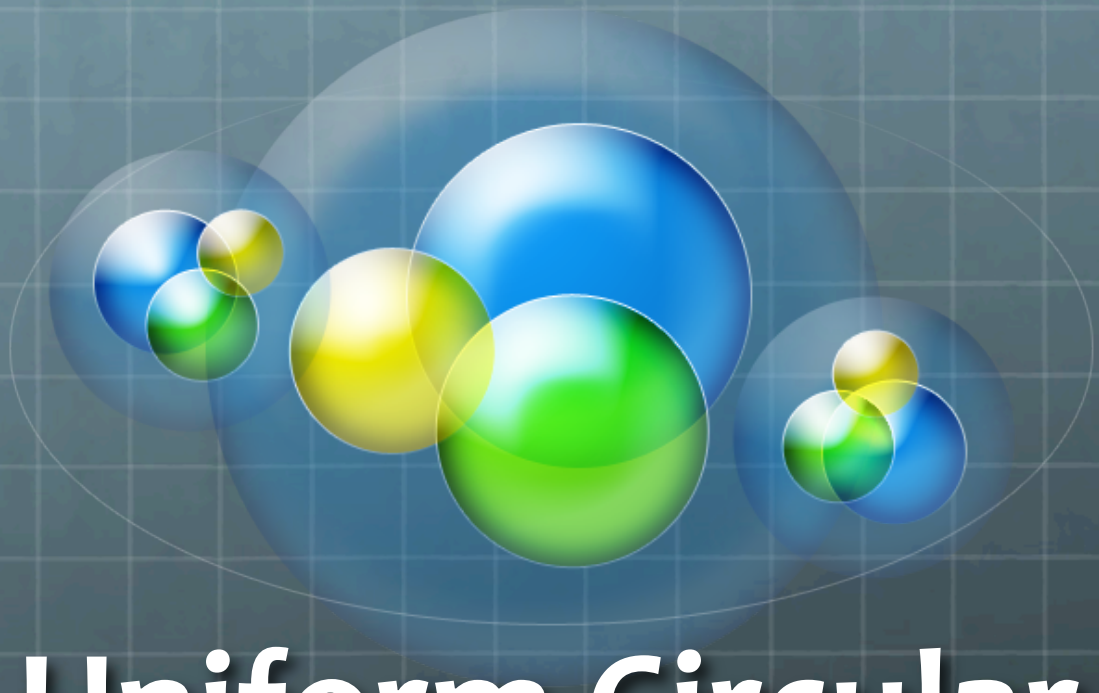
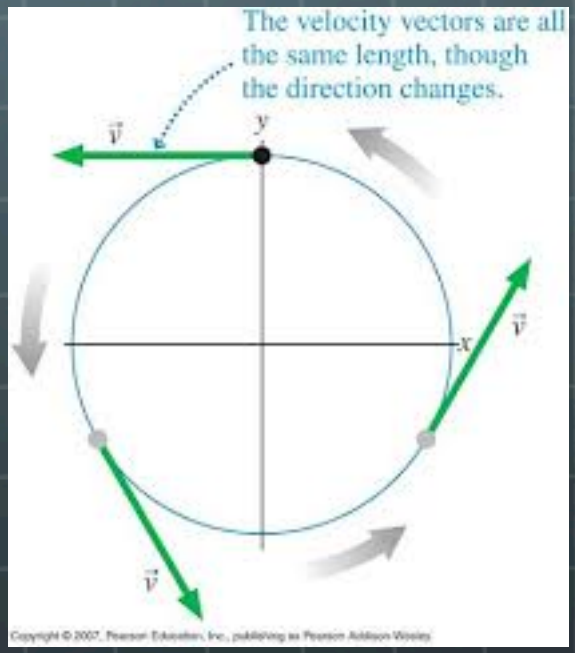


Uniform Circular Motion

Created by Kelly Rick

Uniform circular motion

- the motion of an object in a circle at a constant speed.
- As an object moves in a circle, it is constantly changing its direction.
- At all instances, the object is moving tangent to the circle.
- Since the direction of the velocity vector is the same as the direction of the object's motion, the velocity vector is directed tangent to the circle as well. The animation at the right depicts this by means of a vector arrow.



