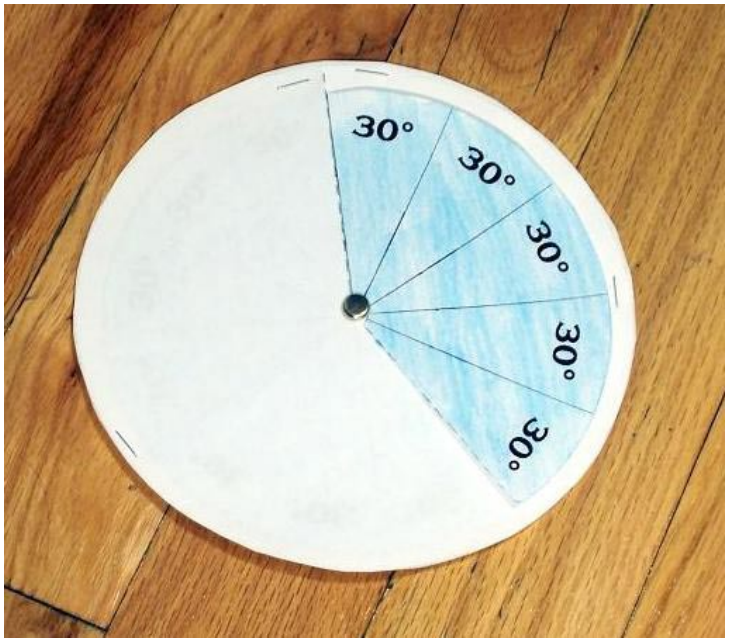
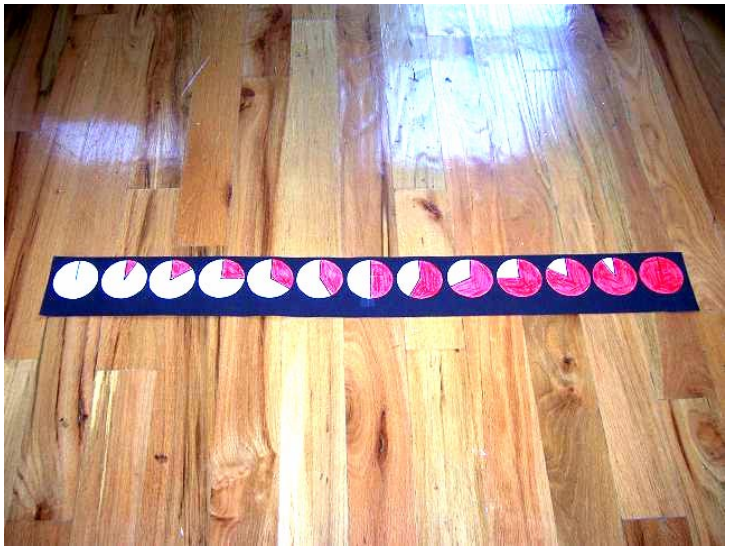
Angles



Materials for the "Paper Protractor"

- 30 degree sheets, page 119 (1 per student)
- Circle sheets, page 120 (2 photocopies per student)
- Crayons (1 color per student)
- Scissors (1 per student)
- Stapler (for the teacher)
- Brass tacks (for the teacher)
- The completed project prepared by the teacher before the lesson



Materials for the "Angel Comparison Strip"

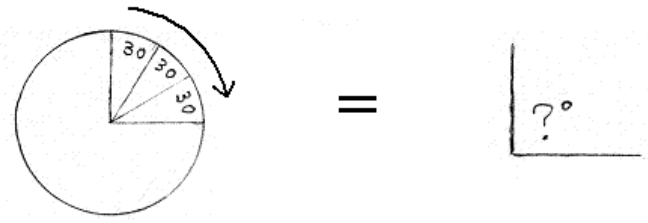
- Pencils (1 per student)
- Angle sheets, pages 121-123 (1 set per student—plus some extra sets held by the teacher in case of student error)
- Paper Protractors constructed by the students in the preceding project (1 per student) OR regular protractors (1 per student)
- Crayons (1 color for each student)
- Scissors (1 per student)
- 12" x 18" construction paper, pre-folded into thirds (1 sheet per student)
- Glue sticks (1 per student)
- The completed project prepared by the teacher before the lesson

