Brachistochrone

More Details

Longer = faster?!?

The shortest route is not always the fastest way to reach a destination. In the end, all three balls have the same speed (because they overcome the same height), but the time they need to pass through the complete track is different. The rear track is a straight line and therefore the shortest path. The middle track has the highest acceleration of all three tracks at the beginning (almost free fall). The front track leads the ball to its destination the fastest, although it is not the shortest of the three tracks. In this case, the lowest point of the track is even lower than the endpoint (Fig. 1).

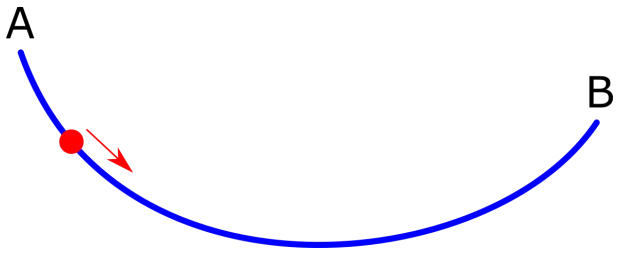

Fig. 1: The ball reaches its destination the fastest, when the track is shaped like the so called Brachistochrone.

Cycloids

The shape of the track that leads to the destination the fastest has the beautiful name Brachistochrone (Greek brachistos = shortest and chronos = time). Mathematicians have examined the shape of this curve more closely and found that it is part of the so-called cycloid, reflected at the x-axis. Generally speaking, a cycloid describes the path of a point on a rolling wheel (Fig. 2, 3, 4). The mathematical formula for such curves is rather complicated, but it is easy to draw.

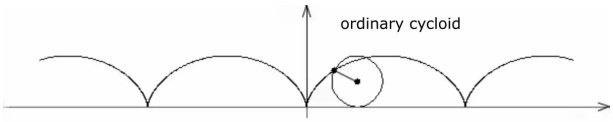

Fig. 2: The ordinary cycloid appears, for example, when you trace the path of the valve on your rolling bicycle wheel.

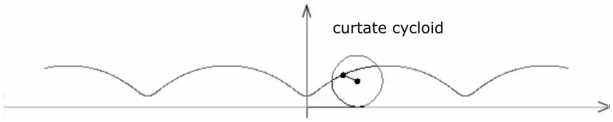

Fig. 3: Cycloids can also look different: A curtate cycloid appears when you look at the path of a spoke reflector on your bicycle wheel.

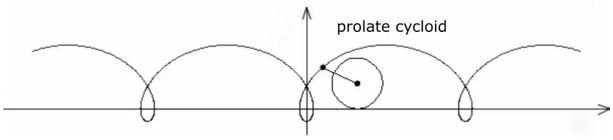

Fig. 4: A prolate cycloid requires that a point outside of the rolling bicycle wheel moves with the bicycle wheel.