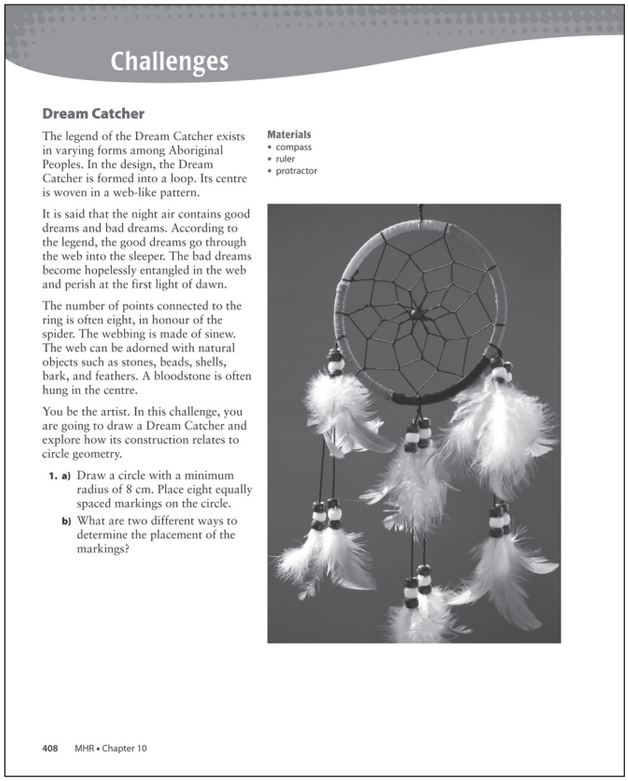

Challenges

Dream Catcher

The legend of the Dream Catcher exists in varying forms among Aboriginal Peoples. In the design, the Dream Catcher is formed into a loop. Its centre is woven in a web-like pattern.

It is said that the night air contains good dreams and bad dreams. According to the legend, the good dreams go through the web into the sleeper. The bad dreams become hopelessly entangled in the web and perish at the first light of dawn.

The number of points connected to the ring is often eight, in honour of the spider. The webbing is made of sinew. The web can be adorned with natural objects such as stones, beads, shells, bark, and feathers. A bloodstone is often hung in the centre.

You be the artist. In this challenge, you are going to draw a Dream Catcher and explore how its construction relates to circle geometry.

Materials
- compass
- ruler
- protractor

1. a) Draw a circle with a minimum radius of 8 cm. Place eight equally spaced markings on the circle.

b) What are two different ways to determine the placement of the markings?

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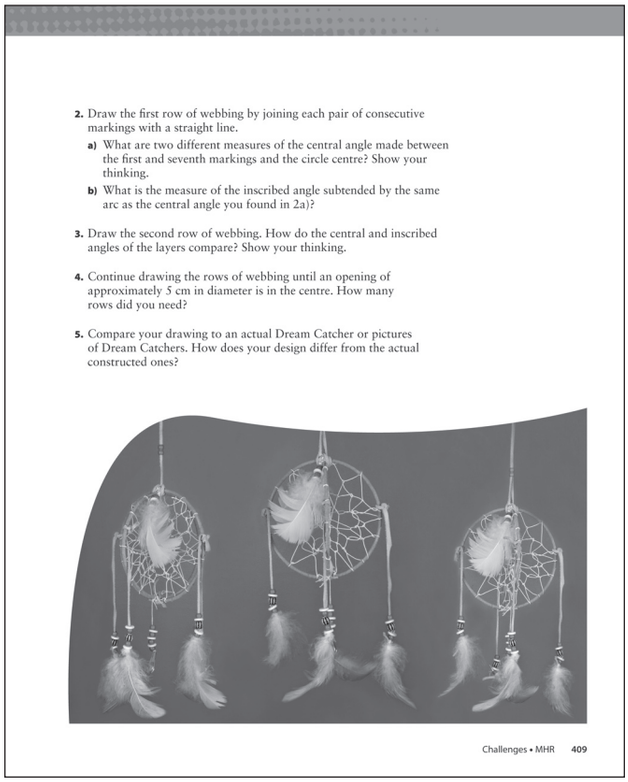

2. Draw the first row of webbing by joining each pair of consecutive markings with a straight line.

a) What are two different measures of the central angle made between the first and seventh markings and the circle centre? Show your thinking.

b) What is the measure of the inscribed angle subtended by the same arc as the central angle you found in 2a)?