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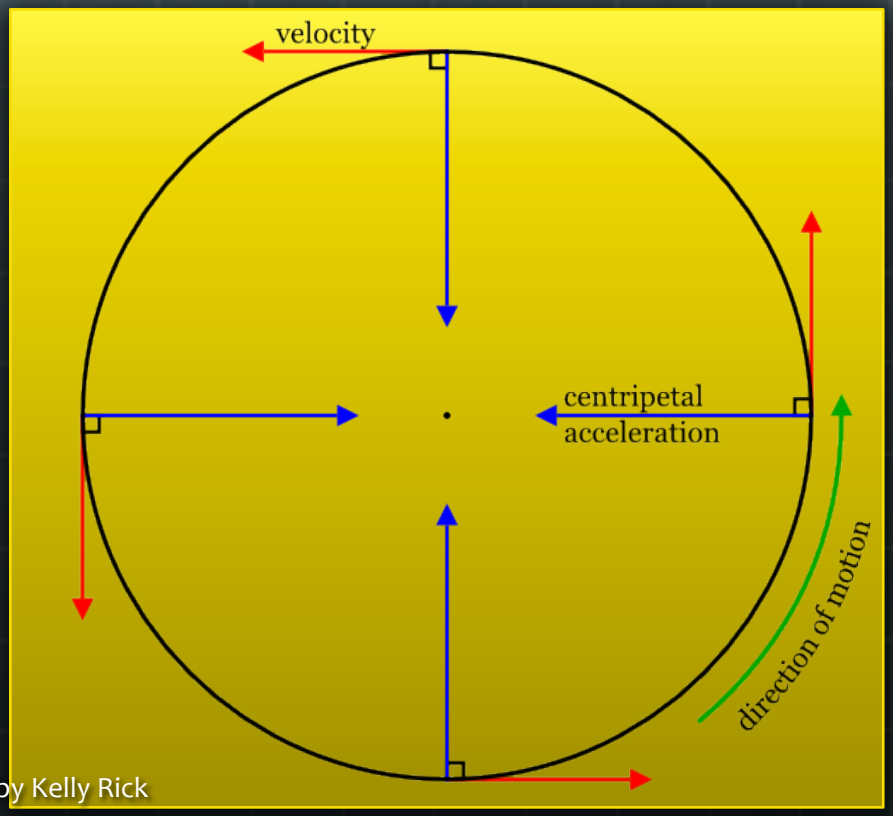
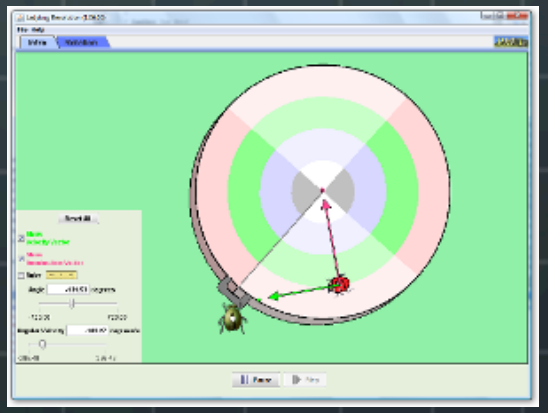
Centripetal Acceleration (a_c)

- If direction is changing, even if speed is constant, it must be accelerating!

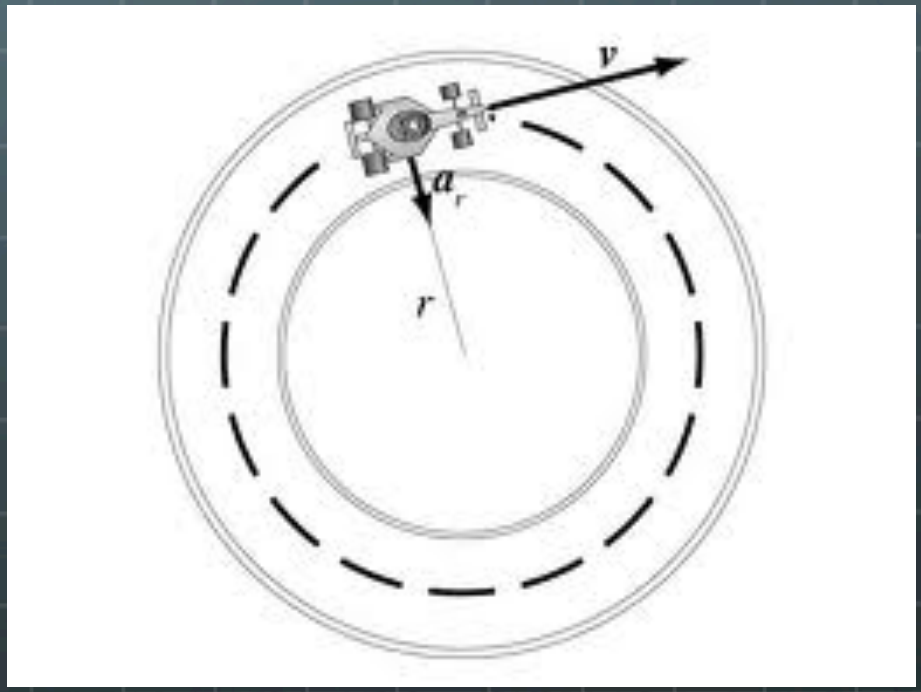




Created by Kelly Rick

Velocity

- The velocity of an object traveling at the same speed in a circular path is always tangent to the direction of motion.



Finding a_c

- Equation:

$$a_c = v^2/r$$

- a_c = centripetal acceleration (m/s2)
- V = velocity (m/s)
- r = radius (m)

Created by Kelly Rick

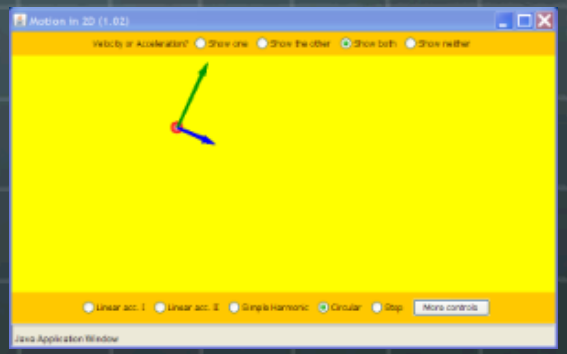
N2L

- When an object undergoes a constant acceleration, there must be a constant force acting upon it.
- Centripetal Force

$$F_c = ma$$

$$F_c = ma_c$$

$$F_c = m(v^2/r)$$



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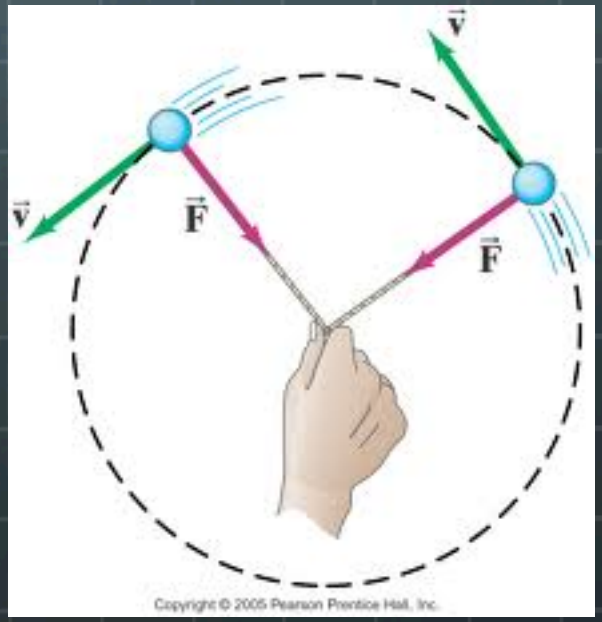
Centripetal

- Centripetal means "center seeking"
- So centripetal force is always center seeking, and if F_c is center seeking than ac is as well. Because Net force and acceleration are ALWAYS in the same direction.



