Tension and Friction problems
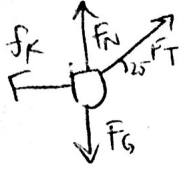
17. A sled is being pulled along a horizontal road at constant speed by means of a rope that makes a 25° with the horizontal. If the friction between the sled and the snow is 84N, how much is the forward pull, and how much is the tension on the rope?

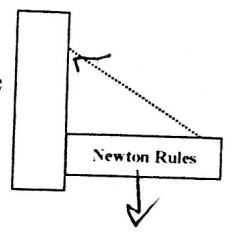forward pull 84N

$F_T = \dfrac{84}{\cos 25} = 93N$

18. A sign is supported as shown; the tension in the rope is 350N. How much does the sign weigh if the angle between the rope and the wall is 40°?

268N

Newton Rules
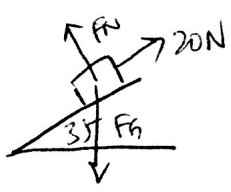
19. A 20-kg pile of books is resting on a plank tilted so that it makes an angle of 20° with the ground. How much force do the books exert against the plank? $188 N = F_{G\perp}$

20. A force of 20-N is needed to push a wagon up a frictionless 35° slope. How much does the wagon weigh?

20N   24N

1. You have a rope attached to a cart that weighs 450-N, and you are lowering the cart down a 25° ramp. If the friction is 75-N, how hard do you have to pull on the rope to prevent the cart from running away from you?

$f_k = 75N$ 333N

$F_G = 450N$