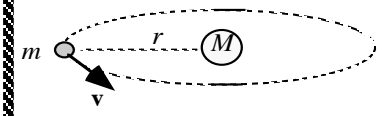
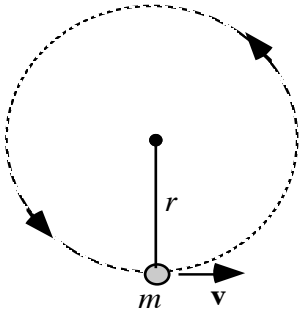
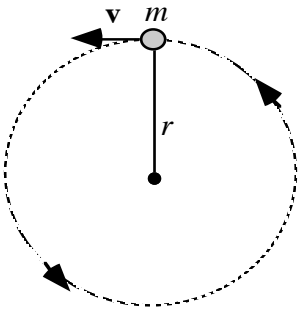
CIRCULAR MOTION REPRESENTATION CHANGES 1

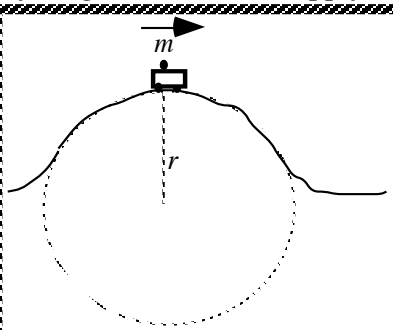
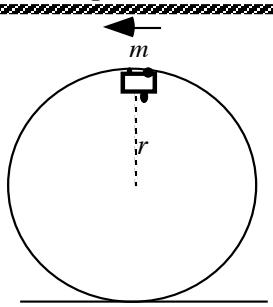
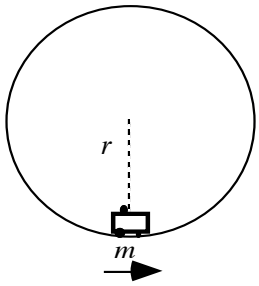
For each situation below, determine the direction of the acceleration of m, construct a free-body diagram for m, and apply the radial component form of Newton's second law for m.

Sketch	 Smaller mass moving in circular orbit about larger mass.	 Ball moving at constant speed in a vertical circle at the end of a string.	 Ball moving at constant speed in a vertical circle at the end of a string.
Direction of a			
FBD for *m*			
Apply $\Sigma F_{\text{radial}} = m a_c$			

Does the direction of acceleration agree with the direction of the net force?

CIRCULAR MOTION REPRESENTATION CHANGES 2

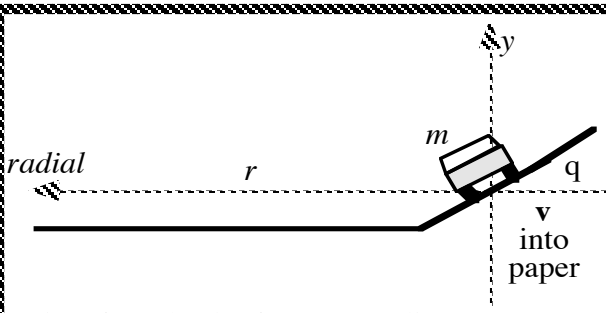
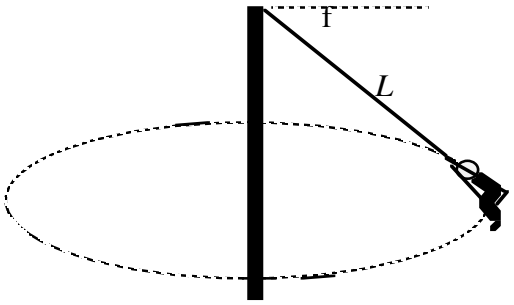
For each situation below, determine the direction of the acceleration of m, construct a free-body diagram for m, and apply the radial component form of Newton's second law for m.

Sketch	 A car traveling toward right at constant speed over a circular hump in a road.	 A cart coasting in the counterclockwise direction around a loop-the-loop.	 A cart coasting in the counterclockwise direction around loop-the-loop.
Acceleration	Subtract velocities to find direction of a	Subtract velocities to find direction of a	Subtract velocities to find direction of a
FBD for *m*	Make force arrows appropriate relative lengths.	Make force arrows appropriate relative lengths.	Make force arrows appropriate relative lengths.
Apply $\Sigma F_{\text{radial}} = m a_c$			

Does the direction of acceleration agree with the direction of the net force?

CIRCULAR MOTION REPRESENTATION CHANGES 3

For each situation below, determine the direction of the acceleration of m, construct a free-body diagram for m, and apply the component form of Newton's second law for m.

