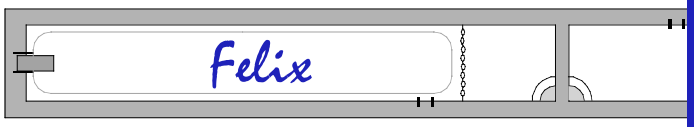
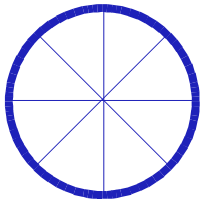
PhyzSpringboard: A New Kind of Motion



1. What distinguishes a moving object from one at rest? ("The moving one is moving and the one at rest isn't," or other such circular answers would be unacceptable here.)

The POSITION or LOCATION of a moving object changes as time goes by. An object at rest remains at one position. By position or location, we are referring to an object's center of mass.

2. The words above form a definition for translational or linear motion. By this definition, does the



spinning bicycle wheel

qualify as a moving object? Justify your answer.

No. Its position is not changing.

3. Do you agree with this classification of the object? Why or why not?

No. The spinning bicycle wheel IS moving; it's spinning! There are parts of it whose positions are changing. It's moving. It just doesn't fit our definition of moving.

4. The motion seen in the object is a new kind of motion. A kind of motion we have not yet studied. In this kind of motion, what about the moving object changes?

Angle...? Angle with respect to something...?
ORIENTATION! The orientation of the object is changing.

5. What are two names we could use to describe this new kind of motion? (Recall we had two names—*translational* and *linear*—for the kind of motion we have studied so far.)

ROTATIONAL as opposed to translational.
ANGULAR as opposed to linear.

6.a. How far does an object need to turn so that its orientation changes?

An infinitesimal amount.

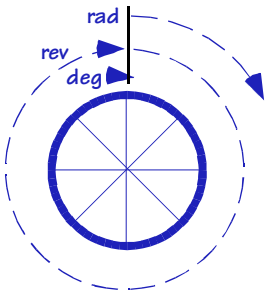
b. How many different orientations does an object go through in one complete turn?

Infinite!

c. Which involves passing through a greater number of different orientations: rotating 1/100th of a turn or rotating one complete turn?

Same for both: Infinite!

7.a. For objects in translational motion, we measure changes in position with units such as meters, inches, and light-years. What would be appropriate units for measuring the changes in ___orientation___ that occur in ___rotational___ motion? And how do they relate to each other?



Degrees, revolutions, radians.
1 rev = 360° = 2 rad

b. Which of these do we prefer for scientific work?

Radians

8. How could we distinguish a "fast" object from a "slow" one in this new kind of motion?

FAST turns through more degrees/revolutions/radians in each second and SLOW.

9.a. What units of measure would be appropriate for quantifying fastness or slowness of this kind of motion?

Degrees per second (°/s),
Revolutions per second (rev/s),
Radians per second (rad/s).

b. Which of these do we prefer in scientific work?

Radians per second (rad/s).

10. An old-style phonograph record turns through 936 revolutions in 12 minutes.
a. What is the meaning of 936/12 in this context?

The number of revolutions the record made in each minute.

b. What is the meaning of 12/936 in this context?

The number of minutes the record needed to make turn each revolution.