

Centripetal Acceleration

Solve the following problems

1. (Serway, p.236, #1) A rope attaches a tire to an overhanging tree limb. A girl swinging on the tire has a centripetal acceleration of 3.0 m/s^2 . If the length of the rope is 2.1 m , what is the girl's tangential speed?
2. (Serway, p.236, #2) As a young boy swings a yo-yo parallel to the ground and above his head, the yo-yo has a centripetal acceleration of 250 m/s^2 . If the yo-yo's string is 0.50 m long, what is the yo-yo's tangential speed?
3. (Serway, p.236, #3) A dog sits 1.5 m from the center of a merry-go-round. The merry-go-round is set in motion, and the dog's tangential speed is 1.5 m/s . What is the dog's centripetal acceleration?
4. (Serway, p.236, #4) A race car moving along a circular track has a centripetal acceleration of 15.4 m/s^2 . If the car has a tangential speed of 30.0 m/s , what is the distance between the car and the center of the track?
5. A cement mixer of radius 2.5 m turns with a frequency of 0.020 Hz . What is the centripetal acceleration of a small piece of dried cement stuck to the inner wall of the mixer?
6. A popular trick of many physics teachers is to swing a pail of water around in a vertical circle fast enough so that the water doesn't spill out when the pail is upside down. If the teacher's arm is 0.60 m long, what is the minimum speed with which

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the teacher can swing the pail so that the water doesn't spill out at the top of the path? [HINT: What is the **acceleration** of the pail at the *top of the path*?!?!]

7. To test their stamina, astronauts are subjected to many rigorous physical tests before they fly in space. One such test involves spinning the astronauts in a device called a *centrifuge* that subjects them to accelerations far greater than gravity. With what **linear speed** would an astronaut have to spin in order to experience an acceleration of 3 g's at a radius of 10.0 m? [REMEMBER: 1 g equals 10.0 m/s²!]

8. Maria's favorite ride at the fair is the rotor, which has a radius of 4.0 m. The ride takes 2.0 s to make one full revolution. What is the **period** of revolution? What is Maria's **linear speed** on the rotor? What is Maria's **centripetal acceleration** on the rotor? What is the **centripetal force** acting on Maria?

9. The pilot of a 60,500-kg jet plane, is told that he must remain in a holding pattern over the airport until it is his turn to land. If Captain Alaimo flies his plane in a circle whose radius is 50.0 km with a period of 30.0 minutes, what **centripetal force** must the air exert against the wings to keep the plane moving in a circle?

10. Joe's favorite record has a scratch 12 cm from the center that makes the record skip 45 times each minute. What is the **linear speed** of the scratch as it turns? What is the centripetal acceleration a mouse standing at the edge of the record?