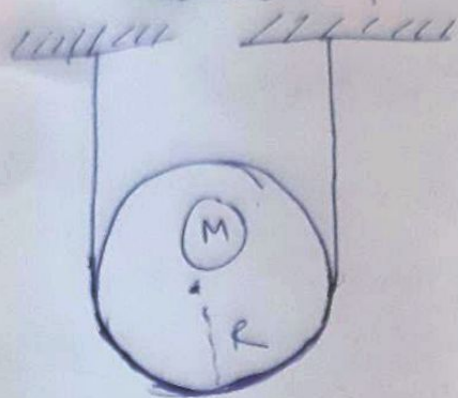


which no such F exists.

(2)



A disk of mass M and radius R is held up by a massless string, as shown in Fig. The surface of the disk is frictionless. What is the tension in the string? What is the normal force per unit length that the string applies to the disk?

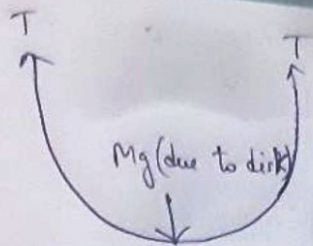
Concepts Used :-

1. Balancing of forces in different direction by drawing F.B.D of the concerned object.
2. Tension remains same in a massless string.

Formulae Used

1. Gravitational force = Mg

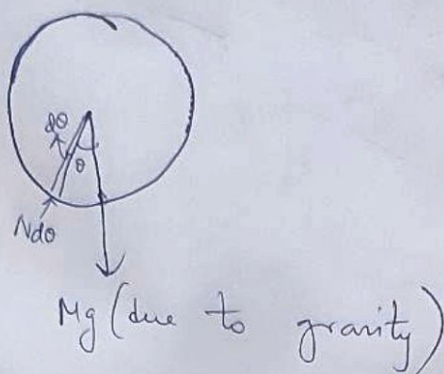
∴ Drawing the F.B.D of the string:



Since these forces must balance

$$\Rightarrow T = \frac{Mg}{2}$$

Now, we consider the second part of the question. Again drawing F.B.D. of disk:



Let $N d\theta$ be the normal force on an arc of the disk that subtends an angle $d\theta$.

Such an arc has length $R d\theta$, so N/R is the desired normal force per unit arc length.

Since string is massless \Rightarrow tension is same

\Rightarrow all points are equivalent $\Rightarrow N$ is constant and independent of θ . The upward component of

the normal force is $N d\theta \cos \theta$, where θ is measured from the vertical $(-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2})$.

Since, the total upward is Mg and net force on disk is zero, we have,

$$\int_{-\pi/2}^{\pi/2} N \cos \theta d\theta = Mg$$

~~Q~~ $\Rightarrow 2N = Mg \Rightarrow \boxed{N = \frac{Mg}{2}}$

\Rightarrow Normal force per unit length = $\frac{N}{R} = \frac{Mg}{2R}$