3. Draw the second row of webbing. How do the central and inscribed angles of the layers compare? Show your thinking.

4. Continue drawing the rows of webbing until an opening of approximately 5 cm in diameter is in the centre. How many rows did you need?

5. Compare your drawing to an actual Dream Catcher or pictures of Dream Catchers. How does your design differ from the actual constructed ones?

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***MathLinks 9*, pages 408–409**

Suggested Timing
50–60 minutes

Materials
- compass
- ruler
- protractor

Blackline Masters
Master 1 Project Rubric
BLM 10–15 Making a Dream Catcher (optional)
BLM 10–16 Chapter 10 BLM Answers

Mathematical Processes
- ☑ Communication (C)
- ☑ Connections (CN)
- ☑ Mental Mathematics and Estimation (ME)
- ☑ Problem Solving (PS)
- ☑ Reasoning (R)
- ☐ Technology (T)
- ☑ Visualization (V)

Specific Outcomes
SS1 Solve problems and justify the solution strategy using circle properties including:
- the perpendicular from the centre of a circle to a chord bisects the chord
- the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc
- the inscribed angles subtended by the same arc are congruent
- a tangent to a circle is perpendicular to the radius at the point of tangency.

Planning Notes: Dream Catcher

You may wish to use the following steps to introduce and complete this Challenge:

1. Read the introduction for the Challenge with students. The day before class, you may wish to ask students who have dream catchers to bring them to class. If you have one, bring it to class. Alternatively, bring and post, or show pictures of, various Dream Catcher designs.
2. Discuss the overall design of the webbing. Ask students if it reminds them of a design that they have observed in nature (e.g., spider's web).
3. As students work through the directions, you might provide the following guiding prompts:
   - What is the radius of the circle you are drawing?
   - What is the diameter? How do you know?

- What methods might you use to put equally spaced markings around the circumference of this circle? (For example, draw a diameter, find the perpendicular bisector of the diameter, bisect the four right angles, or draw eight central angles of 45°.)
- Show me a central angle between the first and seventh markings on your circle.
- What other central angle is there?
- How are the two angles related?
- How can you determine the measure of these angles?
- Show me an inscribed angle formed by two chords passing through two pairs of consecutive markings.
- How can you determine the measure of this angle?
- Now that you have the second row of webbing, show me a central angle on that row of webbing.
- Show me an inscribed angle.
- Show me the related angles on the first row of webbing.
- How do the angles compare?
- Show me a right angle in your drawing.
- Show me a right angle that is not part of a central angle. How do you know this is a right angle?

4. Ask students to answer the questions as they design the Dream Catcher. If they try to answer the questions after the drawing has been completed, it may be difficult to find the central angles, the inscribed angles, and the right angles.

5. Clarify that the task is to
- draw the circle and divide the circumference into eight equally spaced segments.
- join each pair of consecutive markings with a straight line. Answer #2 in the Challenge.
- draw the second row of webbing. Answer #3 and 4 in the Challenge.
- complete the rows of webbing and answer #5.
- make comparisons between the Dream Catcher design and an actual Dream Catcher.

6. Review the **Master 1 Project Rubric** with students so that they will know what is expected.

Meeting Student Needs

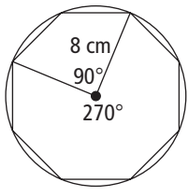
- Some students may benefit from working with a partner.
- Some students may need assistance with dividing the circle into eight equal parts.
- Finding a right angle that is not part of a central angle may be challenging for some students. Each chord of the first row of webbing is tangent to the circle passing through the knots on the second row of webbing. The radius of the circle that the second row of webbing passes through forms a right angle at the point of tangency.
- Some students may find it useful to construct an actual Dream Catcher. This should be done after the Challenge has been completed because the angles in the actual Dream Catcher differ from the angles in the design. Provide students with **BLM 10–15 Making a Dream Catcher**.

