Unit 7, Lesson 11

Usemos un transportador para dibujar ángulos

Standards

Addressing **4.G.A.1, 4.MD.C.5, 4.MD.C.6, 4.MD.C.7**

Instructional Routines

- Estimation Exploration

Goals

- Use a protractor to draw angles of given measurements.

Student Facing Learning Goals

Dibujemos algunos ángulos.

Lesson Purpose

The purpose of this lesson is for students to use a protractor to draw angles of given measurements.

Narrative

In earlier lessons, students reasoned about angle measurements, learned to use a protractor, and measured given angles. They have sketched angles by referring to clock faces and sketched estimates of angles of a given size, based on benchmark angles.

In this lesson, students use a protractor to draw angles of specified measurements (not limited to benchmark angles) and to verify the sizes of the angles in their partners' drawings. They begin to use known angle measurements to reason about unknown measurements and notice relationships between the measurements of angles that share the same starting endpoint.

Access for Students with Disabilities

- Action and Expression

Access for English Learners

- MLR8

Required Materials

Materials to Gather

- Protractors: Activity 1, Activity 2
- Rulers or straightedges: Activity 1, Activity 2
- Index cards: Activity 2

Lesson Timeline

Warm-up	10 min
Activity 1	15 min

Teacher Reflection Questions

What were some of the challenges students encountered when measuring and drawing angles? What support might help students overcome those hurdles?

Activity 2	20 min
Synthesis Estimate	10 min
Actividad de cierre	5 min

Warm-up

10 min

Exploración de estimación: Manecilla larga y manecilla corta

Standards

Addressing **4.MD.C.5**

Instructional Routines

- Estimation Exploration

In this *Warm-up*, students practice estimating a reasonable angle measurement, based on their knowledge of angles so far and their familiarity with clocks. Later in the unit, students will take a closer look at the angles in an analog clock and apply their understanding of angles to solve more sophisticated problems.

Student Task Statement

¿Cuántos grados mide el ángulo formado por la manecilla larga y la manecilla corta del reloj?

Escribe una estimación que sea:

muy baja	razonable	muy alta

Student Response

- Too low: 0° – 90°
- About right: 130° – 160°
- Too high: 170° or more

Launch

- Groups of 2
- Display the image.
- *"¿Qué estimación sería muy alta?, ¿muy baja?, ¿razonable?"* // "What is an estimate that's too high? Too low? About right?"
- 1 minute: quiet think time

Activity

- 1 minute: partner discussion
- Record responses.
- Draw an arc to label the angle that measures 143° and show the clockwise turn of the minute hand from the hour hand.
- *"Sus estimaciones deben mostrar el tamaño de este ángulo en grados. Si lo necesitan, ajusten sus estimaciones"* // "Your estimate should show the size of this angle in degrees. If you need to, revise your estimate."
- As needed, record any revisions.

Activity Synthesis

- Consider asking:
  - *"¿Alguien hizo una estimación menor que ____? ¿Alguien hizo una estimación mayor que ____?"* // "Is anyone's estimate less than ____? Is

anyone's estimate greater than ____?"

- *"¿Cómo lograron hacer una estimación? ¿Cómo supieron que ____ sería muy baja y ____ sería muy alta?"* // "How did you go about making an estimate? How did you know that ____ must be too low and ____ must be too high?"
- *"Teniendo en cuenta esta discusión, ¿alguien quiere ajustar su estimación?"* // "Based on this discussion, does anyone want to revise their estimate?"

- Consider revealing the actual measurement: 143°.

Activity 1

15 min

Dibujemos estos ángulos

Standards

Addressing **4.MD.C.6**

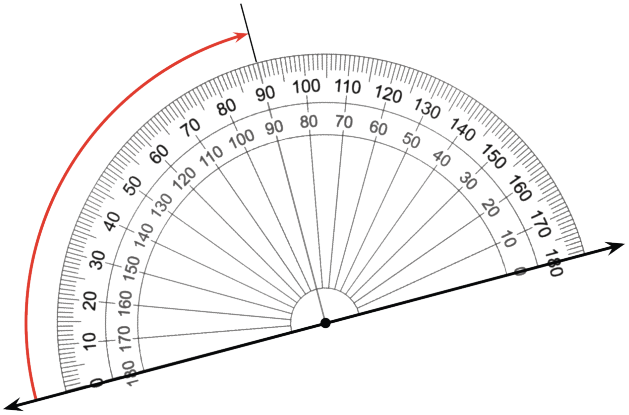
In this activity, students follow directions for drawing lines, rays, and angles. To create angles precisely and as specified, students need to use a protractor and a ruler or straightedge (MP6).

