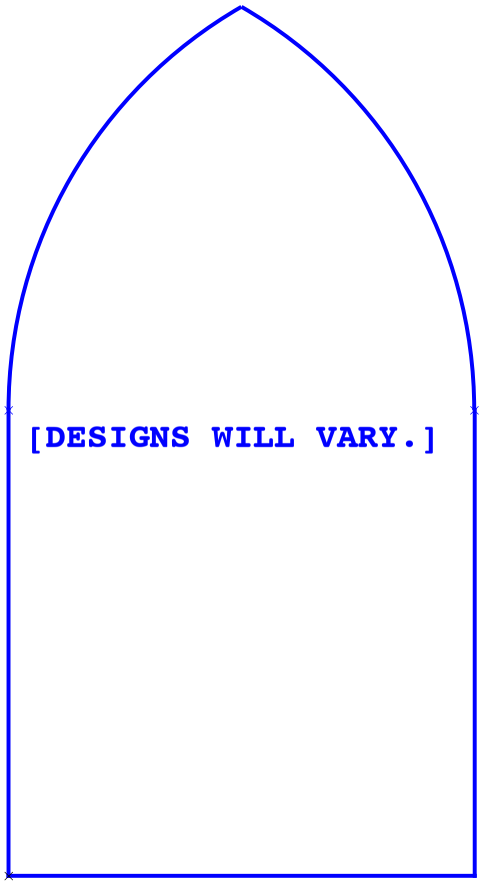


1. Draw the radiation warning symbol as shown below. You decide in what order to draw the lines and arcs.

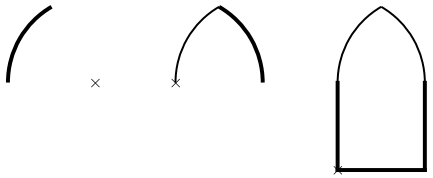


r (circle) = 1.5 cm
r (sm arcs) = 2 cm
r (large arcs) = 5 cm

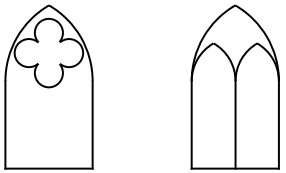




2. Create the basic double 60° arc using your own dimensions. Use the space to the left.



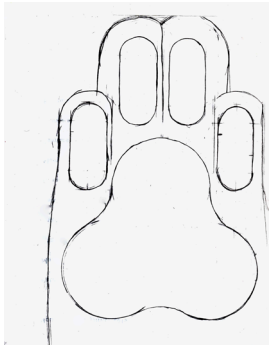
3. Add your own design. Here are some ideas.



NOTES: Problem 1 can be constructed using various sequences of steps.

Problem 2 will vary. Here are some students' designs.

The first one is from Josephine Wilson from Colorado. The second is from Maia from Ontario, Canada. The last one, colored in blue and purple, is from Melody, age 13, from Kansas.



This cat paw was done by Jasmine Giasson, 11 years old.

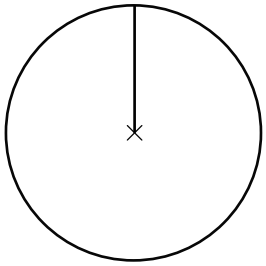
If your student has a creative design, please send it to info@RightStartMath.com. With parent or guardian's permission, we will post it on our website.

DICTIONARY TERMS: central angle

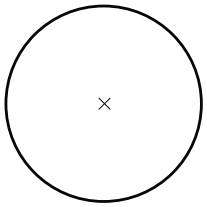
Name: _____

Date: _____

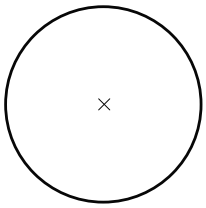
12. Draw a special square using the radius of this circle as one side. Find the perimeter and area of the square and then find the circumference and area of the circle.



