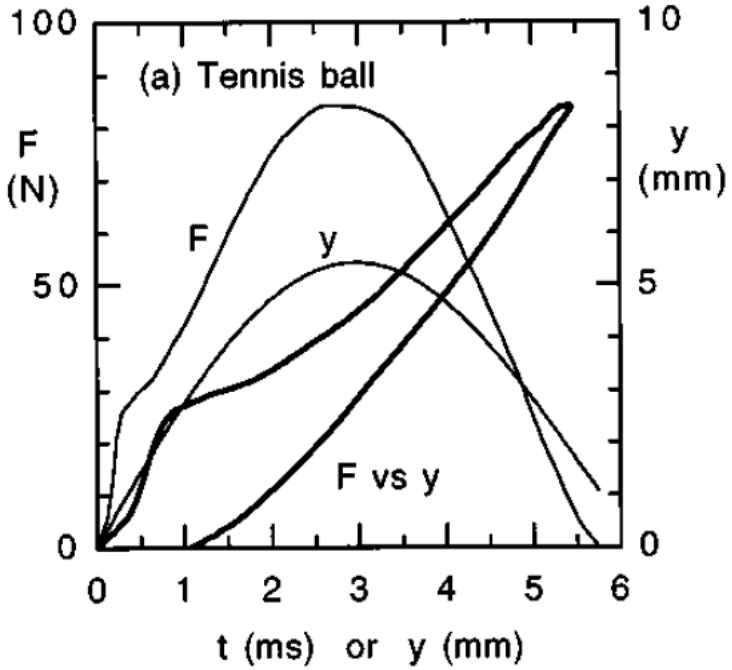
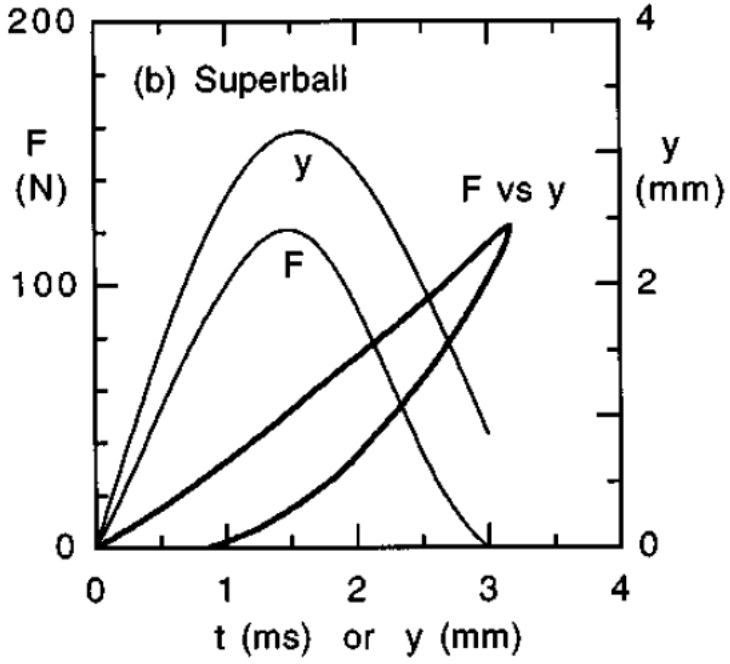
Topics: Finishing Ch 6 – Impulse & Momentum;
Starting circular motion

Below are two graphs of the force experienced by (a) a tennis ball and (b) a superball as function of time. Which experiences a greater *impulse* in the first 3 ms?





