Unit 6 - Centripetal Motion

Today we ponder that eternal question:
Can an object move at a constant speed and still be accelerating?

- In a line, when accelerating forward, your body moves _____!
- When accelerating backwards, (-) accel, your body moves _____!
- So the rule is… You move in the opposite direction as the acceleration!

So when you are spinning and your body tries to move outward, the acceleration must be directed:_____, i.e. center-seeking or centripetal!

- The direction of the force determines the direction of the acceleration, so the force involved in circular motion is also centripetal.
- i.e. $F_c = ma_c$
- The only way an object can move in a circular motion is if there is something pushing or pulling it IN toward the center. If this force disappears, so does the circular motion, and what reappears?

Newton's 1st!

Maxinne is driving recklessly around a corner with a 75 m radius of curvature. She needs at least 4500 N of frictional force to keep her 1120 kg car from sliding into the oncoming lane. What is the fastest speed at which she can make the turn?

We know: 75 m =
4500N =
1120 kg =
we're looking for:
Which v formula to use?
$F_c = mv^2 / r$ algebras to:

What was her angular acceleration?

The Formulas!

$a_c = v^2 / r$ and since $F_c = ma_c$….

$F_c = mv^2 / r$

- What if we don't know velocity, but rather the period of rotation?
- Since v = d / t (we're rotating at a constant speed, remember?)
- v = circumference / period or
- $2 \pi r / T$
- Since v is squared in the above formulas, and r is already on the bottom…

$a_c = 4 \pi^2 r / T^2$ and

$F_c = m\ 4 \pi^2 r / T^2$

If we know T instead of v, we use the second set of formulae, but it is the same process

Unit watch!

- The units are all normal, i.e. a = m/s^2, F = N, et cetera. Period's (T) unit is sec/rev or seconds per revolution.
- That's great if the period is large, but if the period is small (fast) the number would be too tiny, so it typically is written as a frequency, not a period. Frequency is rev/sec, not sec/rev - i.e. an inverse relationship, so… $T = 1 / f$