13. Find the radius of a circle that has twice the circumference of the circle below. Draw the circle.



14. Find the radius of a circle that has twice the area of the circle below. Draw the circle.



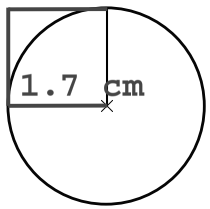
15. The Vikings had a favorite snack called lefsa. It is a soft tortilla made with potatoes, flour, butter, and cream. Find the area to the nearest tenth of a square cm for each size of lefsa in Minnesota and North Dakota. Fill in the chart.

16. Find the price per square centimeter in tenths of a cent for each piece of lefsa.

Lefsa in Minnesota		
Size	20 cm	25 cm
Price	$12.95	$13.55
Area		
Price/cm²		

Lefsa in North Dakota		
Size	20 cm	25 cm
Price	$12.53	$12.95
Area		
Price/cm²		

12. Draw a special square using the radius of this circle as one side. Find the perimeter and area of the square and then find the circumference and area of the circle.



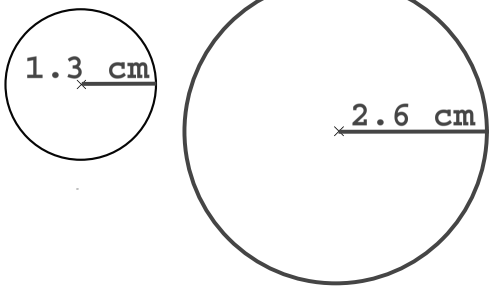
$P = 1.7 \times 4$
$P = 6.8$ cm

$C = 2\pi r$
$C = 2\pi \times 1.7$
$C \approx 10.7$ cm

$A(sq) = r^2$
$A(sq) = 1.7^2$
$A(sq) = 2.9$ cm^2

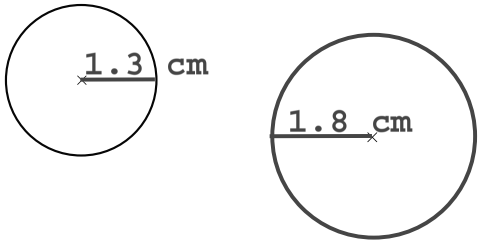
$A(cir) = \pi r^2$
$A(cir) = \pi \times 1.7^2$
$A(cir) \approx 9.1$ cm^2

13. Find the radius of a circle that has twice the circumference of the circle below. Draw the circle.



$C(sm) = 2\pi r$
$C(sm) = 2\pi \times 1.3$
$C(sm) = 8.2$ cm
$C(lg) = 8.2 \times 2$
$C(lg) = 16.4$ cm
$16.4 = 2\pi r$
$r(lg) = \frac{16.4}{2\pi} \approx 2.6$ cm

14. Find the radius of a circle that has twice the area of the circle below. Draw the circle.



$A(sm) = \pi r^2$
$A(sm) = \pi \times 1.3^2$
$A(sm) = 5.3$ cm^2
$A(lg) = 5.3 \times 2$
$A(lg) = 10.6$
$10.6 = \pi r^2$
$\frac{10.6}{\pi} = r^2 \approx 3.37$
$r(lg) = 1.8$ cm

15. The Vikings had a favorite snack called lefsa. It is a soft tortilla made with potatoes, flour, butter, and cream. Find the area to the nearest tenth of a square cm for each size of lefsa in Minnesota and North Dakota. Fill in the chart.

16. Find the price per square centimeter in tenths of a cent for each piece of lefsa.

Lefsa in Minnesota		
Size	20 cm	25 cm
Price	$12.95	$13.55
Area	314.2	490.9
Price/cm²	4.1¢	2.8¢

Lefsa in North Dakota		
Size	20 cm	25 cm
Price	$12.53	$12.95
Area	314.2	490.9
Price/cm²	4.0¢	2.6¢

NOTES: On Question 16, the sizes given, 20 cm and 25 cm, is the diameter. Although it does not specifically say it is the diameter of the snack, using a radius measurement is not practical nor likely.