Each step in the drawing process involves one or more decisions for students to make. In some cases, the resulting drawing will be the same.

For example, in the first question, students could use the protractors in different ways to create perpendicular lines.

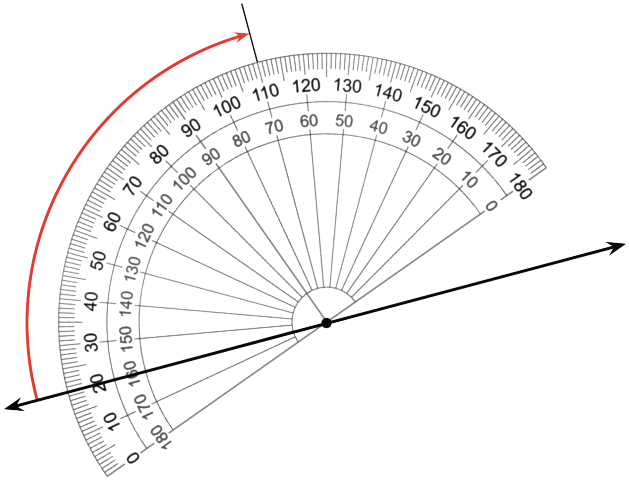
Going from 0° to 90°

(outer set of numbers):



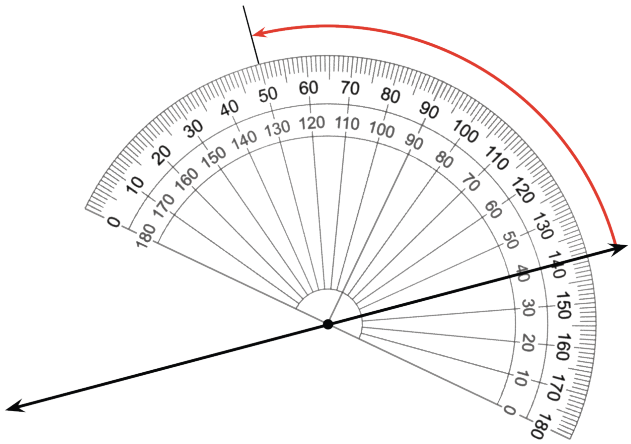
Going from 20° to 110°

(outer set of numbers):



Going from 40° to 130°

(inner set of numbers):



In other cases, the resulting drawings will vary, depending on the decisions made. For example, in the second question, students could choose to draw the first angle (40°) above or below the given ray. When drawing the second angle (20°), they could choose to draw it inside the 40° angle or adjacent to the 40° angle (and choosing one side or the other)—in both cases, meeting the specifications. Similarly, when drawing the third angle (95°), students could choose to draw it adjacent to the other angles or with one or both of the other angles inside.

Access for English Language Learners

MLR8 Discussion Supports. Synthesis: Some students may benefit from the opportunity to rehearse with a partner what they will say before they share with the whole class.
Advances: Speaking

Access for Students with Disabilities

Action and Expression: Develop Expression and Communication. Provide alternative options for expression. For example, invite students to work with a partner. One partner can draw as the other partner tells them what to do (for example, exactly how to move the protractor and where to draw points and lines).
Supports accessibility for: Visual-Spatial Processing, Language, Fine Motor Skills

Required Materials

Materials to Gather

- Protractors: Activity 1
- Rulers or straightedges: Activity 1

Student Task Statement

1. Dibuja una recta que no sea ni vertical ni horizontal. Pon un punto en algún lugar de esa recta. Usa tu transportador para dibujar una recta perpendicular que pase por ese punto. Sé lo más preciso posible. (¡Esta vez sin doblar el papel!).

Launch

- Groups of 2
- Give each student a protractor and access to rulers or straightedges.
- 2 minutes: independent work time on the first question

2. Este es un rayo que comienza en el punto *M*.

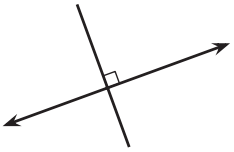
Usa un transportador para dibujar:

   a. Un rayo que comience en el punto *M* para crear un ángulo de 40°.
   b. Otro rayo que comience en el punto *M* para crear un ángulo de 20°.
   c. Un rayo más que comience en el punto *M* para crear un ángulo de 95°. Marca cada ángulo con su medida.

