This print-out should have 11 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 (part 1 of 2) 10.0 points
An amusement park ride consists of a rotating circular platform 8.78 m in diameter from which 10 kg seats are suspended at the end of 3.54 m massless chains. When the system rotates, the chains make an angle of 40.7° with the vertical.

The acceleration of gravity is \( g \). 8 m/s².

What is the speed of each seat? Answer in units of m/s.

002 (part 2 of 2) 10.0 points
If a child of mass 49.1 kg sits in a seat, what is the tension in the chain (for the same angle)? Answer in units of N.

003 (part 1 of 2) 10.0 points
An amusement park ride consists of a large vertical cylinder that spins about its axis fast enough that any person inside is held up against the wall when the floor drops away (see figure). The coefficient of static friction between the person and the wall is \( \mu \) and the radius of the cylinder is \( R \).

Set up two \( \varepsilon \) sets, what \( \varepsilon \) should \( \varepsilon \) be?

004 (part 2 of 2) 10.0 points
Suppose a person whose mass is \( m \) is being held up against the wall with a constant tangential velocity \( v \) greater than the minimum necessary.

Find the magnitude of the frictional force between the person and the wall.

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004 (part 2 of 2) 10.0 points
Suppose a person whose mass is \( m \) is being held up against the wall with a constant tangential velocity \( v \) greater than the minimum necessary.

Find the magnitude of the frictional force between the person and the wall.
3. \( F = mg + \frac{\mu m v^2}{R} \)
4. \( F = \frac{\mu m v^2}{R} - mg \)
5. \( F = \frac{mv^2}{R} \)
6. \( F = \mu mg + \frac{mv^2}{R} \)
7. \( F = \frac{mv^2}{\mu R} \)
8. \( F = mg \)
9. \( F = \mu \frac{mv^2}{R} \)
10. \( F = \mu mg \)

005 10.0 points
A ball rolls around a circular wall, as shown in the figure below. The wall ends at point X.

When the ball gets to X, which path does the ball follow?
1. Path C
2. Path A
3. Path D
4. Path E
5. Path B

006 (part 1 of 3) 10.0 points
A hawk flies in a horizontal arc of radius 18.6 m at a constant speed of 3.9 m/s.

Find its centripetal acceleration. Answer in units of m/s².

007 (part 2 of 3) 10.0 points
It continues to fly along the same horizontal arc but increases its speed at the rate of 0.84 m/s².

Find the magnitude of acceleration under these new conditions. Answer in units of m/s².

008 (part 3 of 3) 10.0 points
Find the direction of acceleration relative to the direction of motion under these conditions. Answer between -180° and 180°. Answer in units of °.

\[ \theta = \tan^{-1}\left( \right) \]

009 10.0 points
A racing car is traveling on a circular race course of radius 574 m at a speed such that it makes 1.32 rev in 1 minute. The mass of the car is 1220 kg.

What is the centripetal force acting on the car? Answer in units of N.

010 (part 1 of 2) 10.0 points
A car rounds a slippery curve. The radius of curvature of the road is \( R \), the banking angle with respect to the horizontal is \( \theta \) and the coefficient of friction is \( \mu \).

What should be the car’s speed in order that there is no frictional force between the car and the road?
1. \( v = \sqrt{gR\tan\theta} \)
2. \( v = \sqrt{g\sin\theta} \)
3. \( v = \sqrt{gR\cos\theta} \)
What is the minimum speed required in order for the car not to slip?

1. \( v_{\text{min}} = \sqrt{\frac{gR}{\mu \sin \theta + \cos \theta}} \)
2. \( v_{\text{min}} = \sqrt{\frac{gR (\sin \theta + \mu \cos \theta)}{\cos \theta - \mu \cos \theta}} \)
3. \( v_{\text{min}} = \sqrt{gR (\sin \theta + \mu \cos \theta)} \)
4. \( v_{\text{min}} = \sqrt{\frac{gR (\cos \theta + \mu \cos \theta)}{\mu \sin \theta - \cos \theta}} \)
5. \( v_{\text{min}} = \sqrt{\frac{gR (\sin \theta + \mu \cos \theta)}{\mu \sin \theta + \cos \theta}} \)
6. \( v_{\text{min}} = \sqrt{\frac{gR (\sin \theta - \mu \cos \theta)}{\mu \sin \theta - \cos \theta}} \)
7. \( v_{\text{min}} = \sqrt{\frac{gR (\sin \theta - \mu \cos \theta)}{\mu \sin \theta + \cos \theta}} \)