Lesson 122: Rotational Symmetry

OBJECTIVES:

1. To learn the terms *rotational symmetry*, *order of rotation symmetry*, and *point symmetry*
2. To apply rotational symmetry and point symmetry

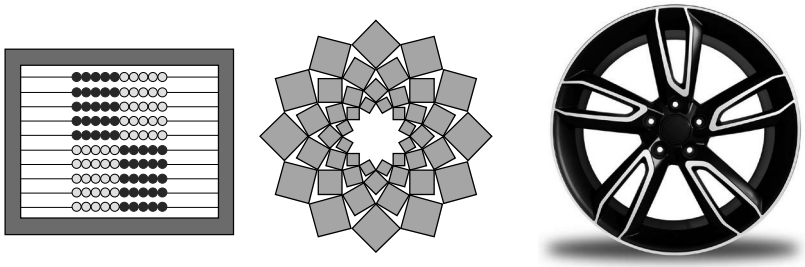
MATERIALS:

1. Math Dictionary
2. Worksheet 122, Rotational Symmetry
3. Tangrams
4. **Colored pencils, optional**
5. *Math Card Games* book

ACTIVITIES:

Rotational symmetry. Just as line symmetry refers to a line of symmetry within an object, *rotational symmetry* refers to rotation of an object. If a figure can be rotated and looks the same as before the rotation, it has rotational symmetry.

In the left figure below, the abacus has rotational symmetry; you can turn it 180° and it will look exactly as the original abacus.



In the center figure above, an image of the design (a logo) can be rotated 30° and still fit exactly on the original. Actually, it can be rotated for every multiple of 30° up to 360°, such as 30°, 60°, 90°, and so on, for a total of 12 times because 360 ÷ 30 = 12. When counting the number of rotations, we only go around once so do not count anything past 360°. The number of times it can be rotated is the *order of rotation symmetry*.

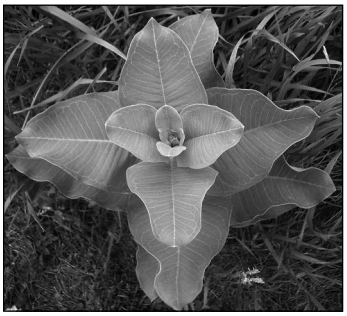
The car wheel above on the right can be rotated 72° (360 ÷ 5) and four more multiples of 72 and still look like the original.

The figures below show the five counterclockwise rotations. Notice the shadow. It will help you keep track as you observe the rotations. What is the order of rotation symmetry? Answer is below.

Sometimes rather than saying the order of rotation symmetry is 5, you will see the term "5-fold" or "12-fold" for the order of 12.

EXTRAS:

This lily demonstrates rotational symmetry.



The leaves on a milkweed plant rotate so they receive as much sunlight as possible.

The point of rotation is usually easy to find: it's the center of the figure.

LESSON CONTINUES ON THE NEXT PAGE.

Answer: 5

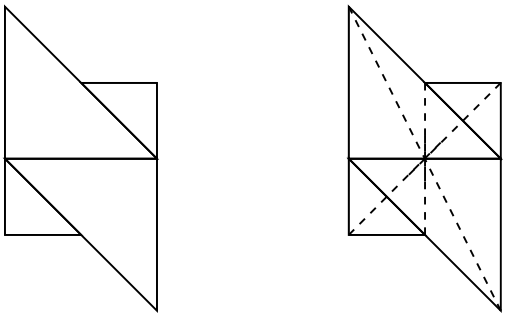
ACTIVITIES:

All objects have an order of rotational symmetry of 1 or more. Can you think why every object has at least an order of rotation of 1? Hint: what is 360 ÷ 360? It's 1!

So, in other words, you can always rotate an object completely around, 360°, and it will look the same. Therefore, everything has an order of rotation of 1 and sometimes more.