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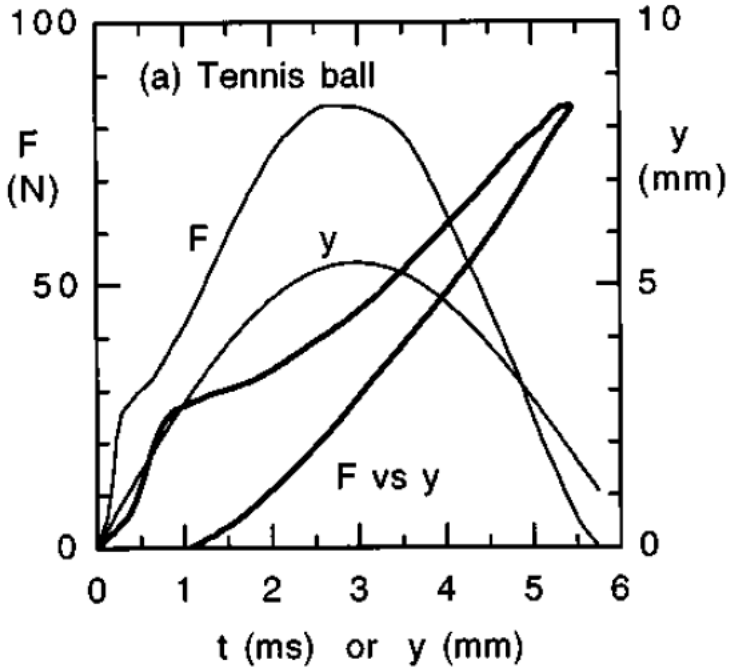
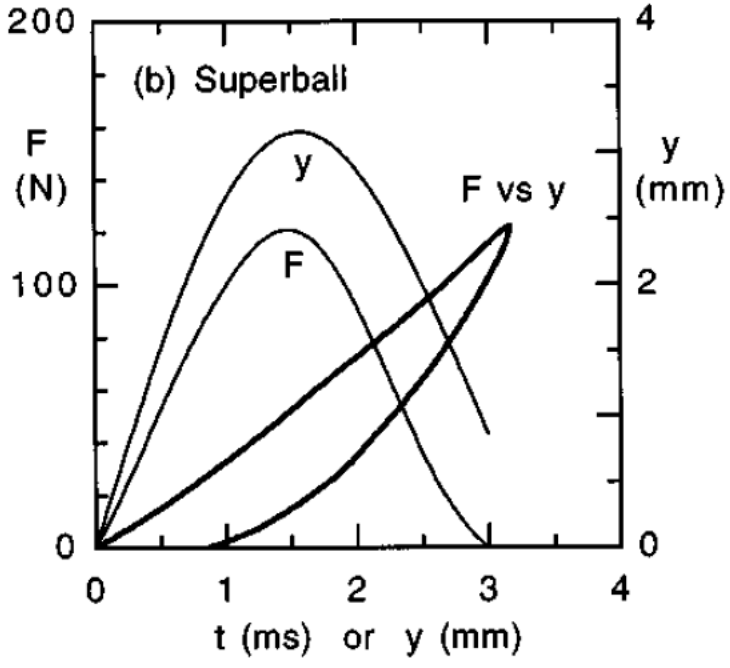