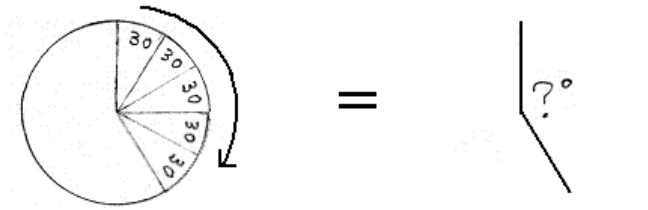
Introduction

This lesson will involve two activities: the construction of a "Paper Protractor" and an "Angle Comparison Strip."* The main purpose of both these projects is to improve students' ability to estimate and compare angle measurements. These skills will make later instruction on triangles, protractors, rotations, and other topics more effective.

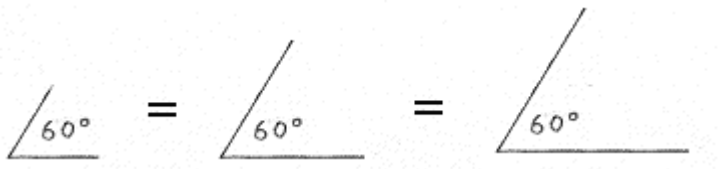
Introduction to the Rotating "Paper Protractor"

Introduce the first project to students by simply asking, "What are angles?" Good responses to elicit are "angles are two connected lines," or "angles are corners." Draw some examples on the board and show students how to use a paper protractor (constructed beforehand by the teacher) to estimate angle sizes. For instance:





Also, teach students that the size of an angle depends on how opened or closed it is, not how long its lines are.



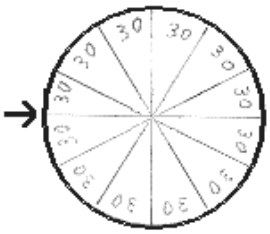
Next, using the paper protractor (or the teacher's previously constructed "Angle Comparison Strip"), the teacher should focus student attention on landmark angles, namely 60, 90, 180, and 360 degrees. Point out to students that the lines of a 90

* Normally, students use their "Paper Protractors" when creating their "Angle Comparison Strips." However, teachers of older students might pass over the "Paper Protractor" project, choosing instead to have students construct the "Angle Comparison Strip" using regular protractors.

degree angle can also be called “perpendicular” lines. Also, show them that a 180 degree angle is when two lines open up to the point of forming a straight line. A 360 degree angle is an angle that has opened up so much that it has closed back on itself, making it look a lot like a 0 degree angle. To really help students remember these landmarks, the teacher or a student volunteer could perform a 180 and/or 360 degree “spin jump” (they will love it).

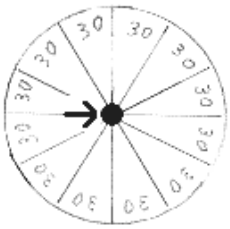
Constructing the Rotating “Paper Protractor”

Students begin making their adjustable paper protractor by coloring their 30 degree sheet (page 119) with a single color crayon. Then they follow three steps to cut it out. First, they cut around the circle. Second, they cut down the dotted line leading to the middle. Finally, they carefully cut out the *very small* black dot in the circle’s center.



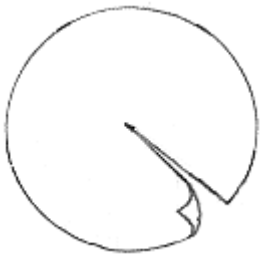
First cut

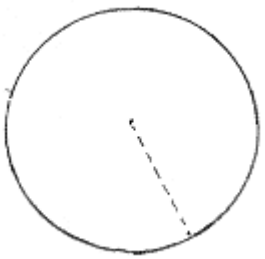
Second cut



Third cut

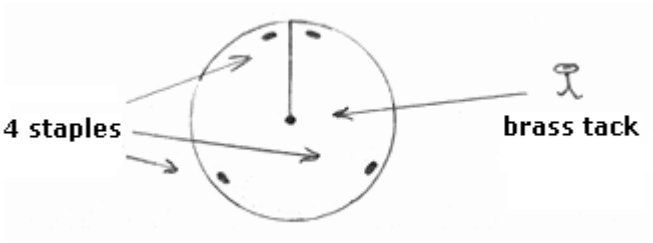
After coloring and cutting the 30 degree sheet, students cut out *two* circle sheets (page 120). Students should cut along the dotted line on *only one* of these circle sheets. The three pieces, unconnected, should look like this:



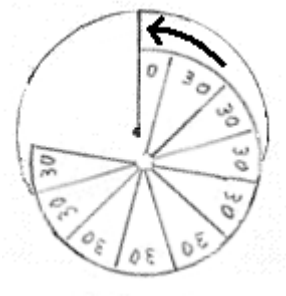


Notice that the 30 degree circle is slightly smaller than the other two circles. This is because the smaller circle will need to easily rotate when it is eventually inserted between the two larger circles.

When a student finishes cutting-out all three pieces, the teacher should assist in putting them together. *Connect the two plain white circles first*, using four staples and a brass tack.



This creates a "container" designed to hold the 30 degree circle. Students insert one of the flaps of the 30 degree circle into the slit located on the container. The students use a turning motion to slide the 30 degree sheet between the container sheets.

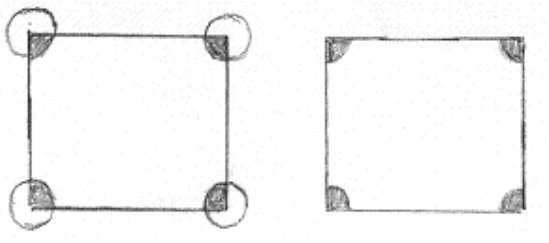


Introduction to the "Angle Comparison Strip"

The "Angle Comparison Strip" places angle measurements in a side-by-side sequence, making comparisons easier. Students draw the angles on the strip by using their Paper Protractor. However, teachers who have chosen to pass over the Paper Protractor project would instead have students complete this second project using real protractors instead of the self-made paper ones.*

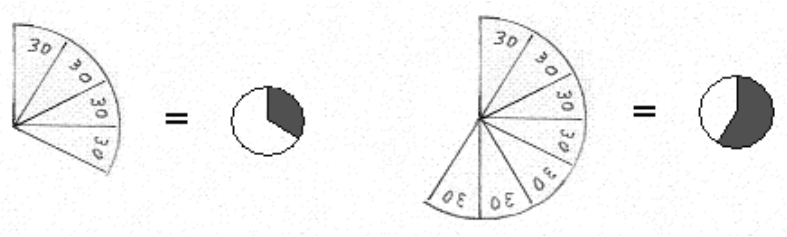
* If real protractors are used instead of the Paper Protractor, it is recommended that the teacher make an overhead projection of the angle sheets (page x, y, and z) so as to better model how to use a real protractor to measure and draw each angle.

Before constructing the Angle Comparison Strip, it is important to remind students that angles are not always in circles. Drawing two diagrams such as the ones below will help students understand that angle measurements are the same whether or not they have a circle around them.

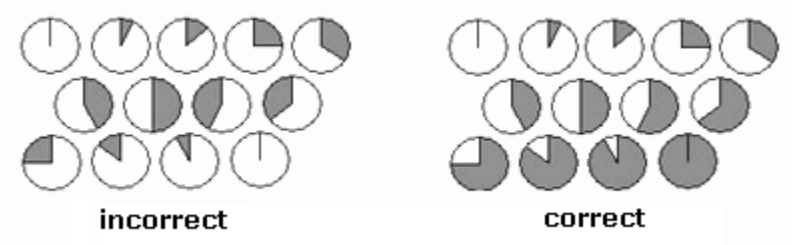


Constructing the "Angle Comparison Strip"

To start the project, students use their Paper Protractor to measure (and a pencil to draw) the 13 angle measurements indicated on their angle sheets (pages 121-123). Using their Paper Protractor requires students to draw angles equal in degree measurement but smaller in scale. It also has them counting by 30's.



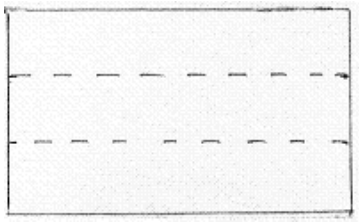
After drawing the angles in pencil, students can use a single crayon to color the interior of each angle. It is extremely common for students to make the mistake of coloring the wrong side of angles greater than 180 degrees.