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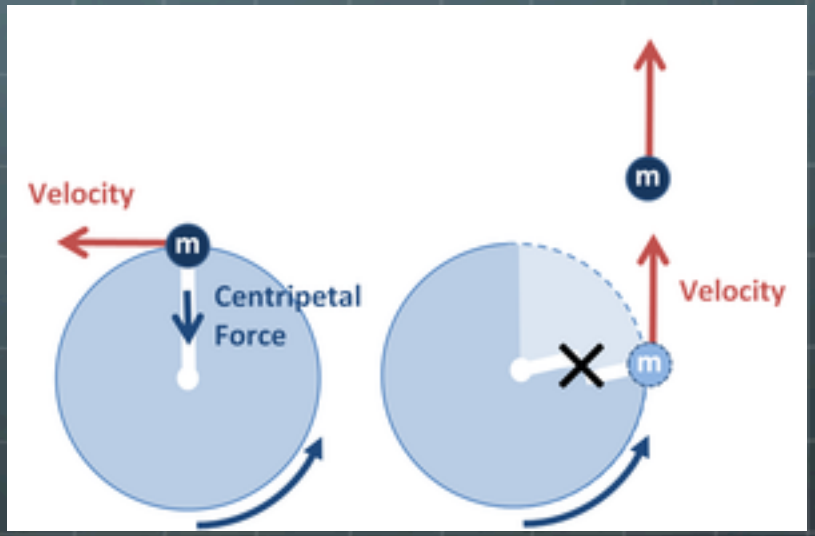
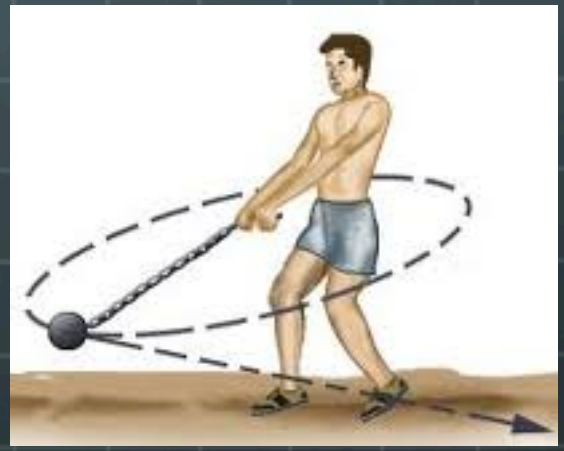
What happens when this force is removed?

http://www.physicsclassroom.com/mmedia/circmot/rht.gif





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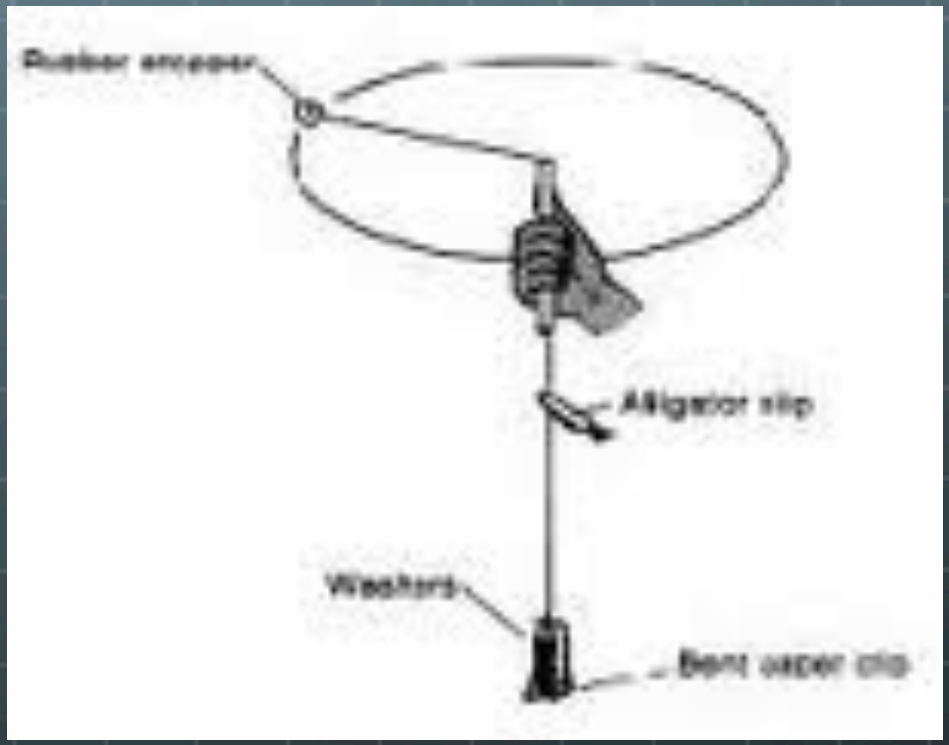
Test your understanding



