Another FREE SAMPLE LAB from TOPS LEARNING SYSTEMS!

This **TOPS Idea** is taken from an original series of black-and-white line masters, adapted to stand alone as an independent mini-lesson. Please purchase our original book to get the whole in-depth program.

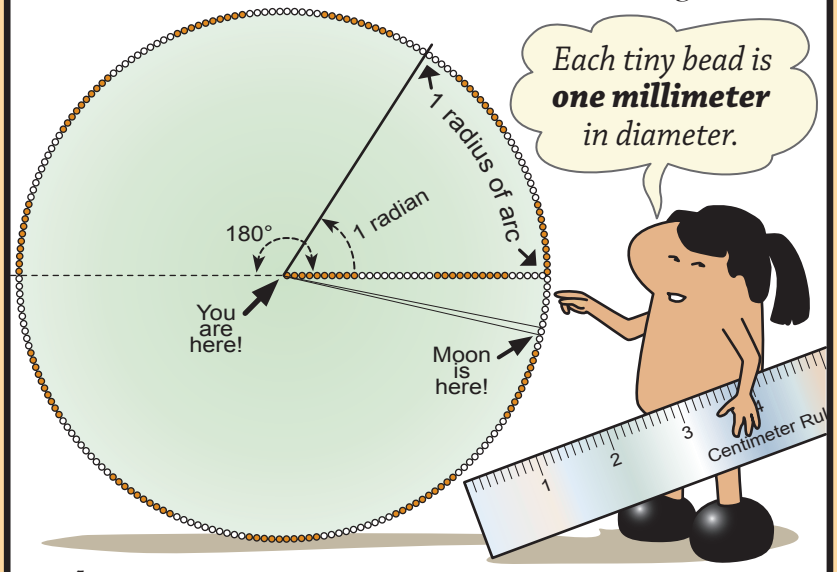
millimeter beads

…adapted from **PI IN THE SKY #45** by TOPS Learning Systems

1. Count the ***mm beads*** to find the radius (R), diameter (D), and circumference (C) of this circle. How many D's fit around C? How many R's?

2. Argue that 180° = π radians.

3. ***If*** the moon were 35 moon-diameters from Earth, what would be its apparent angular size in radians? In degrees?



4. Our moon is ***actually*** 110 moon-diameters away. What tiny angle does it subtend in your field of view?

OBJECTIVE

To understand the geometry of circles, and how astronomers calculate *apparent angular size*.

MATERIALS

- A metric ruler or straight edge.
- A calculator.

MODEL ANSWERS

1. R = 35 mm; D = 70 mm. C = 220 mm.
D fits into C π times! (π = $3\,1/7$ = $22/7$ = 3.14).
R fits into C 2π times.

2. Students might draw 3 one-radian angles, observing that they fall 5 beads short of 180°:
$3\,5/35$ rad = $3\,1/7$ rad = π rad = 180°

3. angular size = $1/35$ radius of arc
($1/35$ rad) (180° / π rad) = 1.64°

4. angular size = 1/110 radian
($1/110$ rad) (180° / π rad) = 0.52°

EVALUATION

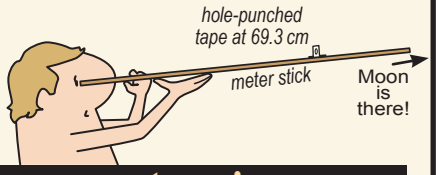
- If you divided a pizza into radian slices, how many would you have? *2π slices = $6\,2/7$ slices*
- How big does a paper plate appear when viewed at a distance of 110 paper-plate diameters from your eye? *$1/110$ radian, about $1/2$°*

EXTENSION

Model the *apparent angular size* of our real moon by holding a paper-punch hole precisely 110 hole-diameters from your eye! Let students engineer creative ways to do this on their own:

moon diameter = 3,480 km
average orbiting distance = 384,000 km
10 paper punch diameters = 6.3 cm
110 paper punch diameters = 69.3 cm

Use string, straws and tape; or adding machine tape; or paper-punched masking tape stuck to a window; or a meter stick.... The moon can't possibly look this small! Can it?



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