Point symmetry. A special case of rotational symmetry is *point symmetry*. An easy way to check for point symmetry is to rotate it 180°. If it looks the same, upside down as right side up, it has point symmetry.

To understand why it's called point symmetry, follow these steps. First construct this figure with your tangrams on top of a sheet of paper. Then rotate the paper 180° to see that the tangram design has point symmetry.



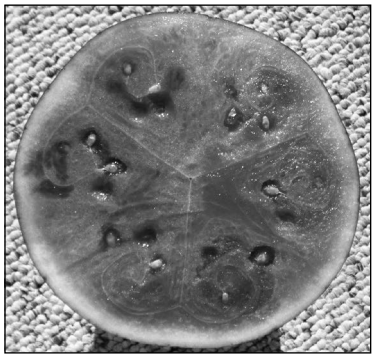
Next consider what happens if you connect the corresponding points. As you can see in the figure above on the right, the lines intersect at the center. The center also bisects each connecting line. It can be thought of as though each point is reflected through the center point. That's point symmetry.

Worksheet 122. The worksheet is a collection of problems applying symmetries.

Symmetry in logos, optional. Collect a dozen or so logos from magazines, the internet, or products. Analyze them for symmetry.

Today's game. Play your choice of math card game from the *Math Card Games* book.

EXTRAS:

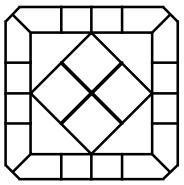


Watermelons also exhibit symmetry.

Name: _____

Worksheet 122,
Rotational Symmetry

Date: _____

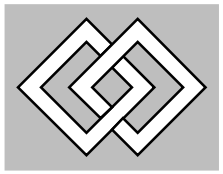

A

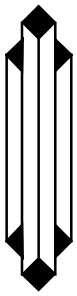

B


C


D


E


F


G

1. Which of the figures above have line symmetry? _____

2. Which of the figures have rotational symmetry? Give the order of rotation symmetry.

_____

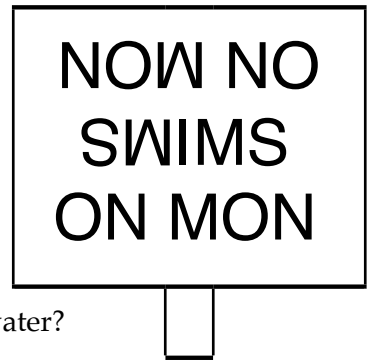
3. Which of the figures have point symmetry? _____

4. List the seven capital letters that have rotational symmetry.

_____

5. List the three digits that have rotational symmetry.

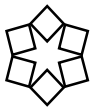
_____



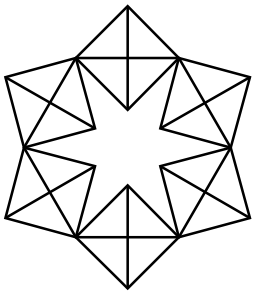
6. What did the diver read on the sign while traveling headfirst toward the water?

_____

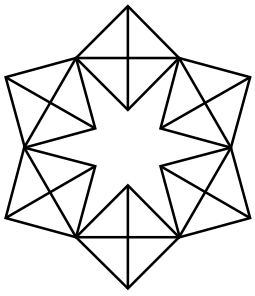
7–10. Color the squares in the figures below to show the order of rotation symmetry given.