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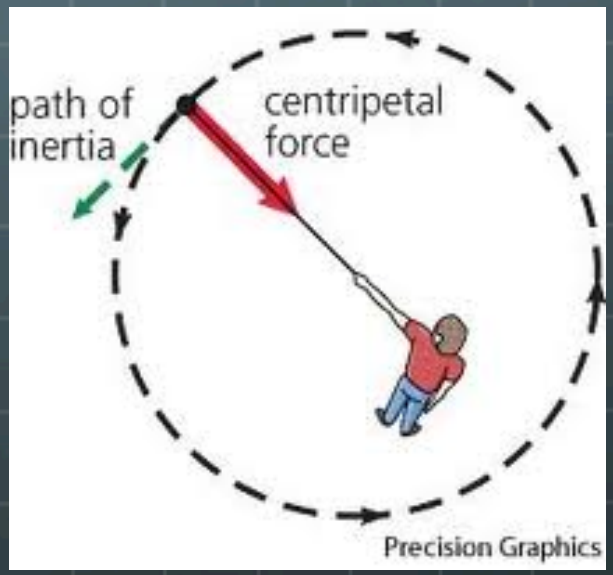
N1L

- An object moving at a constant velocity will continue to move with a constant velocity in the same direction, unless acted upon a net force (F_c)



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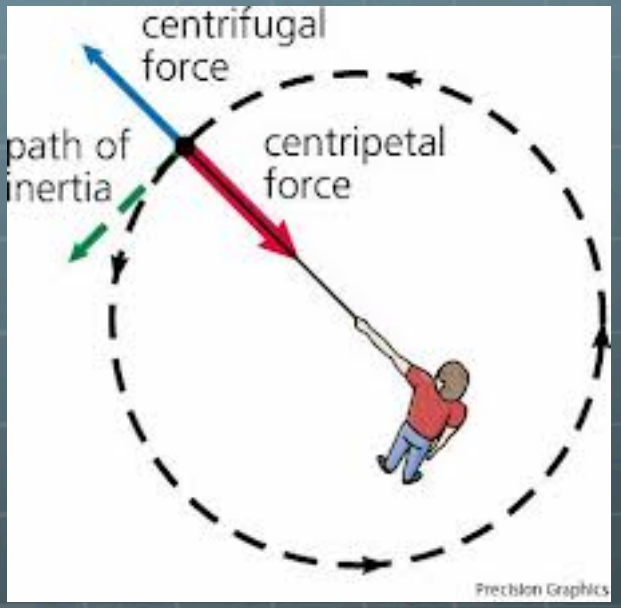
Period

- the period of circular motion is the time it takes to make one complete circle..