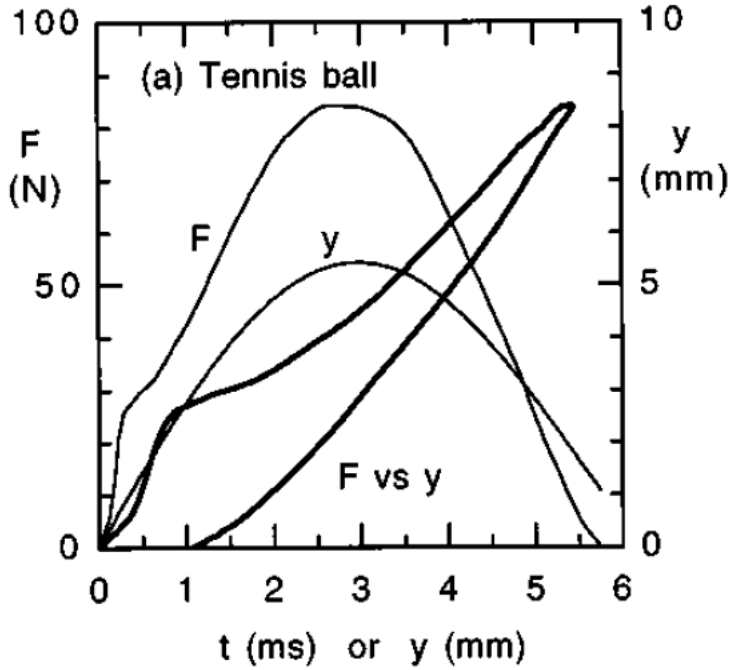


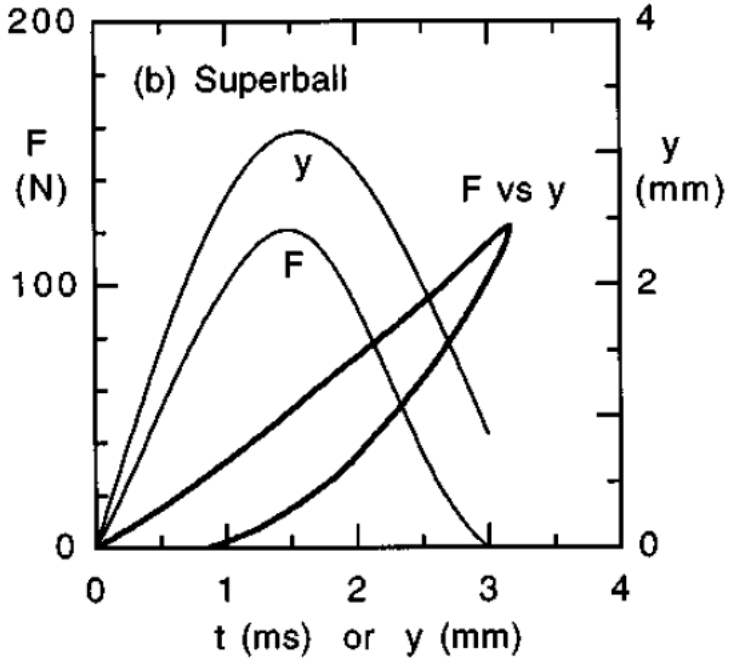
A. Tennis Ball

B. Superball

C. They are equal

Below are two graphs of the force experienced by (a) a tennis ball and (b) a superball as function of time. Which experiences a greater *change in momentum* in the first 3 ms?





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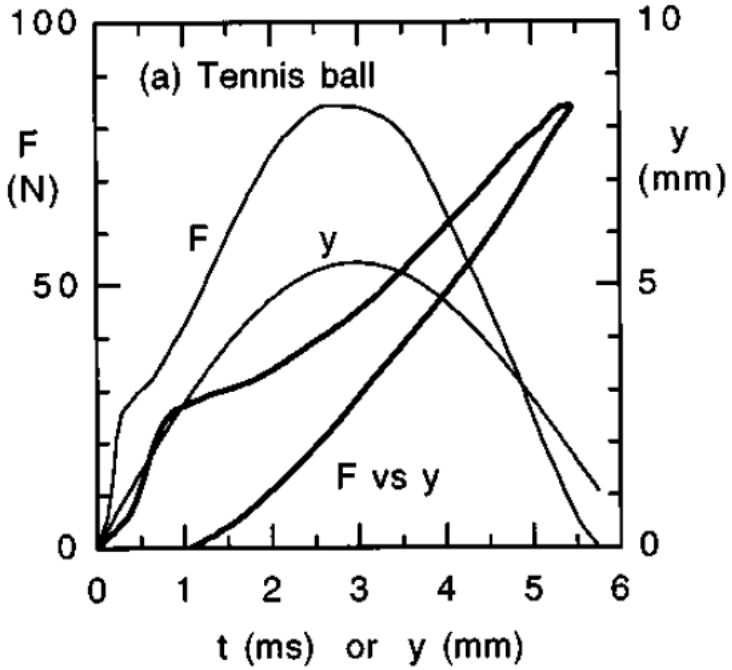

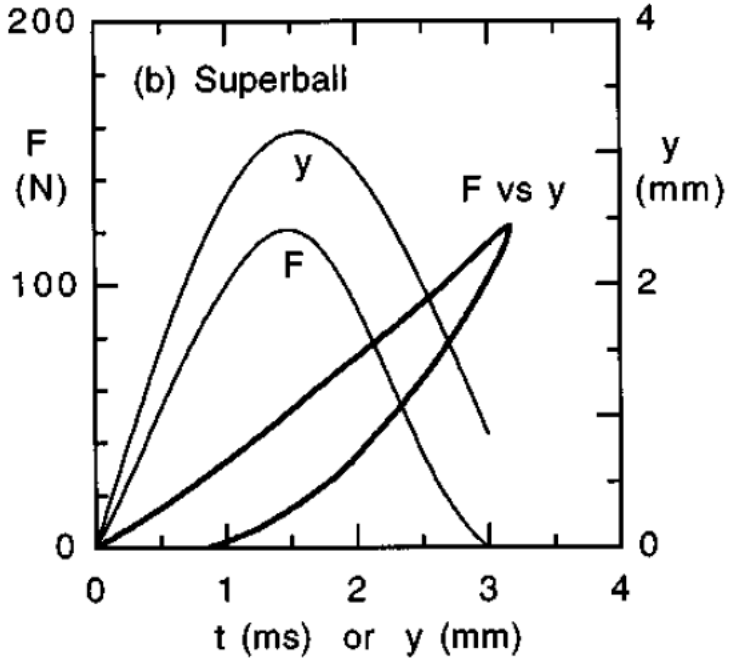

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Can you go over the math in the terminal velocity section?

