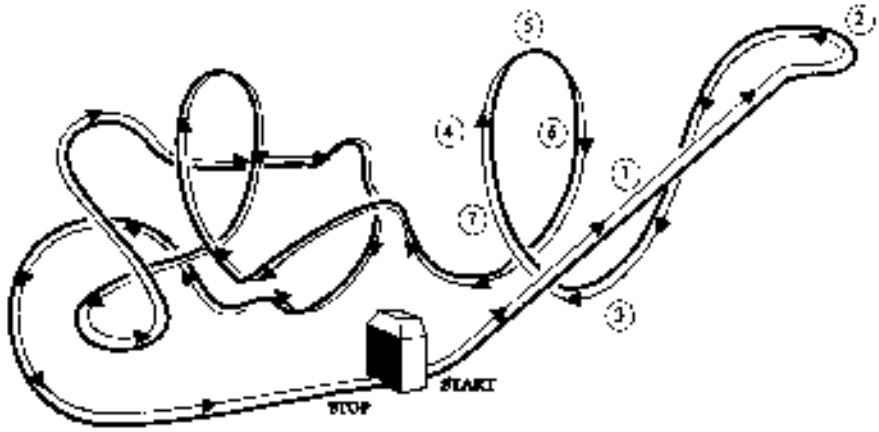
BATMAN™
THE RIDE



1. Calculate the force due to the track, force due to the chain, and the force down the plane due to gravity for a ride up the high rise.

2. Calculate the minimum horsepower needed to haul one Batman train up the high rise.

3. Estimate the speed of the Batman train as it bottoms out right before the first vertical loop.

4. Produce a force diagram for the train in the vertical loop at the following clock positions: 3, 6, 9, and 12 o'clock. Is the force of the track at 12 o'clock the same magnitude as the force of the track at 6 o'clock. Please explain. Calculate the force of the seat for a 60 kg. person at the 3, 9, and 12 o'clock positions.

5. When the train is at the bottom of the first vertical loop, will the supporting feet for the vertical loop push up or pull down at point A? Answer the same question for point B. Please support your answers.

6. Compare the radius of the first vertical loop of Batman to the radius of the first vertical loop of the Iron Wolf. Does each vertical circle have the same radius? Explain any differences. Even though a passenger is riding on the outside of the vertical loop for the Batman ride, does one experience the same sensation for both the Batman and Iron Wolf vertical circles?

7. It has been said that one can easily lose their shoes during this ride. Where would this most likely to happen? If you lost your shoes at your predicted location, where would you place a shoe catcher along the ground?

8. Position yourself along the walkway between the first vertical circle and the zero "g" roll section of Batman. Listen to the sound of the train as it travels down the first big hill through the vertical loop and then through the next vertical loop. Is the frequency of the sound due to the train's motion changing pitch? Please explain.

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9. From point C to point D, the heart line, the path your heart traces through space, follows a parabolic path. Why didn't the engineers design the track to look exactly like a parabola?

10. Total mechanical energy at any one section is potential energy + kinetic energy at that location. When Batman twists through the zero "g" roll does it possess more kinetic energy than if it were to just glide through without twisting? Please explain your answer.

11. Using the diagram on the previous page, record the location of the following:

___ Maximum speed
___ Minimum speed
___ Maximum potential energy
___ Minimum potential energy
___ Maximum kinetic energy
___ Minimun kinetic energy
___ Weightless sensation
___ Heavy sensation

12. Describe your sensation in terms of forces at each point on the labeled diagram of the track layout.

Use the drawing below to answer questions on previous page.