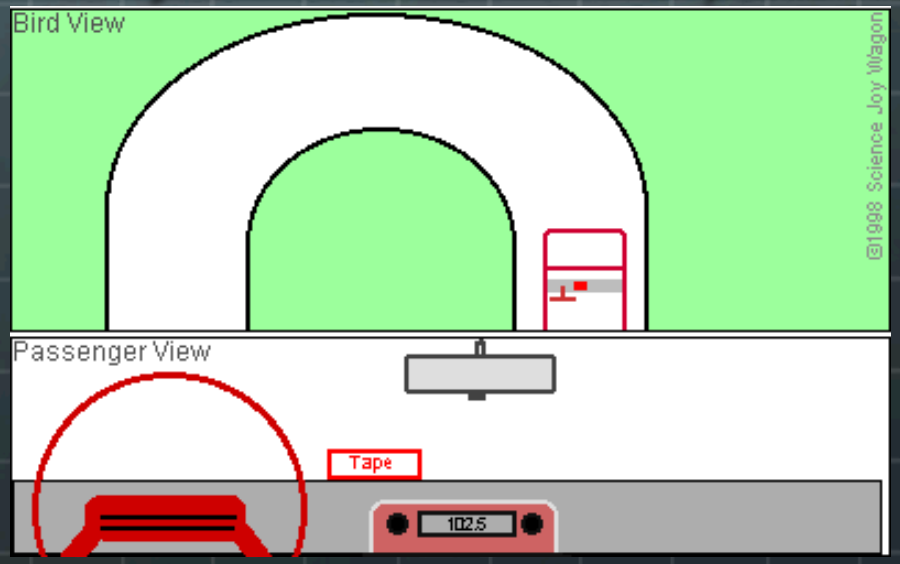
Recap

- $a_c = v^2/r$
- $F_c = ma_c$
- Net force and acceleration point toward the center
- Velocity is tangent to the curve

Common Misconceptions



- Centripetal- toward the center
- Centrufugal-away from the center
  - Doesn't actually exist
  - Used to describe the apparent outward motion that you feel (with is actually the absence of force)
  - Actually N3L



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Guided Practice Problems

- An 5kg object moves in a circular path of radius .5m at a speed of 10m/s.
  - Calculate the centripetal acceleration
  - Calculate the centripetal force.

  - 200m/s/s
  - 1000N

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Period

- Amount of time for one revolution
- Measured in seconds

Frequency

- The number of revolutions per time interval.
- Measured in hertz (Hz)

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Sample Problem

The 1909 New England Carousel has a diameter of 7.75m and makes 4 revolutions per minute.

Q1:What is its period of motion?

Q2: What is its frequency?

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If you were on a horse and were to drop a coin while the ride was in motion, where would it land relative to you?

- It would land behind you because of centripetal force.

Linear speed

- The distance traveled per time
- $v = 2\pi r^2/T$

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Understanding Linear Speed

- A carousel at the local carnival rotates once every 50 seconds.
  - What is the linear speed of an outer horse on the carousel, which is 2.60 from the axis of rotation?
  - What is the linear speed of an inner horse that is 1.60m from the axis of rotation?

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Mega Question

- The yo-yo is considered the second oldest toy in history, if the 0.22 kg bob circulates 1 meter from the finger knot, with a string tension (F_c)of 3N.
- What is the ac, speed and the period?

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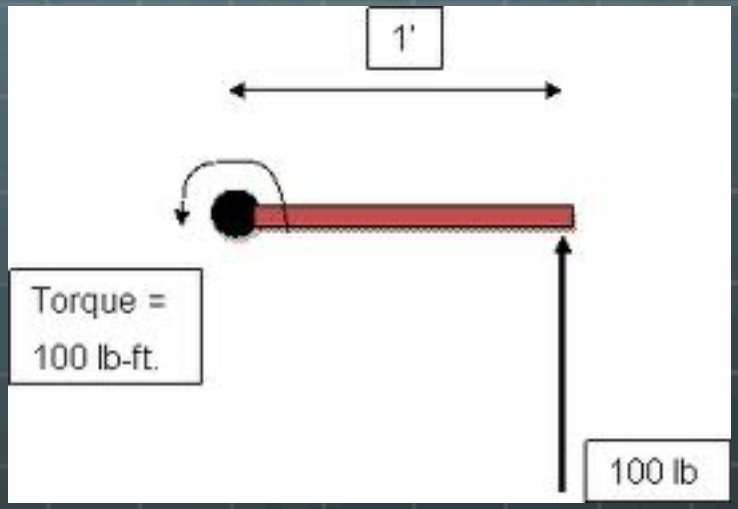
Torque

- A force that causes rotation



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Torque (τ)

$\tau = rF$

- Symbol: τ
- r = point from which torque is measured to the point where force is applied
- F= force applied
- O= pivot point

This is the Force that is perpendicular to r

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Increasing Torque

- Increase the applied force
- Increase the length of the arm (increasing the leverage, generating more torque)

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Torque Components

- Find components of force only use the perendicular component

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- A force of 20 N is applied perpendicular to the end of a bar of length 0.5 m. Calculate the torque produced by the force.

- 10Nm

Great Review

- http://www.mrfizzix.com/review/torquerev/torquerev.htm