

### Homework #3: Coefficient of Restitution

By the rulebook, the ball must drop from 100'' and return to 53-56''  $e=0.73$  to  $0.75$

Test new ball coef: (this example, it is 0.83)

$$m_{ball}u_{ball} + m_{racquet}u_{racquet} = m_{ball}v_{ball} + m_{racquet}v_{racquet}$$

$$m_{ball}u_{ball} + m_{racquet}u_{racquet} = m_{ball}v_{ball} + m_{racquet} [e(u_{ball} - u_{racquet}) + v_{ball}]$$

$$0.058kg(0m/s) + 0.45kg(u_{racquet}) = 0.058kg(68.4m/s) + 0.45kg [0.83(0m/s - u_{racquet}) + 68.4m/s]$$

$$0.45kg(u_{racquet}) = 3.967 - .3735u_{racquet} + 30.78$$

$$u_{racquet} = 42.2m/s$$

With initial racquet speed, test coef of old ball (this example, it is 0.75)

$$m_{ball}u_{ball} + m_{racquet}u_{racquet} = m_{ball}v_{ball} + m_{racquet}v_{racquet}$$

$$m_{ball}u_{ball} + m_{racquet}u_{racquet} = m_{ball}v_{ball} + m_{racquet} [e(u_{ball} - u_{racquet}) + v_{ball}]$$

$$0.058kg(0m/s) + 0.45kg(42.2m/s) = 0.058kg(v_{ball}) + 0.45kg [0.75(0m/s - 42.2m/s) + v_{ball}]$$

$$18.99 = 0.058v_{ball} - 14.243 + .45v_{ball}$$

$$v_{ball} = 65.4m/s$$

New ball: 68.4 m/s = 153 mph

Old ball: 65.4 m/s = 146 mph