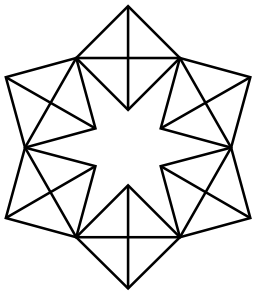
2



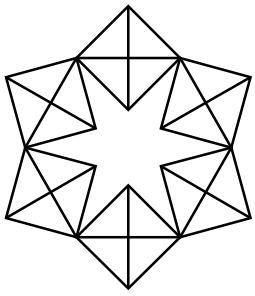
3



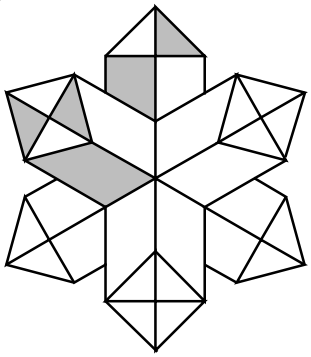
6



1



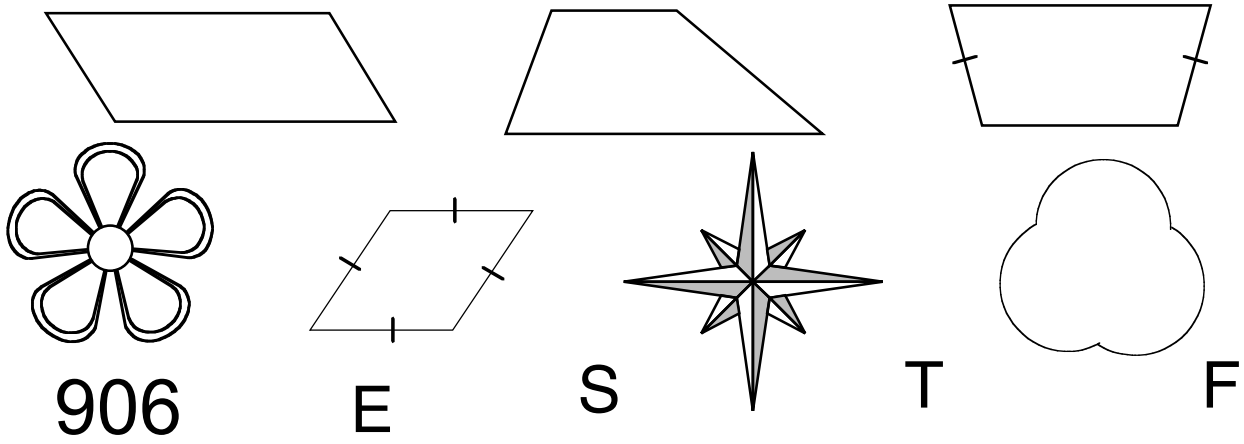
11. Color the shaded part of the logo on the right. Then color the remaining part of the logo so it has rotational symmetry. What is the order of rotation symmetry? ____



Name: _____

Date: _____

4. Consider the symmetry of each figure and fill in the table below.



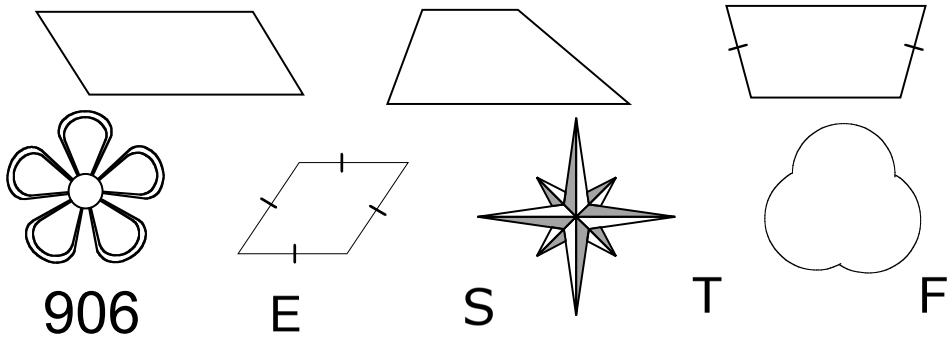
Shape	Line Symmetry?	Point Symmetry?	Rotational Symmetry?	Order of Rotation Symmetry	Degrees of Rotation
					
					
					
					
					
					
					
906					
E					
S					
T					
F					

5. What is the relationship between point symmetry and the order of rotation? _____

_____

BONUS: Can you have rotational symmetry without line symmetry and point symmetry? _____

4. Consider the symmetry of each figure and fill in the table below.



Shape	Line Symmetry?	Point Symmetry?	Rotational Symmetry?	Order of Rotation Symmetry	Degrees of Rotation
	no	yes	yes	2	180°
	no	no	no	1	360°
	yes	no	no	1	360°
	yes	no	yes	5	72°
	yes	yes	yes	2	180°
	no	yes	yes	4	90°
	yes	no	yes	3	120°
906	no	yes	yes	2	180°
E	yes	no	no	1	360°
S	no	yes	yes	2	180°
T	yes	no	no	1	360°
F	no	no	no	1	360°

5. What is the relationship between point symmetry and the order of rotation? **Point symmetry only exists when order of rotation is even.**

BONUS: Can you have rotational symmetry without line symmetry and point symmetry? **yes**

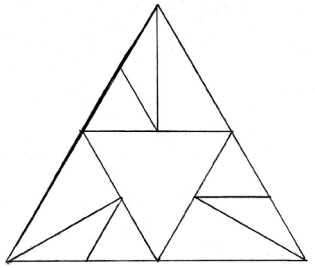
NOTES: Approaching this table systematically may be beneficial for some students. Considering line symmetry for all figures, then point symmetry, then rotational symmetry, etc, helps keep each definition straight.

The star is not symmetrical because of the shading.

An object having rotational symmetry with an order of 1 occurs when an object has symmetry about a point only when rotated by 360 ÷ 1, which is 360 degrees. In other words, the order of rotation symmetry of 1 happens with objects that have no symmetry less than 2. Rotational symmetry for these objects is trivial. Therefore, the simplest possible rotational symmetry is of order 2.

Question 5 can also reference the order of rotation being a multiple of 2.

For the bonus question, only looking to the chart's information, when neither line symmetry nor point symmetry exist, rotational symmetry does not appear to exist. The second quadrilateral and the letter F both have no line symmetry, no point symmetry, as well as no rotational symmetry.



Joshua Dill from St. Paul, MN, age 14, wondered about this. After some work, he shows that rotational symmetry can exist without point or line symmetry being present.

So the answer to the bonus question is "yes." Additionally, consider figure B from Worksheet 122 as shown here. It has rotational symmetry without line symmetry and point symmetry.

DICTIONARY TERMS: heptagon

Name: _____

Date: _____

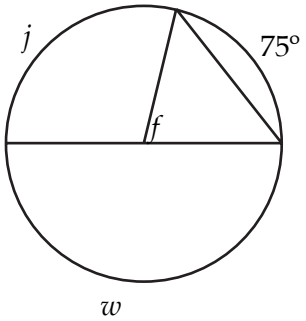
66. Draw a right triangle below using your drawing tools. Using the given measurements, construct the angle bisectors and inscribed circle.

