# Physics 180

Problem Set #3:                                                                                    Due: October 4, 2006

"And now comes an act of enormous enormance.
No former performer's performed this performance"
*-Ringmaster in Dr. Seuss' "If I ran the Circus"*

1) Charlie is at the end of a 1.5 km caravan moving a uniform speed across the Mohave desert when he is asked to deliver a message to the leader, Mirna, at the head of the caravan.  Moving at constant speed, he delivers the message to Mirna and returns at the same uniform speed. By the time he returns the caravan has advanced 2 km.  How far did Charlie travel?

2)  Gavin is operating the rotating saw blade at the Kootenay Forest sawmill in Nelson, BC. When he flicks the switch to begin operation, the circular blade accelerates uniformly and reaches its maximum angular speed of 3 revolutions/sec in 3 s.  What is the angular acceleration?  How many revolutions did the blade undergo in the last second before reaching its maximum angular speed?   If the blade has a radius of 0.75 m, what is the angle that the (linear) acceleration vector of a tooth on the edge of the blade makes with the tooth's radius vector 1 s after motion begins?  Just as it reaches its maximum angular speed a piece of sawdust that was at the bottom of the blade when the blade was turned on, flies off. What is its velocity at the instant it dislodges?

3) Marc is riding a bicycle with 65 cm (radius) wheels at a uniform speed of 20 km/hr along Bloor St.  On the front wheel there is a reflector halfway between the axle and the rim. What is the angular speed of this reflector if the bicycle moves without slipping?  What is the magnitude of its (linear) acceleration?  What is the maximum speed of the reflector relative to the ground?

4) Zhao is moving on an Archimedes spiral defined (in polar co-ordinates) by the equation $r = b\theta$. If he moves with a constant angular speed of 1 rad/s and b= 1 m, what is his (linear)velocity and acceleration at t = 1 s, if he begins at $\theta_i$ = 1 rad?