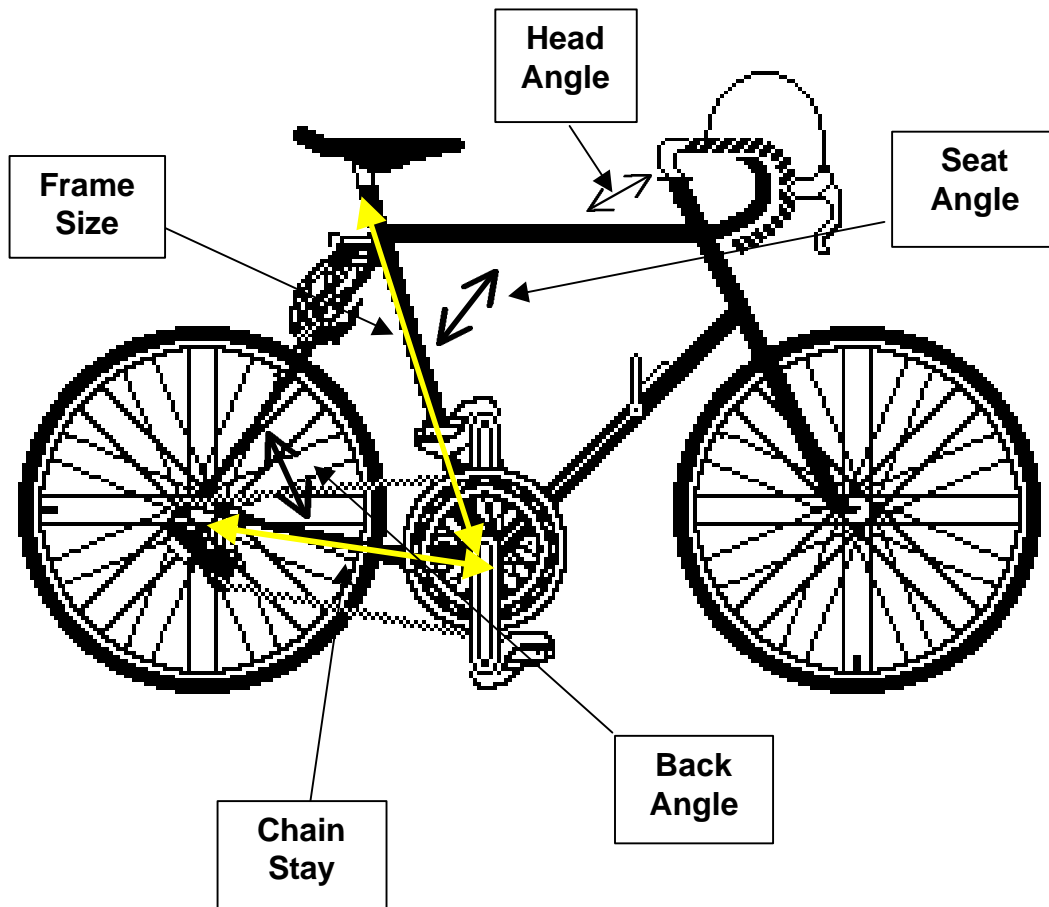


## Activity 1

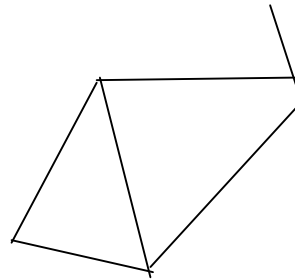
### Industrial Design: The Geometry of Bicycle Designs

The diagram below identifies the various parts of a bicycle: the frame size, chain stay, seat angle, head angle, and back angle. On the pages that follow, measure the different parts for bicycles that have been designed for different purposes (racing, riding on trials, and performing tricks). You can measure the parts on the pictures provided on each page. If you have a real bike available, make the measurements on it as well.



A. Road Bike or Racing Bike (Cannondale™ Saeco Team Replica)

The bicycle below is known as a road bike, used for riding on paved surfaces and for long distance races. The line diagram at the side is made of two triangles and describes the geometry of the frame for this road bike.



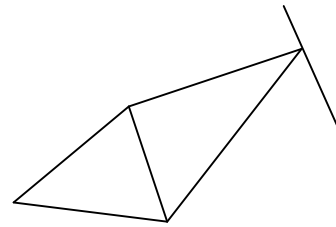
1. Use a ruler and a protractor to measure the lengths and angles that make up the bicycle frame. You should measure the frame size and the chain stay on the picture of the bicycle. The angles can be measured on the line diagram to the right.

Frame Size	
Chain Stay	
Seat Angle	
Head Angle	
Back Angle	

2. Find the ratio of the frame size to the chain stay (the frame Size divided by the length of the chain stay):

B. Mountain Bike or Trail Bike (Cannondale™ F700)

The next bicycle is known as a mountain bike. It is designed for off-road use, for riding and climbing on trails, through woods, over puddles and streams. A line diagram is next to the bicycle to show its frame design clearly.



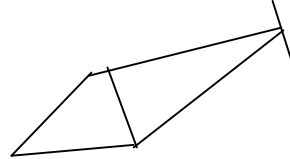
1. Use a ruler and a protractor to measure the lengths and angles that make up the bicycle frame. You should measure the frame size and the chain stay on the picture of the bicycle. The angles can be measured on the line diagram to the right.

Frame Size	
Chain Stay	
Seat Angle	
Head Angle	
Back Angle	

2. Find the ratio of the frame size to the chain stay:

### C. BMX Bike (Huffy™ BMX)

The bicycle below is called a BMX. It is designed for doing tricks on special tracks with ramps and quarter-pipes. BMX bikes are designed for picking up speed quickly and doing spins, wheelies, and jumps.



1. Use a ruler and a protractor to measure the lengths and angles that make up the bicycle frame. You should measure the frame size and the chain stay on the picture of the bicycle. The angles can be measured on the line diagram to the right.

Frame Size	
Chain Stay	
Seat Angle	
Head Angle	
Back Angle	

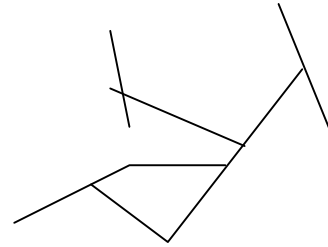
2. Find the ratio of the frame size to the chain stay:

### D. Questions about all three bikes.

Use the information from your tables and the ratios that you calculated for the Road, Mountain, and BMX bikes to respond to the following:

1. Explain the differences in the frame sizes, the chain stays, and the three ratios you found. Are they very different for each bike? Why?
2. Explain why the back angle is different on each bike. Why is it designed that way? Did you find any differences in the seat angle or the head angle? Explain.

3. The last bike is a full-suspension mountain bike with a new style design to allow for a spring that absorbs shock for the back wheel (Cannondale™ Super V800). Notice the familiar geometry involving triangles can no longer be found in this new design. Bicycle designers are now using much more complicated polygons and shapes.



a. Explain any special features you notice about this new style bicycle.

Why do you think these designs now being used?