Sides: 4.3, 10.5, 11.3 cm

r = _____

×

67. Find the missing measurements for the hiking trail sign in the Jule Forest. Do not use your goniometer.



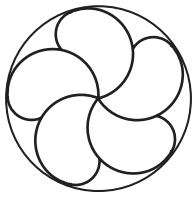
j = _____

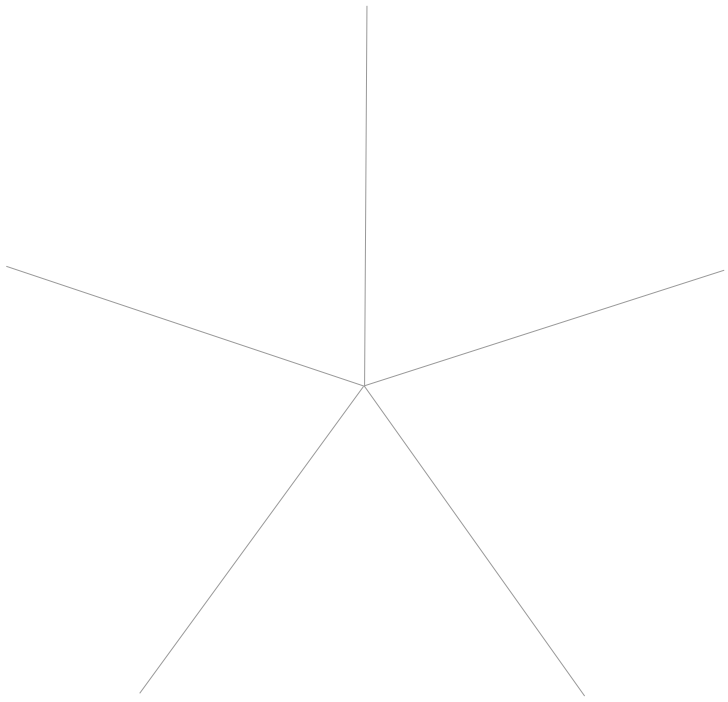
f = _____

w = _____

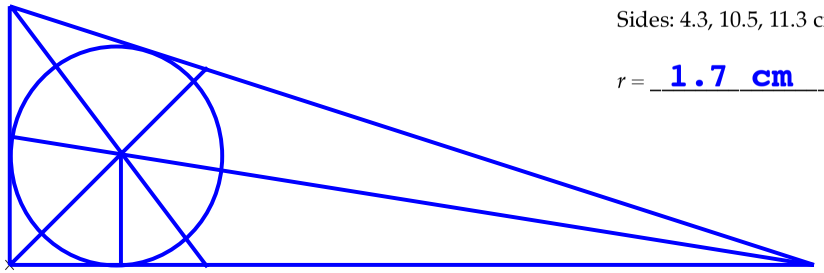
68. Create the Flower Planting sign of the Sparkle Meadow. Use the following guide and arc measurements.

r = 1.3 cm for small arcs
r = 2.3 cm for middle arcs
r = 4.6 cm for large circle





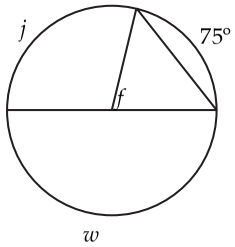
66. Draw a right triangle below using your drawing tools. Using the given measurements, construct the angle bisectors and inscribed circle.



Sides: 4.3, 10.5, 11.3 cm

r = 1.7 cm

67. Find the missing measurements for the hiking trail sign in the Jule Forest. Do not use your goniometer.



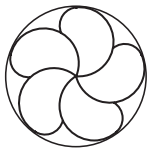
j = 105°

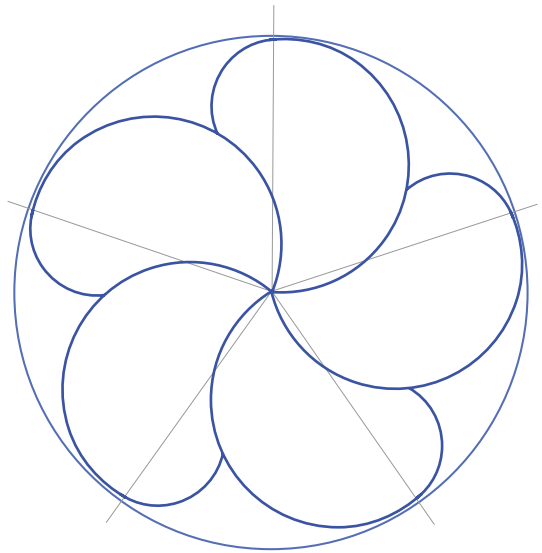
f = 75°

w = 180°

68. Create the Flower Planting sign of the Sparkle Meadow. Use the following guide and arc measurements.

r = 1.3 cm for small arcs
r = 2.3 cm for middle arcs
r = 4.6 cm for large circle





NOTES: none

Solutions: Worksheet 127-6, Assessment 3