Quiz 3

Name: _____ Student Number: _____

1. (4 marks) A 1000 kg car travels around a bend in the road that has a radius of 200 meters at a speed of 80 km/hr. The bend is not banked.

   a) What is the centripetal acceleration of the car around the bend?

   $$80 \frac{km}{hr} = 80 \frac{km}{hr} \times 1000 \frac{m}{km} \times \frac{1}{3600} \frac{hr}{sec}$$

   $$= 22.2 \; m/sec$$

   $$Acceleration \quad a = \frac{v^2}{r}$$

   $$= \frac{(22.2)^2}{200}$$

   $$= 2.5 \; m/sec^2$$

   b) If the centripetal force is to be supplied by friction of the road on the wheels, what must the coefficient of friction be for the car not to slip?

   $$Centripetal \; Force \quad \frac{mv^2}{r} = \mu \, mg.$$

   $$\mu = \frac{v^2}{rg}$$

   $$= \frac{a}{g}$$

   $$\therefore \mu = 0.25$$

2. (6 marks) A mother pulls her two children, each of which is in a separate sleigh. Two sleighs are used because the children fight if they are together. The sleighs are attached by a rope. The mother exerts a force of 40 Nt which is applied as shown below. For simplicity, we ignore friction.
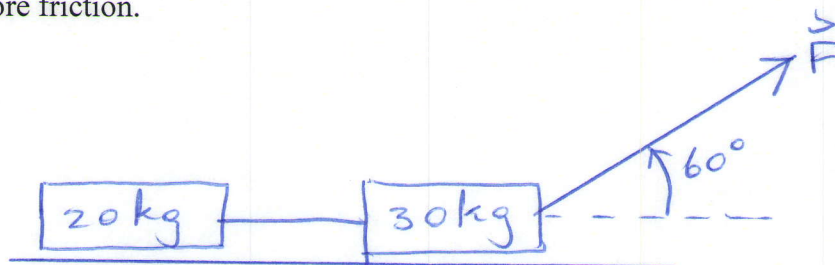
a) What is the acceleration of the sleighs?

Component of $\vec{F}$ in horizontal direction is $F\cos 60°$

$\therefore F\cos 60° = (20+30)\, a.$

$$a = \frac{40 \cos 60}{50}$$

$$= 0.4 \text{ m/sec}^2$$

b) What is the tension in the rope connecting the two sleighs?

Tension in rope is responsible for acceleration of 20kg. sled. $\Rightarrow T = 20kg \times 0.4 \text{ m/sec}^2$

$$= 8 \text{ Nt.}$$

Total = 10 marks