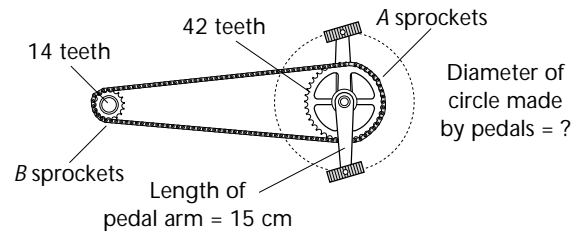
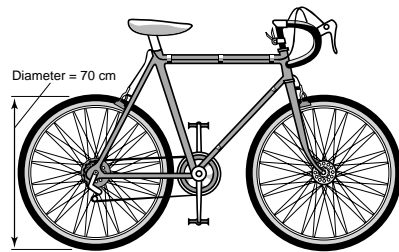


A Bicycle Trip

Use your math skills to see how the gears of a bicycle transfer energy.

The gears on a bicycle make up a system for transferring energy from the rider's legs to the front sprockets (or gears) and then through the chain to the rear wheel. The 12-speed bicycle below has two front sprockets (A) connected to the pedals. The sprockets contain 42 and 52 teeth, respectively. The rear wheel has a diameter of 70 cm. It has six different-sized sprockets (B) attached at the center containing 14, 17, 20, 23, 26, and 28 teeth, going from the smallest to the largest sprocket. Front and rear *derailleurs* transfer the chain from one sprocket to another during the process of changing gears. The length of the pedal arm is 15 cm.

Sample Situation



Use What You Know!

Suppose the chain is connected to the smaller sprocket in front, which contains 42 teeth, and to the smallest sprocket in the rear, which contains 14 teeth. Use the sample situation to answer the following questions:

1. When the pedals make one complete rotation, how many teeth in the front sprocket does the chain move over?

2. How many times will the rear sprocket and rear wheel turn during one rotation of the pedals?

3. a. What distance will each foot move during one complete turn (rotation) of the pedals? (*Hint*: circumference = $3.14 \times \text{diameter}$)

- b. What distance will the rear wheel and bicycle move forward while the pedals make one complete turn?

4. How many times farther will the rear wheel of the bicycle move compared with the distance the rider's feet moved?



A Bicycle Trip, continued

5. Using the sample situation from the previous page, fill out the following table:

	Teeth in A	Teeth in B	Wheel turns per pedal turn	Distance (cm) bicycle wheel moves per pedal turn	Distance (cm) pedals move per turn	Ratio of wheel distance to pedal distance
Smallest A connected to largest B	42	28				
Smallest A connected to second largest B		26				
Smallest A connected to third largest B		23				
Smallest A connected to fourth largest B						
Smallest A connected to fifth largest B						
Smallest A connected to smallest B (sample from previous page)			$42 \div 14 = 3$	$3 \times (3.14 \times 70) = 659.4$	$30 \times 3.14 = 94.2$	$659.4 \div 94.2 = 7$
Largest A connected to largest B	52					
Largest A connected to second largest B						
Largest A connected to third largest B						
Largest A connected to fourth largest B		20				
Largest A connected to fifth largest B		17				
Largest A connected to smallest B		14				

Challenge Yourself!

6. Which A sprocket connected to which B sprocket will achieve the greatest distance?

7. What arrangement of the gears will give the least multiplication of the distance?