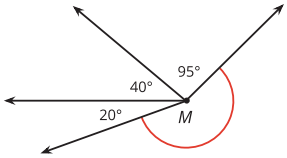
3. Hay un ángulo que no está marcado con una medida y que es mayor que 180°. Marca ese ángulo con un arco. ¿Cuántos grados mide este ángulo? Explica cómo lo sabes.

Student Response

1. Sample response:



2. Sample response:



3. Sample response: The unlabeled angle is 205°. The sum of the three known angles is $20 + 40 + 95$, which is 155°. Subtracting 155 from 360 gives 205.

- Pause for class discussion. Ask 1–2 students to share how they drew their perpendicular lines.

Activity

- 5–6 minutes: independent work time on the remaining questions
- 2 minutes: partner discussion
- Identify students with different-looking drawings to share later.

Activity Synthesis

- Select students to share their drawings and their reasoning for the last question.
- *"¿Qué decisiones tuvieron que tomar al crear el dibujo?" //* "What decisions did you have to make when creating the drawing?"
- *"Muchos de ustedes ubicaron el ángulo de 20° al lado del ángulo de 40°. Algunos de ustedes lo ubicaron dentro del ángulo de 40°. De manera similar, muchos de ustedes ubicaron el ángulo de 95° al lado del ángulo de 20° o del ángulo de 40°. Algunos de ustedes lo ubicaron con los ángulos de 20° y de 40° adentro. ¿Cómo influyeron las distintas elecciones en el tamaño del ángulo de la última pregunta?" //* "Many of you placed the 20° angle next to the 40° angle. Some of you placed it inside the 40° angle. Similarly, many of you placed the 95° angle next to the 20° angle or the 40° angle. Some of you placed it with the 20° angle and the 40° angle inside. How did the different choices affect the size of the angle in the last question?" (Putting the 20° angle inside the 40° angle made the last, unlabeled angle 20° larger. Putting the 20° angle and the 40° angle inside the 95° angle made the last, unlabeled angle 60° larger.)

Activity 2

20 min

Ángulos a la orden

Standards

Addressing **4.G.A.1, 4.MD.C.6**

In the first activity, students drew angles with some scaffolding in place: a line and a point were given, each step was

described, and the vertex and the measurements of each angle were specified.

In this activity, students continue to draw angles but with less guidance. For each drawing, students are given only a range of angle measurements and no other criteria, prompting them to make additional decisions about how to draw the angles (for instance, where to position the vertex of an angle, how to orient the first ray or line, and so on). After drawing, students trade their cards and use a protractor to measure and check one another's angles.

The drawings created here will be used in the next lesson. Consider collecting the cards from each group or otherwise supporting students in keeping the cards until then.

Required Materials

Materials to Gather

- Index cards: Activity 2
- Protractors: Activity 2
- Rulers or straightedges: Activity 2

Student Task Statement

Tu profesor te va a dar 4 tarjetas en blanco. Márcalas con una letra de la A a la D.

1. En cada tarjeta marcada, dibuja un ángulo que cumpla el requisito que le corresponde a esa letra. Usa una regla y un transportador.
    a. un ángulo que sea menor que 35°
    b. un ángulo que esté entre 35° y 80°
    c. un ángulo que sea mayor que 80° pero menor que 120°
    d. un ángulo que sea mayor que 120° pero menor que 180°
2. Intercambia las tarjetas con tu compañero.
    a. Escribe la medida de cada ángulo. Revisa para asegurarte de que cada ángulo cumple el requisito.
    b. Haz que tu compañero corrija el ángulo si este no cumple el requisito. Guarda las tarjetas para la próxima lección.

Si te queda tiempo:

1. Haz un dibujo que muestre varios ángulos. Después, escribe algunas descripciones acerca de tu dibujo. Sé lo más específico que puedas.
2. Pídele a tu compañero que reproduzca el dibujo según tus descripciones. ¿Su dibujo se parece al tuyo? Si no es así, revisa tus descripciones y pídele que lo intente de nuevo.