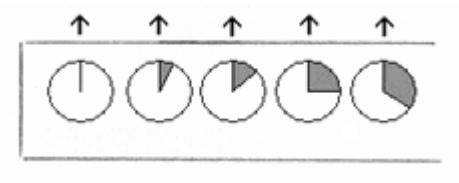
However, this mistake is instructive, since it causes students to think about each angle's reflex angle. Therefore, the teacher probably should not warn students beforehand. Just make sure to have backup angle sheets available.

After coloring the interior of each angle, students should cut out each circle. The teacher should have prepared sheets of 12" x 18" construction paper, pre-folded into

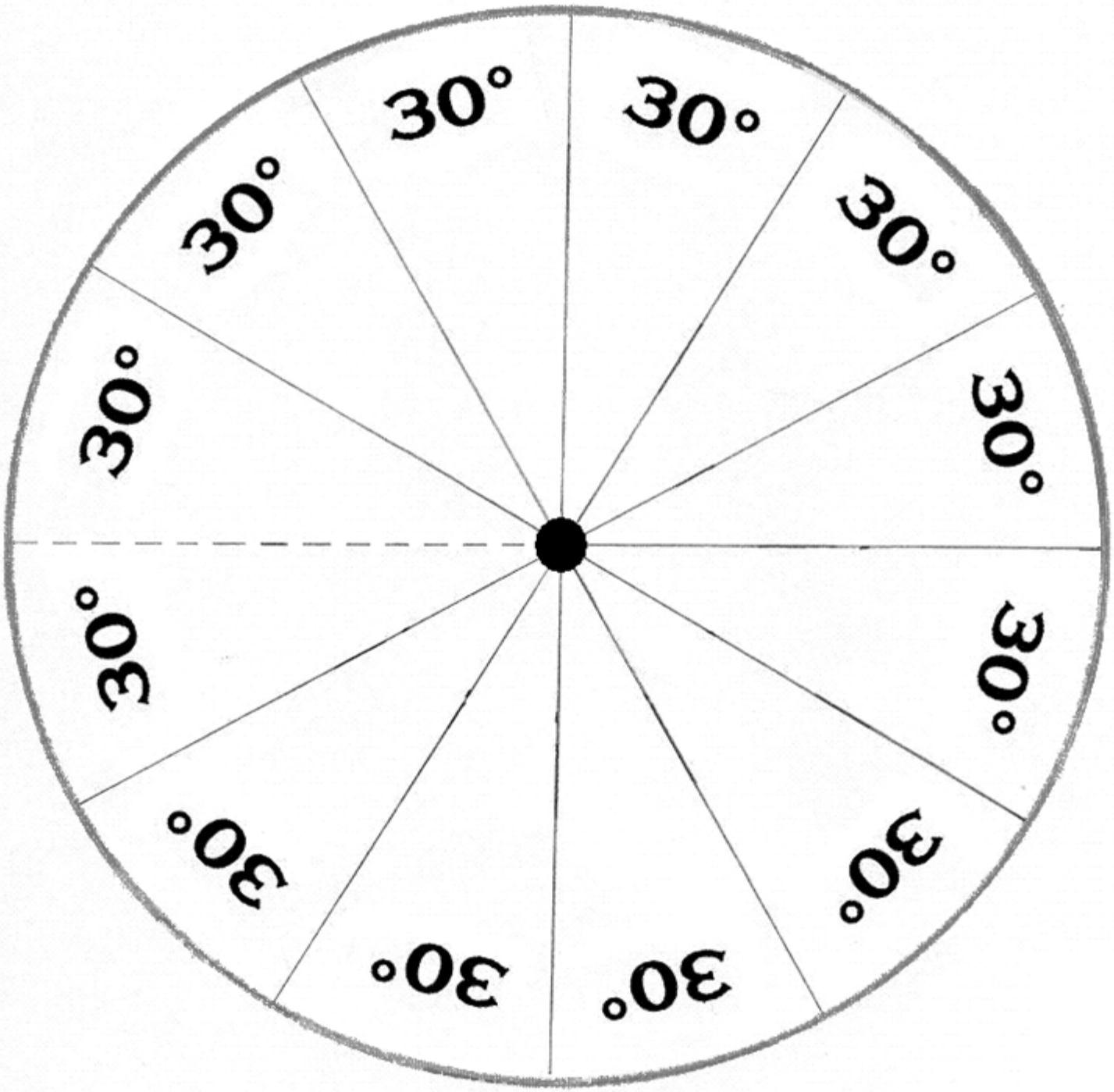
thirds. Students should cut the construction paper along the folded lines into three strips. They glue two of the strips together end-to-end, saving the third strip in case it is needed. If students use space frugally they should not need to connect more than two of the strips.



