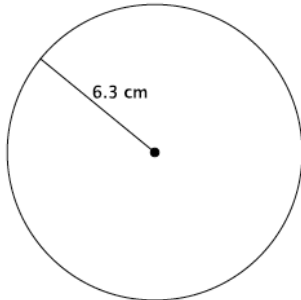# Lesson 14: The Decimal Expansion of π
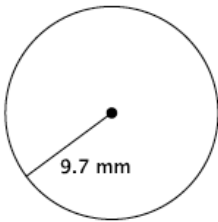
Classwork

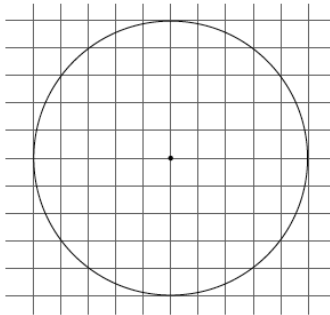### Opening Exercises 1–3

1. Write an equation for the area, A, of the circle shown.

2. Write an equation for the circumference, C, of the circle shown.

3. Each of the squares in the grid below has an area of 1 unit^2.

   a. Estimate the area of the circle shown by counting squares.

   b. Calculate the area of the circle using a radius of 5 units and 3.14 for π.

COMMON CORE | **Lesson 14:** The Decimal Expansion of π
Date: 4/5/14
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Exercises 4–7

4. Gerald and Sarah are building a wheel with a radius of 6.5 cm and are trying to determine the circumference. Gerald says, "Because $6.5 \times 2 \times 3.14 = 40.82$, the circumference is 40.82 cm." Sarah says, "Because $6.5 \times 2 \times 3.10 = 40.3$ and $6.5 \times 2 \times 3.21 = 41.73$, the circumference is somewhere between 40.3 and 41.73." Explain the thinking of each student.

5. Estimate the value of the irrational number $(6.12486 \dots)^2$.

6. Estimate the value of the irrational number $(9.204107 \dots)^2$.

7. Estimate the value of the irrational number $(4.014325 \dots)^2$.

Lesson Summary

Irrational numbers, such as π, are frequently approximated in order to compute with them. Common approximations for π are 3.14 and $\frac{22}{7}$. It should be understood that using an approximate value of an irrational number for computations produces an answer that is accurate to only the first few decimal digits.

Problem Set

1. Caitlin estimated π to be $3.10 < \pi < 3.21$. If she uses this approximation of π to determine the area of a circle with a radius of 5 cm, what could the area be?

2. Myka estimated the circumference of a circle with a radius of 4.5 in. to be 28.44 in. What approximate value of π did she use? Is it an acceptable approximation of π? Explain.

3. A length of ribbon is being cut to decorate a cylindrical cookie jar. The ribbon must be cut to a length that stretches the length of the circumference of the jar. There is only enough ribbon to make one cut. When approximating π to calculate the circumference of the jar, which number in the interval $3.10 < \pi < 3.21$ should be used? Explain.

4. Estimate the value of the irrational number $(1.86211 \dots)^2$.

5. Estimate the value of the irrational number $(5.9035687 \dots)^2$.

6. Estimate the value of the irrational number $(12.30791 \dots)^2$.

7. Estimate the value of the irrational number $(0.6289731 \dots)^2$.

8. Estimate the value of the irrational number $(1.112223333 \dots)^2$.

9. Which number is a better estimate for π, $\frac{22}{7}$ or 3.14? Explain.

10. To how many decimal digits can you correctly estimate the value of the irrational number $(4.56789012 \dots)^2$?