Launch

- Groups of 2
- Give each student one protractor and 4 blank (unlined) index cards.
- Give students access to rulers or straightedges.

Activity

- 7–8 minutes: independent work time on the first question, and then switch cards to complete the second set of questions

Activity Synthesis

- Invite students to share 1–2 examples of an angle that meets each requirement.
- Consider asking:
    - *"¿Pueden saber con solo mirar que este ángulo mide _____?"* // "Can you tell just by looking that this angle is _____?"
    - *"Si dijeron que sí, expliquen"* // "If you say yes, explain."
    - *"Si dijeron que no, ¿qué necesitarían para asegurarse de que mide _____?"* // "If you say no, what would you need to make sure it is _____?"

Student Response

1. Answers vary.
2. No response required.

Lesson Synthesis

"Hoy usamos transportadores para dibujar ángulos de varios tamaños y para revisar los dibujos de los otros" // "Today we used protractors to draw angles of different sizes, and to check one another's drawings."

"¿Cuáles fueron algunos retos al intentar dibujar ángulos de manera precisa?" // "What were some challenges in drawing angles precisely?" (The distance between the closest tick marks, showing a 1° angle, is very small. It's easy to misread the marks. If the first ray is not lined up correctly at 0° or 180°, or if the vertex is not lined up exactly at the center point of the protractor, then the created angle would be off.)

"En la última actividad, dibujaron muchos ángulos, algunos más pequeños, algunos más grandes. ¿Algunos tamaños de ángulo fueron más fáciles de dibujar que otros? ¿Por qué sí o por qué no?" // "In the last activity, you drew a bunch of angles, some smaller, some larger. Did you find some sizes of angles easier to draw than others? Why or why not?"

"Si le fuéramos a explicar a un compañero cómo usar un transportador para medir ángulos, ¿qué deberíamos decirle?" // "If we were explaining to a partner how to use a protractor to measure angles, what should we say?"

Suggested Centers

- Target Measurements (2–5), Stage 4: Degrees (Addressing)
- Compare (1–5), Stage 6: Fractions (Supporting)

Cool-down

5 min

Un rayo o dos

Standards

Addressing **4.G.A.1, 4.MD.C.6, 4.MD.C.7**

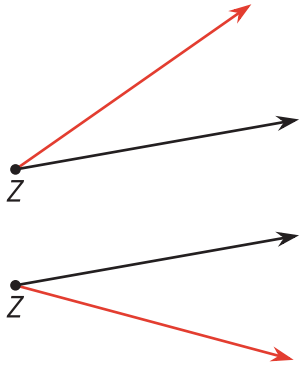
Student Task Statement

1. Dibuja otro rayo que comience en el punto *Z* para crear un ángulo de 25°.

2. Dibuja dos rayos para crear un ángulo que mida 165°.

Student Response

1. Sample responses:



2. Sample response:

Responding to Student Thinking

Students draw an angle that is greater than or less than required.

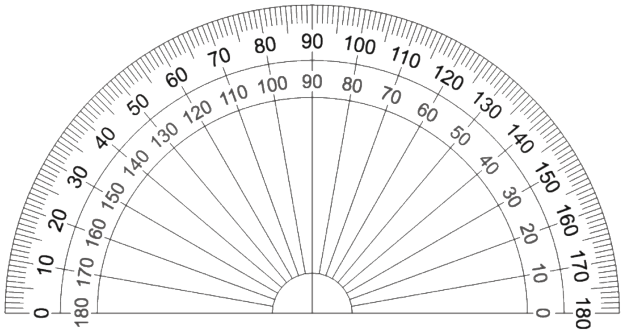
Next Day Supports
Before the *Warm-up*, pass back the *Cool-down* and organize students into small groups to make corrections.

Section B Summary

Aprendimos maneras de describir y de medir el tamaño de un ángulo.

Describimos ángulos como un rayo que gira alejándose de otro. Aprendimos que un grado es una medida del giro alrededor de un círculo y que 1 grado es $\frac{1}{360}$ de un giro completo del rayo en un círculo.

Por último, aprendimos que un transportador es una herramienta que se usa para medir ángulos y que también se puede usar para crear ángulos con una medida específica.



Un transportador tiene dos conjuntos de números que se pueden usar para medir un ángulo. Aprendimos a usar un transportador para medir y dibujar distintos ángulos.