After constructing their long strip, students should lay their thirteen circles across the strip and check with the teacher before beginning to glue them. The circles should be in correct order, arranged tightly, and all pointing the same direction (the top line of each angle should point upwards).



Assessment: Page 174


30°
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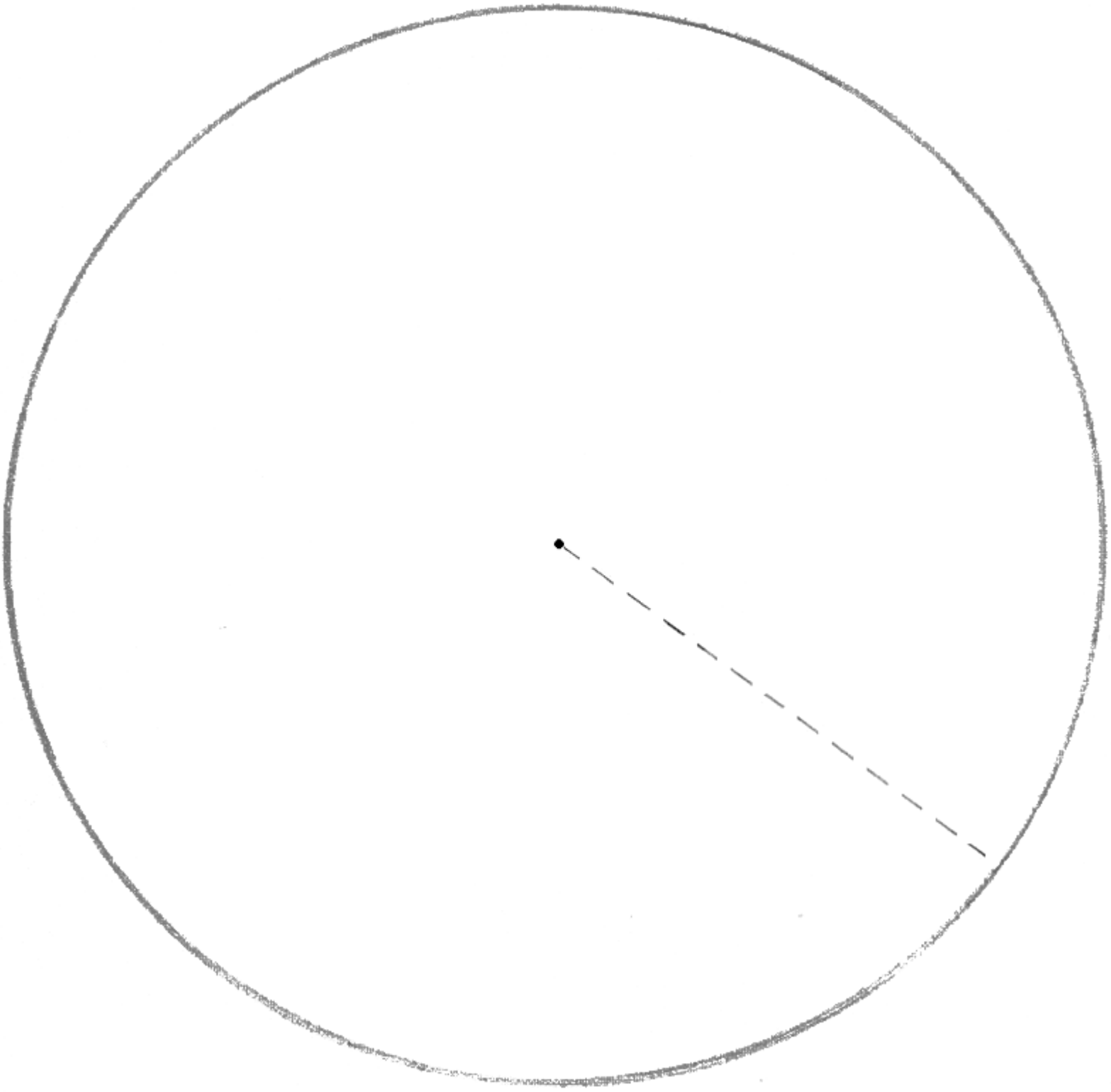
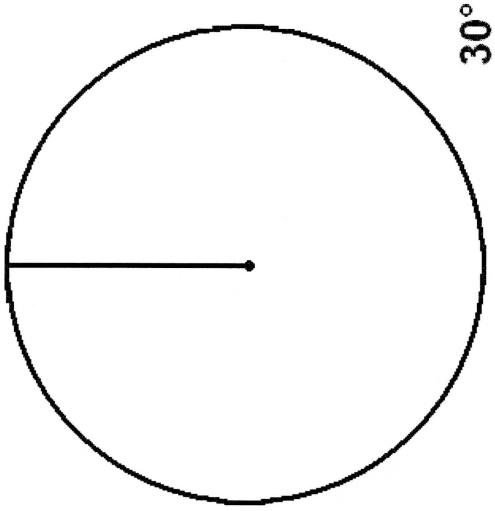
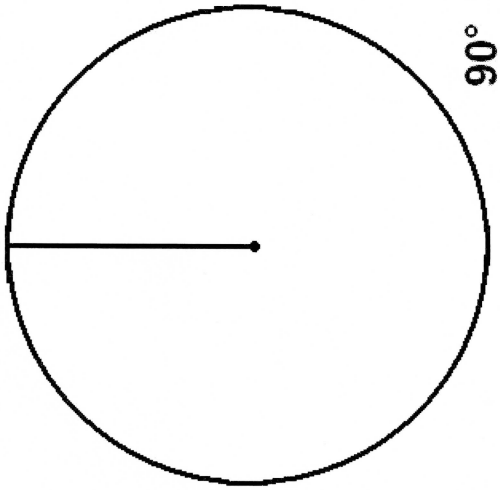
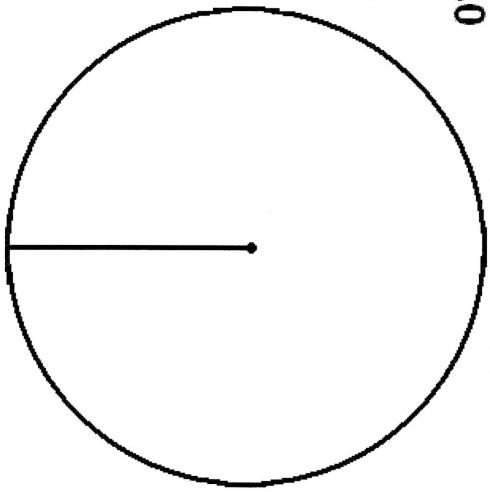
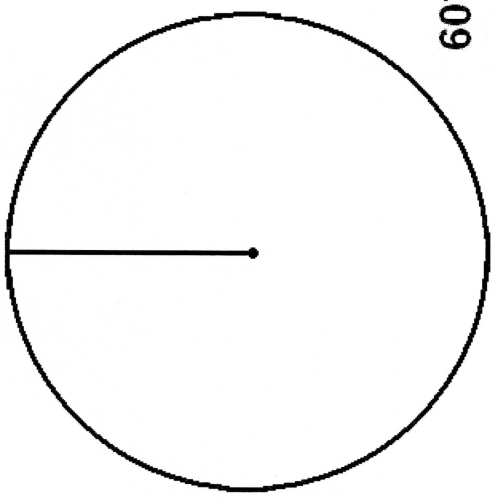
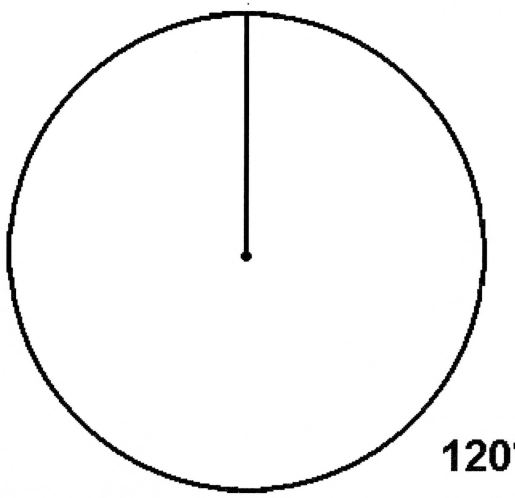