Sketch	 View from back of a car traveling at constant speed v on a banked highway curve. The circular path along that portion of the highway has a radius r. The friction force on the car is zero.	 The person moves in a circle at the end of a rope at speed v.
Direction of a		
FBD for m		
Apply $\Sigma F_{\text{radial}} = m a_c$ **and** $\Sigma F_y = m a_y$ (vertical)		

Circular Motion 1

A rock is being swung in a vertical circle. The rock is attached to a string that you are holding to swing it in a vertical circle. Draw a diagram to represent the path of the rock as it is being swung at a constant speed in a vertical circle. Ignore any effects due to air resistance.

What direction is the rock's acceleration at the top of the circle? _____
Use a motion diagram on the sketch above to determine this.

What direction is the net force acting on the rock at the top of the circle? _____
Use a freebody diagram to help you identify the type of force(s) acting on the rock and the two objects involved with each force(s).

What direction is the rock's acceleration at the bottom of the circle? _____
Use a motion diagram to determine this.

What direction is the net force acting on the rock at the bottom of the circle? _____
Use a freebody diagram to help you identify the type of force(s) acting on the rock and the two objects involved with each force(s).

Circular Motion 2

A rock is being swung in a horizontal circle (path is parallel to the ground). The rock is attached to a string that you are holding to swing it in a horizontal circle. Draw a diagram to represent the path of the rock as it is being swung at a constant speed in a horizontal circle. Ignore any effects due to air resistance.

What direction is the rock's acceleration at the rightmost part of the circle? _____
Use a motion diagram on the sketch above to determine this.

What direction is the net force acting on the rock at this rightmost point? _____
Use a freebody diagram to help you identify the type of force(s) acting on the rock and the two objects involved with each force(s).

What direction is the rock's acceleration at the leftmost part of the circle? _____
Use a motion diagram to determine this.

What direction is the net force acting on the rock at this leftmost point? _____
Use a freebody diagram to help you identify the type of force(s) acting on the rock and the two objects involved with each force(s).

Circular Motion 3

A car is going over a small hill. Draw a diagram to represent the path of the car as it is going over the top of the hill at a constant speed. Ignore any effects due to air resistance.

What direction is the car's acceleration at the top of the hill? _____
Use a motion diagram on the sketch above to determine this.

What direction is the net force acting on the car at the top of the hill? _____
Use a freebody diagram to help you identify the type of force(s) acting on the car and the two objects involved with each force(s).

Which of the vertical forces is the larger? _____

Which of the vertical forces is the smaller? _____

What sensation do you feel when you go over the top of the hill?

If you go fast enough over the top of the hill, it is possible for the car to actually leave the road surface. If this occurs, what happens to the normal force?

What happens to the gravitational weight force?

Circular Motion 4

A car is going into a dip in the road. Draw a diagram to represent the path of the car as it is going over the bottom of the dip at a constant speed. Ignore any effects due to air resistance.

What direction is the car's acceleration at the bottom of the dip? _____
Use a motion diagram to determine this.

What direction is the net force acting on the car at the bottom of the dip? _____
Use a freebody diagram to help you identify the type of force(s) acting on the car and the two objects involved with each force(s).

Which of the vertical forces is the larger? _____

Which of the vertical forces is the smaller? _____

What sensation do you feel when you go through the bottom of the dip?

Circular Motion 5

A cart is going around a loop-the-loop ride. Draw a diagram to represent the path of the cart as it is going through the top of the loop at a constant speed. Ignore any effects due to air resistance.

What direction is the cart's acceleration at the top of the loop? _____
Use a motion diagram on the sketch above to determine this.

What direction is the net force acting on the cart at the top of the loop? _____
Use a freebody diagram to help you identify the type of force(s) acting on the cart and the two objects involved with each force(s).

Circular Motion 6

A cart is going around a loop-the-loop ride. Draw a diagram to represent the path of the cart as it is going through the bottom of the loop at a constant speed. Ignore any effects due to air resistance.

What direction is the cart's acceleration at the bottom of the loop? _____
Use a motion diagram on the sketch above to determine this.

What direction is the net force acting on the cart at the bottom of the loop? _____

Use a freebody diagram to help you identify the type of force(s) acting on the cart and the two objects involved with each force(s).

Circular Motion 7

Draw a diagram to represent a point in the space shuttle's orbit around the Earth.

What direction is the shuttle's acceleration at this point in its orbit? _____
Use a motion diagram on the sketch above to determine this.

What direction is the net force acting on the shuttle at this point in its orbit? _____

Use a freebody diagram to help you identify the type of force(s) acting on the shuttle and the two objects involved with each force(s).