

Centripetal Acceleration

Concepts

- A. If you are going in a circle with a constant speed, why are you accelerating?
- B. If you are going in a circle with a constant speed, in what direction do you accelerate?
- C. If you are going in a circle with a constant speed, describe the direction of your velocity.

Calculations

1. A car is traveling in a circle with a radius of 20 meters.
 - a. If it has a speed of 5 m/s, what is the acceleration of the car?
 - b. If it has a speed of 10 m/s, what is its acceleration?
2. A plane is flying at 125 m/s when it begins to travel in a circle. If its centripetal acceleration is 2 m/s^2 , what is the radius of the circle?
3. A girl is sitting on a merry-go-round 2 meters from the center.
 - a. If she has an acceleration of 1 m/s^2 , how fast is she going?
 - b. If she has an acceleration of 2 m/s^2 , how fast is she going?
4. A person is driving in a circle with a centripetal acceleration of 2 m/s^2 .
 - a. What would be the acceleration if they went twice as fast, but kept the radius the same?

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- b. What would be the acceleration if they went three times as fast, but kept the radius the same?
 - c. What would be the acceleration if they doubled the radius, but kept their speed the same?
 - d. What would be the acceleration if they tripled the radius, but kept their speed the same?
5. A car is traveling in a circle of radius 15 meters. It takes 9 seconds to go once around the circle. What is the centripetal acceleration? (*Hint: Find the speed first.*)
6. A ball is swung on a string in a circle of radius 1.3 meters. If the centripetal acceleration of the ball is 15 m/s^2 , how long does it take the ball to go around once? (*Hint: Find the speed first.*)
7. While flying in circles, a plane has a centripetal acceleration of 5 m/s^2 . If the radius of the turn is 8000 meters, how many seconds does it take to go around once? (*No more hints!*)
8. A person is spinning on the Turkish Twist, which has a radius of 5 meters. If it takes 2.5 seconds to go around once, what is the centripetal acceleration of the person?

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9. A ball on the end of a string is being spun in a circle of radius 2.3 meters. It is spinning at a rate of 45 rpm. What is the centripetal acceleration of the ball?

10. A person on a 10 meter radius Ferris wheel is rotating with a centripetal acceleration of 4 m/s^2 . What is the rate of rotation in rpm?

Answers:

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| 1. a) 1.25 m/s^2 | b) 5 m/s^2 | 2) 7800 m | 3. a) 1.4 m/s | b) 2 m/s |
| 4. a) 8 m/s^2 | b) 18 m/s^2 | c) 1 m/s^2 | d) 0.67 m/s^2 | |
| 5) $v = 10.5 \text{ m/s}$ & $a = 7.3 \text{ m/s}^2$ | 6) $v = 4.42 \text{ m/s}$ & $t = 1.85 \text{ s}$ | 7) $v = 200 \text{ m/s}$ & $t = 251 \text{ s}$ | | |
| 8) $v = 12.6 \text{ m/s}$ & $a = 31.6 \text{ m/s}^2$ | 9) $v = 10.8 \text{ m/s}$ & $a = 51 \text{ m/s}^2$ | 10) $v = 6.32 \text{ m/s}$ & $T = 9.93 \text{ s}$ & $f = 6.04 \text{ rpm}$ | | |