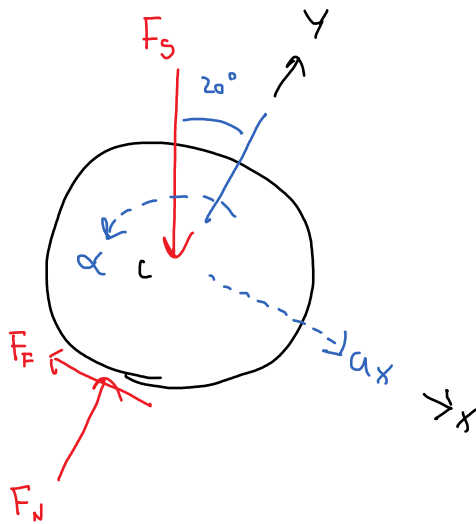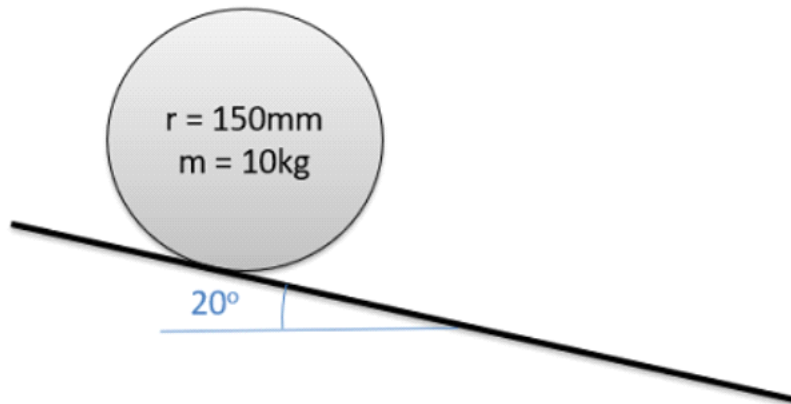# Problem 1

A cylinder with a radius of .15 m and a mass of 10 kg is placed on a ramp at a 20 degree angle. If the cylinder is released from rest and rolls without slipping, What is the initial angular acceleration of the cylinder and the time required for the cylinder to roll 5 meters?

r = 150mm
m = 10kg

20°

$$\sum F_x = (9.81)(10) \sin(20) - F_F = (10)(a_x)$$

$$\sum M_c = -(F_F)(.15m) = \underbrace{\frac{1}{2}(10)(.15m)^2}_{I} \alpha$$

rolling without slipping

$$a_x = -r \alpha$$
$$\uparrow$$
$$.15m$$

×1
$$33.55 - F_F = 10(-.15\alpha)$$

$$F_F = 33.55 + 1.5\alpha$$

M1
$$-(33.55 + 1.5\alpha)(.15) = .1125\alpha$$

$$-5.0328 = .3375\alpha$$

$$\alpha = -14.91 \text{ rad/s}^2$$

$$a_x = -r \,\downarrow\!\alpha = 2.24 \text{ m/s}^2$$

$$\uparrow$$

$$.15$$

$$x(t) = 5 = \frac{1}{2} a t^2$$

$$\boxed{t = 2.11 \text{ s}}$$