Answers

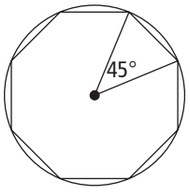
Dream Catcher

1. b) Example:
- Draw a diameter, find the perpendicular bisector of the diameter, and bisect the four right angles.
- Draw eight central angles of 45.

2. a) The two central angles are 90° and 270°.



b) Example: Inscribed angle is half the measure of the central angle subtended by the same arc. The inscribed angle is 45°.



3. The central angles and inscribed angles of each row are congruent. The circles passing through the row of knots have different radii, but since each circle is divided into eight equal parts, the angle measures are unchanged.

4. Example: If starting with an 8-cm radius circle, the design will take approximately 12 rows of webbing.

5. Example: In a real Dream Catcher, the webbing draws together in smooth curves because the sinew has elasticity. In the drawing, straight lines are drawn.

This Challenge can be used for either Assessment *for* Learning or Assessment *of* Learning.

Assessment	Supporting Learning
Assessment *for* Learning	
Dream Catcher Discuss the Challenge as a class. Have students provide individual responses.	• Consider allowing students to work with a partner and then write individual responses.
Assessment *of* Learning	
Dream Catcher Introduce the Challenge to the class. Have students provide individual responses.	• **Master 1 Project Rubric** provides a holistic descriptor that will assist you in assessing student work on this Challenge. Page 552 provides notes on how to use the rubric for this Challenge. • To view student exemplars, go to www.mathlinks9.ca, access the Teacher Centre on the Online Learning Centre, go to Assessment, and then follow the links.

The chart below shows the **Master 1 Project Rubric** for tasks such as this Challenge, Dream Catcher, and provides notes that specify how to identify the level of specific answers for this project.

Score/Level	Holistic Descriptor	Specific Question Notes
5 **(Standard of Excellence)**	❑ Applies/develops **thorough** strategies and mathematical processes making **significant** comparisons/connections that demonstrate a **comprehensive** understanding of how to develop a complete solution ❑ Procedures are **efficient and effective** and may contain a **minor mathematical error** that does not affect understanding ❑ Uses **significant** mathematical language to explain their understanding and provides **in-depth** support for their conclusion	• provides a complete and correct solution. Note: If #5 is not correct or attempted but the remainder of the question is correct, a score of 5 is still awarded.
4 **(Above Acceptable)**	❑ Applies/develops **thorough** strategies and mathematical processes for making **reasonable** comparisons/connections that demonstrate a **clear** understanding ❑ Procedures are **reasonable** and may contain a **minor mathematical error** that may hinder the understanding in one part of a complete solution ❑ Uses **appropriate** mathematical language to explain their understanding and provides **clear** support for their conclusion	Demonstrates one of the following: • provides a complete response to all parts of the question, with weak communication • provides a complete and correct response based on an incorrect initial central angle in #2a) • provides correct and complete #1, 2, and 3, with all justification
3 **(Meets Acceptable)**	❑ Applies/develops **relevant** strategies and mathematical processes making **some** comparisons/connections that demonstrate a **basic** understanding ❑ Procedures are **basic** and may contain a **major error or omission** ❑ Uses **common** language to explain their understanding and provides **minimal** support for their conclusion	• correctly completes #1 and 2 and completes the drawings for #3 and/or 5. Note: Completing the drawings for both #3 and 5 does not move the student to a 4.
2 **(Below Acceptable)**	❑ Applies/develops **some relevant** mathematical processes making **minimal** comparisons/connections that lead to a **partial solution** ❑ Procedures are **basic** and may contain **several major mathematical errors** ❑ Communication is **weak**	Demonstrates one of the following: • correctly completes #1 and makes a significant start to either part in #2 • correctly completes #2 based on an incorrect #1 and makes an initial start to #3
1 **(Beginning)**	❑ Applies/develops an **initial start** that may be **partially correct** or could have led to a correct solution ❑ Communication is **weak or absent**	• provides a correct initial start to any one part of the problem

For student exemplars, go to www.mathlinks9.ca and follow the links.