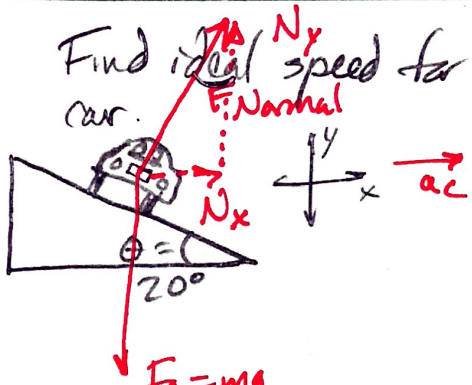
6.68 Find ideal speed for 100.0 m turn banked at 20.0°



I'm not tilting my axes for this analysis because the horizontal turn has a direction of a centripetal pointing toward the center.

The turn is not like this!

It's like this!

$$\Sigma F_c = ma_c = \frac{mv^2}{r}$$

$$F_{Normal\,x} = \frac{mv^2}{r}$$

$$F_N \sin 20 = \frac{mv^2}{r}$$

Need to look at vertical situation to learn more about this.

$$\Sigma F_y = ma = 0$$

$$F_{Normal-y} - F_g = 0$$

$$F_{Normal} \cos 20 = mg$$

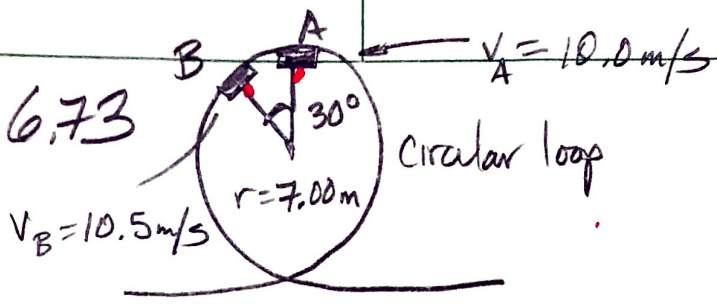
$$F_N = \frac{mg}{\cos 20}$$

$$\left(\frac{mg}{\cos 20}\right) \sin 20 = \frac{mv^2}{100}$$

$$v = \sqrt{100g(\tan 20)}$$

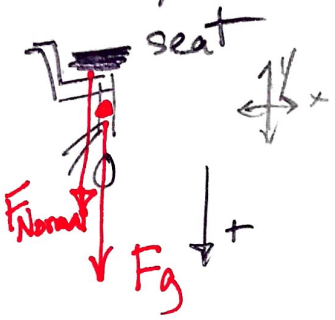
$$= \boxed{18.9\ m/s}$$

6.73



a) Find F_{seat} ($= F_{Normal}$) on child at point A.

Free-body:



$$\Sigma F_c = \frac{mv^2}{r}$$

$$F_{Normal} + F_{gravity} = \frac{mv^2}{r}$$

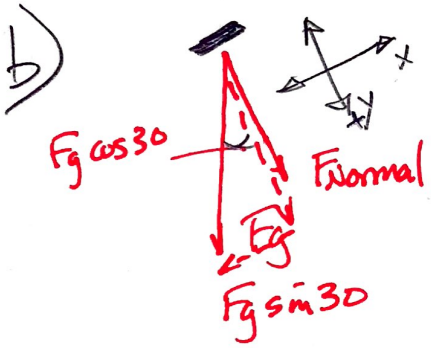
$$F_{Normal} + mg = \frac{mv^2}{r}$$

$$F_{Normal} = \frac{mv^2}{r} - mg$$

$$= \frac{(40)(10)^2}{7} - (40)(9.8)$$

$$= \boxed{179\ N}$$

b)



Because a radial is toward middle of circle, I am going to tilt my axes.

$$\Sigma F_c = \frac{mv^2}{r}$$

$$F_{Normal} + F_{g\ radial} = \frac{mv^2}{r}$$

$$F_{Normal} + mg\cos 30 = \frac{mv^2}{r}$$

$$F_{Normal} = \frac{(40)(10.5)^2}{7} - (40)(9.8)(\cos 30)$$

$$= \boxed{291\ N}$$

c) Minimum v to keep kid in seat at point A?

At minimum speed, there is no F_{Normal} pushing down on the child – only F_g keeps her moving in a circle.

$$\Sigma F_c = \frac{mv^2}{r} = F_g = mg$$

$$\frac{mv^2}{r} = mg$$

$$v = \sqrt{rg}$$

$$= \sqrt{(7m)(9.8\ m/s^2)}$$

$$= \boxed{8.28\ m/s}$$