

2-D Motion - centripetal force (Johnston's "Singapore Sling")

Here is a classic demonstration done in an easy, safe way by anyone who tries it, even young people. Traditionally, it was performed by a strong, older person with a pail of water. If anything went wrong, damage and possible injury could result. This simple piece of apparatus reduces a possible accident to a minimum. It is a classic because it addresses a lot of good physics about 2-D motion, especially circular, and the forces (vectors) involved. Gravity can play a major role in the discussion. I chose the platform shape for several reasons: only three supporting strings are needed; it is easy to cut out; and it reduces the sharpness of the corners (sand them, also).

Make the platform out of $\frac{1}{4}$ " or $\frac{3}{8}$ " plywood (no "voids"). Copy this page and cut out the "platform". Use it as a pattern to trace the edges on the plywood. The center hole accommodates the very popular, 9 oz., plastic party tumbler. #18 nylon mason's line is recommended for the strings. Cut three strings 24 in. long. Thread each string through the hole from the top and tie a tight half knot at the bottom. Gather the three strings together and carefully tie another half knot about 12-14 inches above the platform, making sure the platform is nearly level before tightening. Then make a large knot(s) at the end to hold onto.

I usually start to swing it into a vertical circle before I go to a horizontal circle above my head. Then I return to a vertical circle before I stop. Experiment and find what works best for you. Remind your students that 80% or more of the amusement park rides utilize the concept of centripetal force. The liquid doesn't spill out; the riders don't fall out. If you didn't spill, celebrate by taking a sip of the liquid (soda, etc.) at the end!

Diagram:

