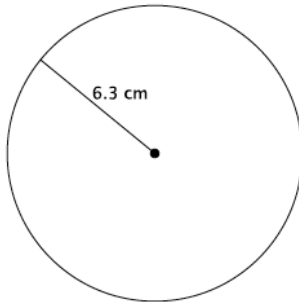


## Lesson 14: Decimal Expansion of $\pi$

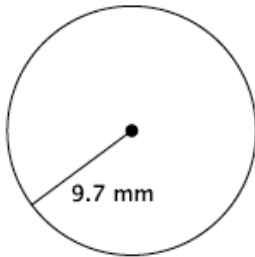
### Classwork

#### Opening Exercise

- a. Write an equation for the area,  $A$ , of the circle shown.



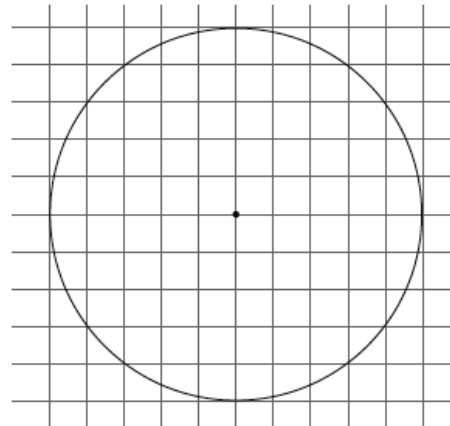
- b. Write an equation for the circumference,  $C$ , of the circle shown.



- c. Each of the squares in the grid on the following page has an area of 1 unit<sup>2</sup>.

- i. Estimate the area of the circle shown by counting squares.

- ii. Calculate the area of the circle using a radius of 5 units. Use 3.14 as an approximation for  $\pi$ .



**Exercises 1–4**

1. 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.
2. Estimate the value of the number  $(6.12486\dots)^2$ .
3. Estimate the value of the number  $(9.204107\dots)^2$ .
4. Estimate the value of the number  $(4.014325\dots)^2$ .

**Lesson Summary**

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

**Problem Set**

1. Caitlin estimated  $\pi$  to be  $3.10 < \pi < 3.21$ . If she uses this approximation of  $\pi$  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  $\pi$  did she use? Is it an acceptable approximation of  $\pi$ ? 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  $\pi$  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 number  $(1.86211\dots)^2$ .
5. Estimate the value of the number  $(5.9035687\dots)^2$ .
6. Estimate the value of the number  $(12.30791\dots)^2$ .
7. Estimate the value of the number  $(0.6289731\dots)^2$ .
8. Estimate the value of the number  $(1.112223333\dots)^2$ .
9. Which number is a better estimate for  $\pi$ ,  $\frac{22}{7}$  or 3.14? Explain.
10. To how many decimal digits can you correctly estimate the value of the number  $(4.56789012\dots)^2$ ?