

Circle Ratio Detectives

Measure several circles and investigate the shared ratio

GRADE 6 • 6.MG.1.c

6.MG.1.c "Develop an approximation for pi (3.14) by gathering data and comparing the circumference to the diameter of various circles, using concrete manipulatives or technological models."

NAME _____ DATE _____

Measure real circular objects, not these printed tables. Record honest observations to the nearest millimeter (0.1 cm). A calculator may be used for ratios; round them to two decimal places.

Materials and setup

Three different-sized circular lids or flat disks labeled A, B and C; nonstretch string, centimeter ruler, paper and pencil.

Wrap string once around the edge without overlap or slack. Straighten and measure it for C. Trace each circle, fold the tracing in half to locate a line through its center, and measure edge-to-edge along that line for d.

Build understanding

Circumference C is distance once around a circle. Diameter d passes through its center from edge to opposite edge. Use the same length unit for both; divide C by d to compare circles of different sizes. Gather measurements before drawing a conclusion about the ratio.

Try it together

In a teacher demonstration, a small circle gives these measurements. How is a comparison ratio calculated?

Demonstration only

Record	Value
Circumference C	9.4 cm
Diameter d	3.0 cm

Divide measurements in the same unit: $9.4 / 3.0 = 3.1333...$ Round the ratio to 3.13. This measured ratio is 3.13; it is an approximation, not an exact universal value.

1. Measure circle A

Measure object A using the string and center-line method. Record its C and d, calculate C/d, and keep the original readings.

Object A

Record	Value
C (cm)	
d (cm)	
C/d	

2. Measure circle B

Measure object B using the string and center-line method. Record its C and d, calculate C/d, and keep the original readings.

Object B

Record	Value
C (cm)	
d (cm)	
C/d	

3. Measure circle C

Measure object C using the string and center-line method. Record its C and d, calculate C/d, and keep the original readings.

Object C

Record	Value
C (cm)	
d (cm)	
C/d	

4. Develop the approximation

Compare all three measured ratios. Give a common approximate value supported by your data. Compare it with 3.14, the usual two-decimal approximation for pi. Explain any differences without changing your readings.

5. Repeat and compare

Choose a circle with C/d farthest from 3.14. If tied, choose any. Remeasure C and d and calculate a second ratio. Write its letter on the lines, record the new values, and explain whether this trial is closer to 3.14; keep the first trial too.

Second trial

Record	Value
New C (cm)	
New d (cm)	
New C/d	

6. Explain the shared ratio

Use one of your measured circles. Predict C and d for a circle with twice its diameter, then calculate the predicted C/d . Explain why changing size should not change the ratio.

7. Radius or diameter?

A circular disk has radius 4 cm and measured circumference 25.1 cm. Sam divides 25.1 by 4 and claims the circle disproves the class pattern. Identify the wrong measurement choice, correct the ratio and compare it with 3.14.

Teacher notes

Observe gathering of data from three distinct real circles. Do not accept copied demonstration values as actual measurements. Grade computations against recorded measurements and explanations against method. Do not require every empirical ratio to equal 3.14 or discard inconvenient readings. The investigation supports an approximation; it does not prove pi is rational.

Task 1

Answers vary. Check a real circumference and center-crossing diameter in cm. The ratio must equal the recorded C divided by d, rounded to two decimal places.

Task 2

Answers vary. Check a real circumference and center-crossing diameter in cm. The ratio must equal the recorded C divided by d, rounded to two decimal places.

Task 3

Answers vary. Check a real circumference and center-crossing diameter in cm. The ratio must equal the recorded C divided by d, rounded to two decimal places.

Task 4

Ratios should cluster near 3.14 with careful measurement, but answers must reflect real observations. Explain precision, slack string or a diameter missing the center if results differ. Pi is not exactly 3.14.

Task 5

Answers vary; any tied circle is valid. Compare $|C/d - 3.14|$. Check new measurements and ratio against the first trial; the second need not be closer.

Accept an equivalent justified solution with the required model or recorded evidence.

Task 6

Using measured C and d, doubled measures are 2C and 2d. Their quotient $(2C)/(2d)$ equals C/d. The circle is scaled equally around and across; measurements may still contain error.

Accept an equivalent justified solution with the required model or recorded evidence.

Task 7

4 cm is the radius, not diameter. Diameter is 8 cm; $25.1 / 8 = 3.1375$, rounded to 3.14. The mistaken ratio $25.1 / 4 = 6.275$ is about twice the expected ratio.