Circular Motion Concepts Name _____

Formula for Centripetal Acceleration	Formula for Centripetal Force
$a_c = \frac{v^2}{r}$	$F_C = \frac{mv^2}{r}$

a_c : centripetal acceleration

v : linear velocity [distance / time]

r : radius

m : mass

F_C : centripetal force

This formula gives the *magnitude* of acceleration that is necessary for an object to remain moving in a circle.
(If the magnitude of acceleration was *less* than this, the object would not longer be able to move in a circle.)

A. These two formulas are related by another simple formula, which one?

B. What is the centripetal acceleration of an object that is moving in a circle of radius 50 cm with a linear velocity of 4 m/s?

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C. A go-kart is moving in a circle with a radius of 2 meters.
The go-kart makes 5 turns in a time of 12 seconds.
What is the *linear velocity* of the go-kart?
(velocity = distance / time ::: you will need to use this formula to find linear velocity)

What is the *centripetal acceleration* of the go-kart?

D. A plane is flying in circles of radius 200 meters.
It flies a full circle in a time of 1.45 seconds.
What is the *linear velocity* of the plane?

What is the *centripetal acceleration* of the planet?

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Part C: Magnitudes of Vectors in Force Equations

Magnitude of position vector:

If the origin is at the center of the circle, the magnitude of the position vector is always equal to the radius of the circle.

Magnitude of velocity vector (the speed):

The magnitude of the velocity vector (the speed) can be determined with the formula

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{\text{Circumference}}{\text{Time for a Circle}}$$

Magnitude of acceleration vector (the centripetal acceleration):

The magnitude of the centripetal acceleration vector is given by the formula:

$$a_c = \frac{v^2}{r}$$

In which *v* is the speed of the moving object and *r* is the radius of the circle.
This equation is given on the AP formula reference page and is called the "Centripetal Acceleration Formula".

Magnitude of the force vector (the centripetal force):

A formula for the magnitude of the centripetal force vector is determined by combining the centripetal acceleration formula with Newton's Second Law:

$$F_c = ma_c = \frac{mv^2}{r}$$

Where *m* is the mass of the moving object.

C.1 What is another name for the magnitude of the velocity vector?