$$m\left(\frac{dv_y}{dt}\right)+6\pi\eta r v_y+mg=0$$

If we could find any function $v_y(t)$ which is a solution to this equation, it would be our prediction for the motion of this small, slow falling object. This equation is a first order linear differential equation. The solution to this equation would take the form:

$$v_y(t)=v_f\left(1-e^{-\lambda t}\right)$$

Does this work as a solution to this equation? To find out, we first calculate the derivative of this function $v(t)$, and insert both into the equation above and see what it tells us:

$$a_y(t)=\frac{dv_y(t)}{dt}=\lambda v_f e^{-\lambda t}$$

$$m\lambda v_f e^{-\lambda t}+6\pi\eta r v_f\left(1-e^{-\lambda t}\right)+mg=0$$

Examining this equation, we see that it can be true if λ and v_f take on the values

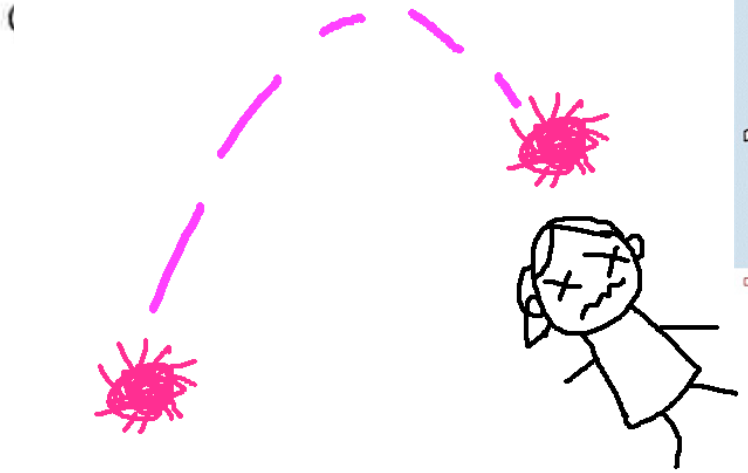
$$\lambda=\frac{6\pi\eta r}{m}$$

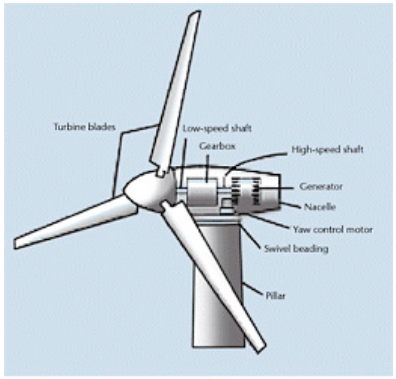
$$v_f=-\frac{mg}{6\pi\eta r}$$

Putting these into the equation makes the total prediction for the velocity of the object as a function of time:

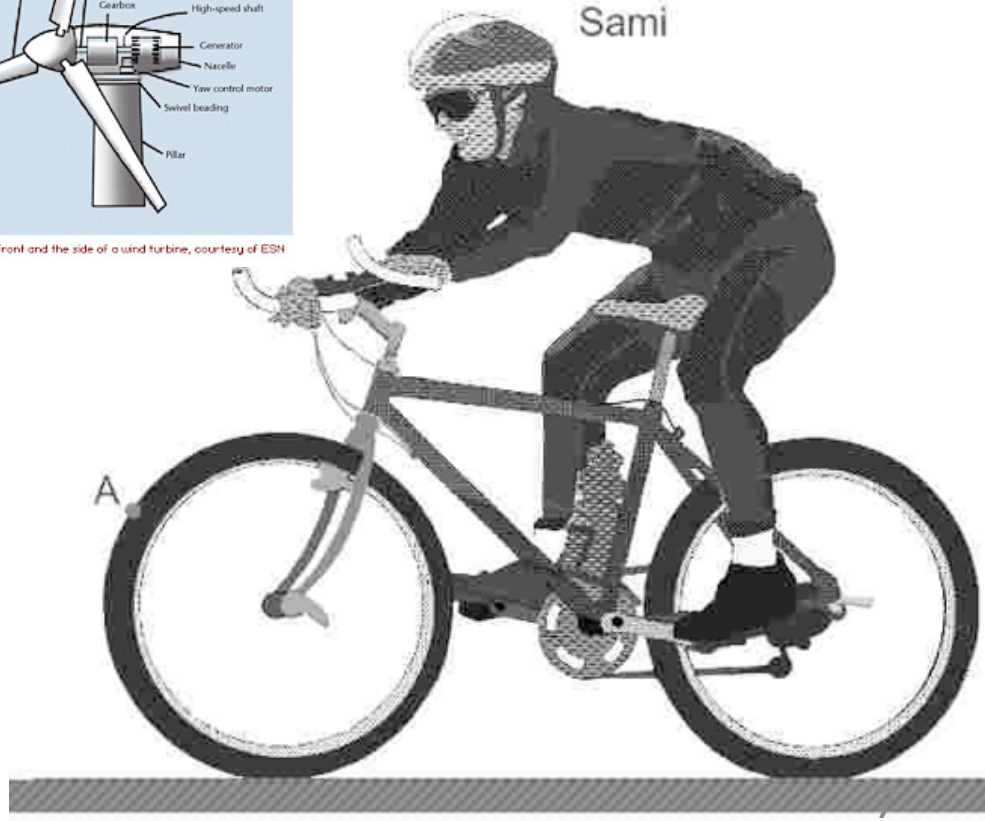
$$v_y(t)=-\frac{mg}{6\pi\eta r}\left(1-e^{-\frac{6\pi\eta r}{m}t}\right)$$

Chapter 8 –
Turning the corner: 2D/3D motion

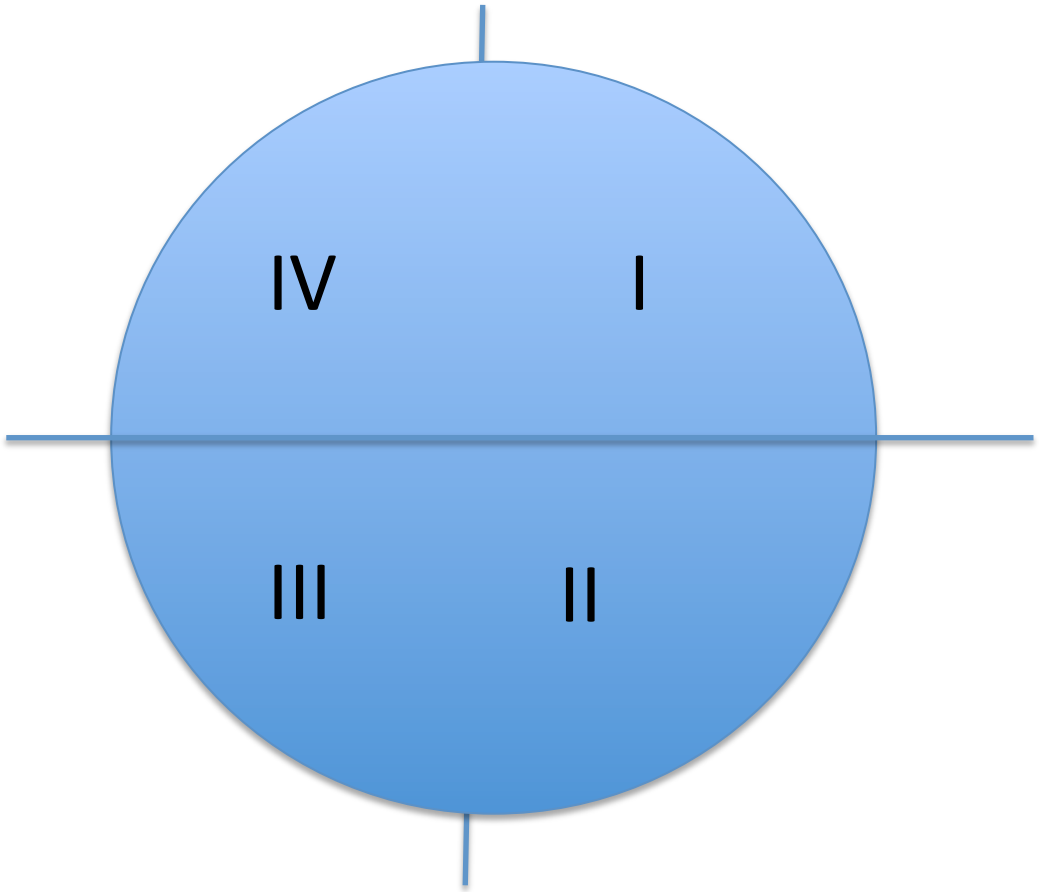




Drawing of the front and the side of a wind turbine, courtesy of ESN



http://paer.rutgers.edu/pt3/experiment.php?topicid=5&exptid=56



A 2.0 kg tether ball is attached to a vertical pole by a 1.5 m long rope. The ball is swung around the pole at an angle of 300 from vertical. What can you say about the force that causes the ball to move in a circle?

A. It the sum of the force of tension and gravity
B. It is equal to the force of tension
C. It is a component of the force of tension
D. It is equal to the force of gravity
E. It is equal to a component of the force of tension and a component of the force of gravity

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