**Today you are going to have to do some learning from the book (just like in college)! Remember that there are notes already for some of this.**

**HOLT TEXTBOOK – Chapter 7**

Define Angular Displacement –

Define Arc Length –

Write the Equation that relates arc length and angular displacement –

Do the following conversions between radians and degrees –

| | | | |
|---|---|---|---|
| 90° = _____ rad | 360° = _____ rad | $\pi$ rad = _____ ° | $\pi/6$ rad = _____ ° |
| 180° = _____ rad | 2 rev = _____ rad | $2\pi$ rad = _____ ° | $3\pi/2$ rad = _____ ° |
| 270° = _____ rad | 3 rev = _____ rad | $\pi/2$ rad = _____ ° | $\pi/3$ rad = _____ ° |

Define Angular Speed –

Write the Equation for Angular Speed –

Define Angular Acceleration –

Write the Equation for Angular Acceleration –

Define Tangential Speed –

Define Angular Acceleration –

Write the Equations for Tangential speed and Tangential Acceleration –

Define Centripetal Acceleration –

Write the two Equations for Centripetal Acceleration –

Write the two Equations for Centripetal Force –

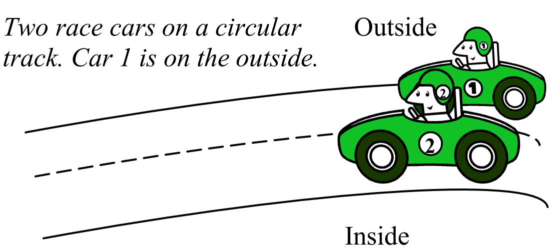
What provides the centripetal force when a car turns a corner?

What provides the centripetal force to keep the earth around the sun?

Define Centrifugal Force (and is it a real force?) –

Write the Equation for Gravitational force (try to do it from memory) –

*Two race cars on a circular track. Car 1 is on the outside.*




*$R_{car1} > R_{car2}$, since it is in the outside lane. The cars are traveling side-by-side (car 1 is staying up with car 4)*

*They travel the same $\theta$ around the track, but Car 1 travels a longer arc length ("s") around the track.*

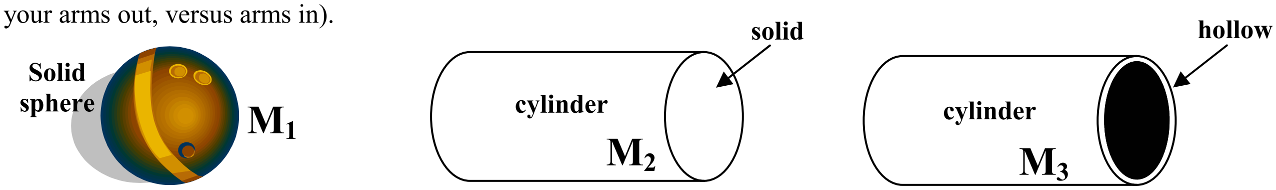
*They have the same $\omega$ (turning the circle at the same rate), but Car 1 has the faster $v_t$ (Car 1's speedometer reads a higher speed).*

*If they started at rest, then they have the same $\alpha$ (speeding up around the circle at the same rate), but Car 1 has the faster $a_t$ (Car 1's*

**HOLT TEXTBOOK – Chapter 8**

The first paragraph is a bit hard to understand. Let me make sure you get these clues: There are three rolling objects going down ramp: a solid sphere (like a bowling ball); a solid cylinder (like a solid metal bar); a hollow cylinder (like a hollow copper tube). All three have the same radius and mass, but their materials are different. (The hollow tube is denser than the material of the solid cylinder or the sphere.) **ALL THREE OBJECTS HAVE THE SAME MASS AND RADIUS!**

The sphere gets down first, the solid cylinder second, and the hollow cylinder last. Why? Because each has a different mass distribution. Compare the two cylinders: the hollow cylinder has all of its mass at the outside; the solid cylinder has some of its mass close to the center. The farther out the mass is, the harder it is to turn. The solid sphere has more mass close to its center. The solid sphere has some of its mass close to the center (since it is a solid, uniform cylinder, it is as if all of its mass half way from its center to the radius). The hollow sphere has ALL of its mass at the outside – really slow to turn (its like having your arms out, versus arms in).




Rolls down fastest: least rotational inertia (Moment of Inertia: I) $I_{solid\ sphere} = (2/5)MR^2$

$M_1 = M_2 = M_3$

Slower than $M_1$. Faster than $M_2$. $I_{solid\ cylinder} = (1/2)MR^2$

Slowest to roll down; most Moment of Inertia $I_{hollow\ cylinder} = MR^2$

A net torque is like a net ________: a net torque causes an ____________.

Define Torque and give the equation:

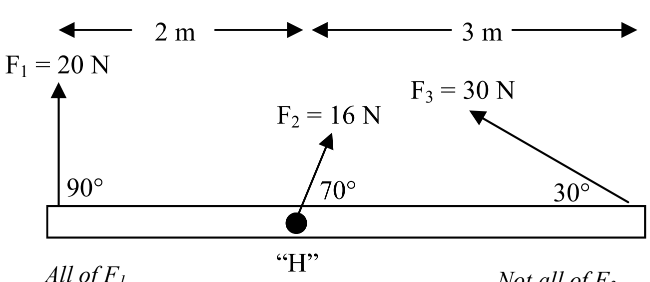
(Torque is like magnetic fields – use the right-hand rule to tell which torque is positive: wrap your fingers in the direction of the torque. If your thumb points up: positive torque [*see example below*].)

Define Moment of Inertia (*see above explanation*):

Define Newton's Second Law of Rotation:

Define (and give equation for) Angular Momentum:

Why does an ice skater pull their arms in while spinning speed up?




*All of $F_1$ torques the lever, since it is attached at 90°.*

*This is the spot around which it rotates.*

*Not all of $F_3$ torques the lever, only the perpendicular portion: the sine portion.*

To find the net torque add up all of the torques:
$\Sigma\tau = \tau_1 + \tau_2 + \tau_3 \ldots$ Where $\tau = Fd\sin\theta$; F is the force; d is the distance from the rotation point (H); θ is the angle from the lever and the force.

$\tau_1$ = 20N(2m)(sin90°) = 40(1) = -40 Nm (clockwise is neg.)
*(You can skip the angle if it is attached perpendicularly.)*

$\tau_2$ = 16N(0m)(sin70°) = 0 Nm
*(distance = 0 m because it is attached at the hinge.)*

$\tau_3$ = 30N(3m)(sin30°) = 90(0.5) = -45 Nm
*(Right-hand rule: counterclockwise is positive.)*

$\Sigma\tau = \tau_1 + \tau_2 + \tau_3 \ldots$ = -40 – 0 + 45 = 5 Nm
*(It will turn counterclockwise.)*