30°

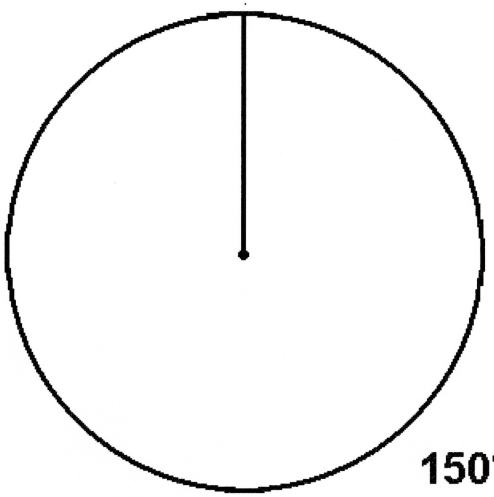

90°


0°

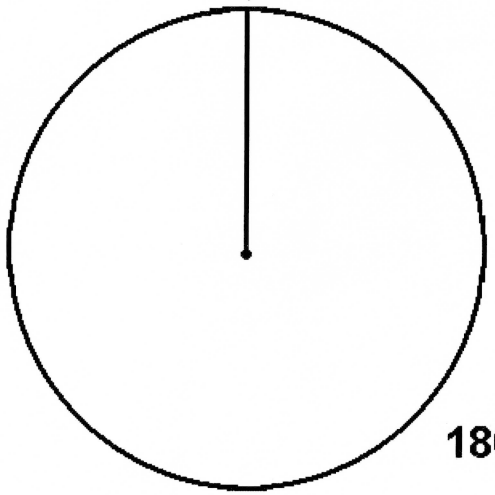

60°



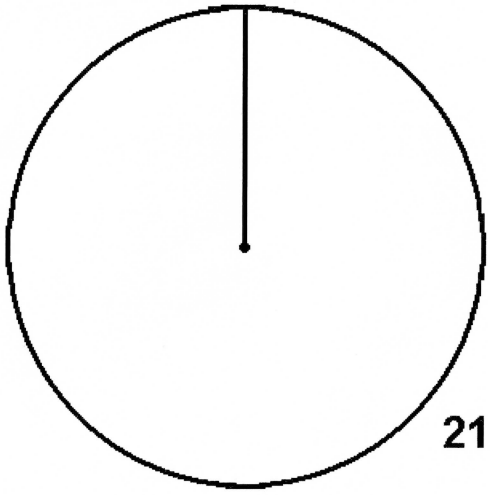
120°



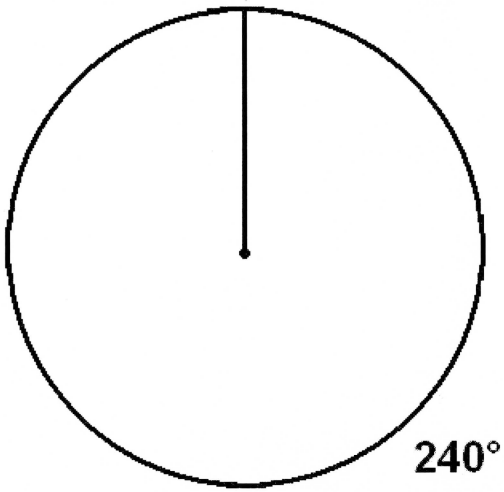
150°



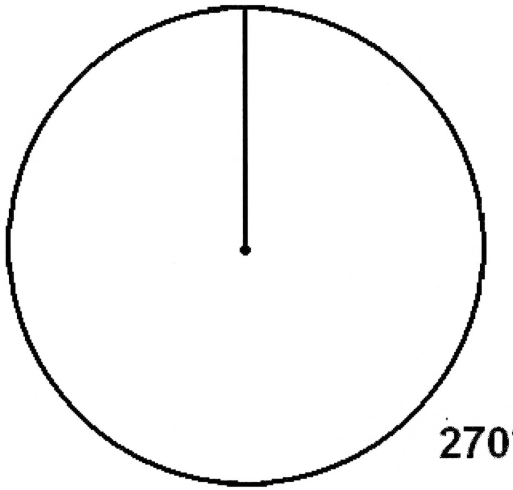
180°



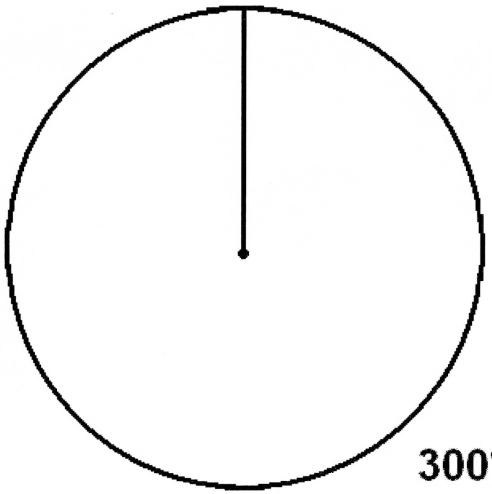
210°



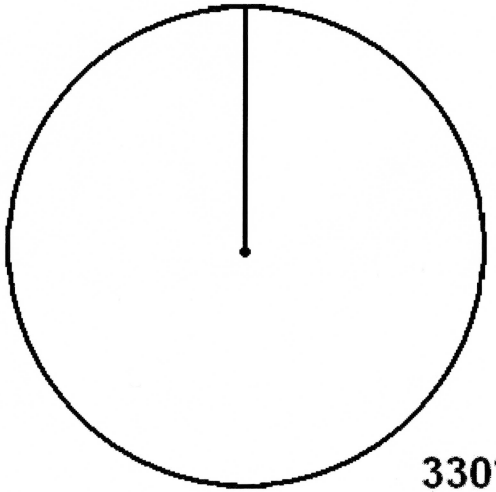
240°



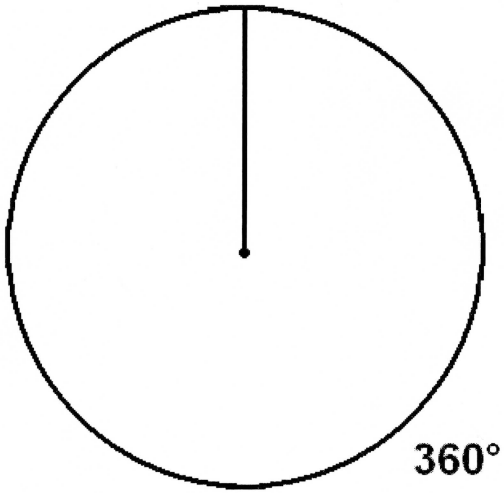
270°



300°



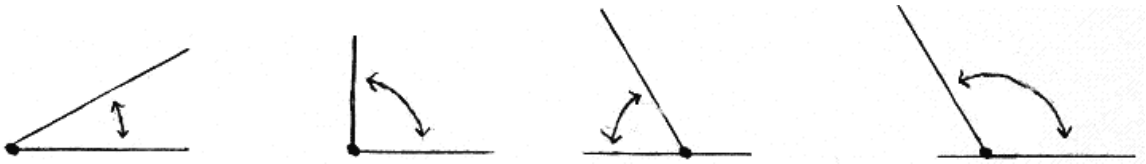
330°



360°

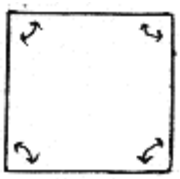
Angles

1. Estimate the size of these angles:



_____ _____ _____ _____

2. How big is each angle in a square?



_____

3. Which angle looks just like a straight line?

_____

4. Circle the triangle that is made of all 60° angles?

5. What size angles do <u>perpendicular</u> lines make?

_____

6. A 0° angles looks a lot like what other angle?

_____

7. REALLY HARD QUESTION: How big is the angle on the other side of the 210° angle?