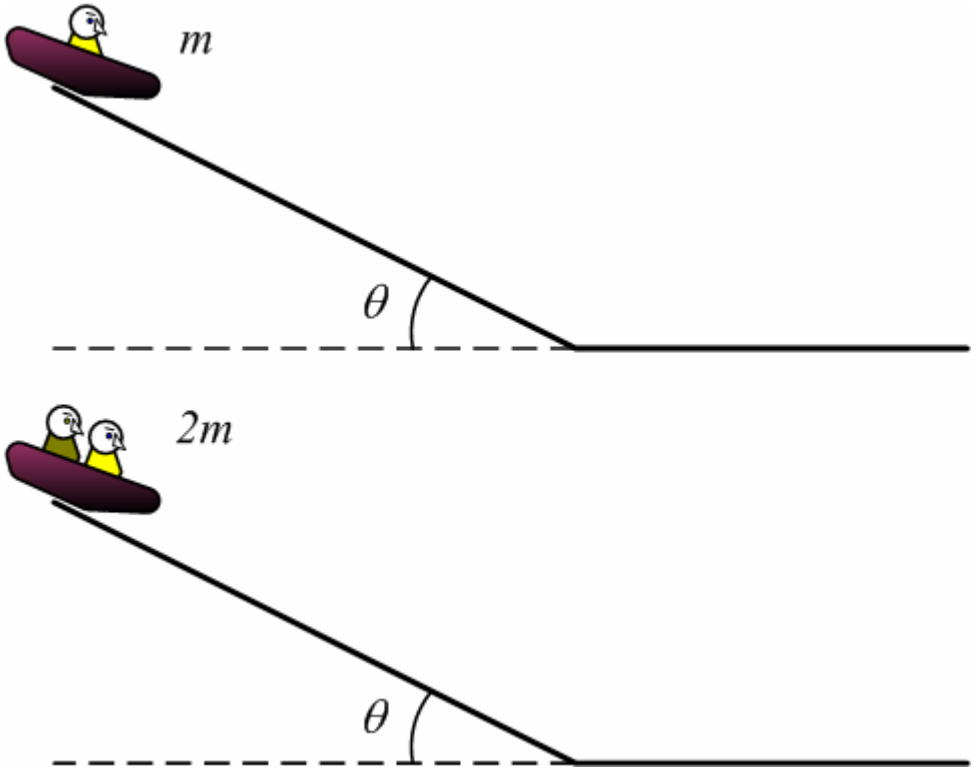
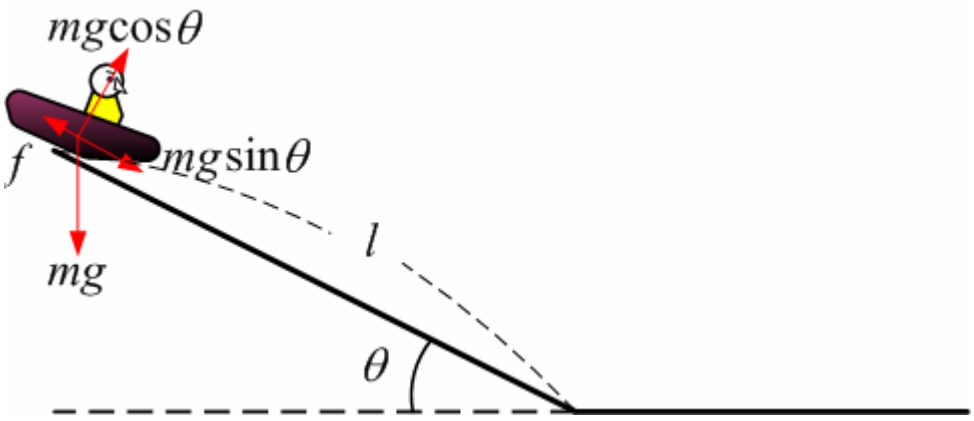
Which bobsleigh goes down faster?

One bobsleigh carries one person to slide down on the hill. The other one carries two people, to goes down on the same hill. This has twice as heavy as the one carrying one person.



So except the masses, everything else has the same condition. You may think, the lighter, the faster, or the heavier, the faster. The answer is: <u>They reach the bottom at the same velocity with the same time interval!</u>

Let's solve the equation of motion.



From the figure, there are the gravitational and frictional forces. The second law of motion gives

$$mg\sin\theta - f = ma$$

The frictional force is given by the coefficient of friction and the normal force, which is equal to $mg\cos\theta$, so

$$f = \mu N = \mu mg\cos\theta$$

Plug this into the above.

$$mg\sin\theta - \mu mg\cos\theta = ma$$

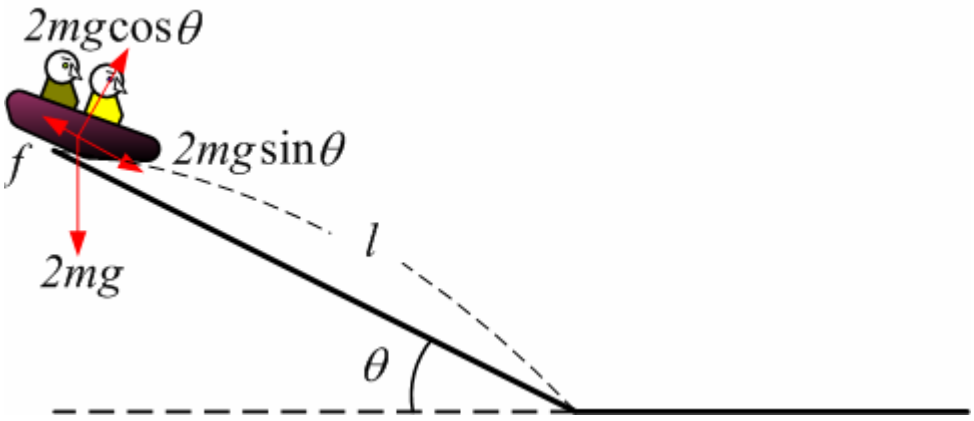
All m's are equal, so

$$a = g\sin\theta - \mu g\cos\theta$$

If the distance is *l*, the velocity at the bottom should be

$$v = \sqrt{2ga}$$

For the second case, we have the following free-body diagram:



The procedure is exactly the same as above.

$$2mg\sin\theta - \mu 2mg\cos\theta = 2ma$$

Thus,

$$a = g\sin\theta - \mu g\cos\theta$$

which is the same as the above result. Obviously, the bobsleigh will have the same velocity at the bottom.