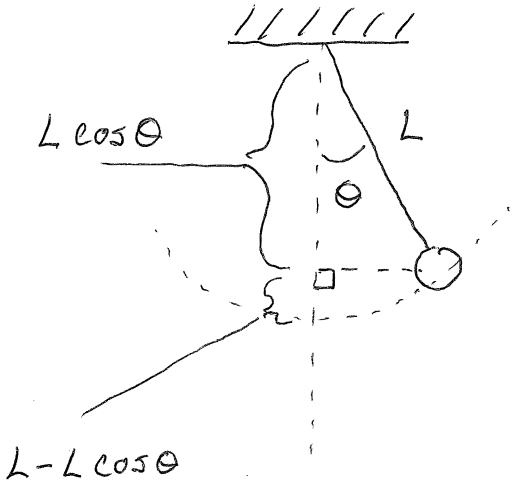
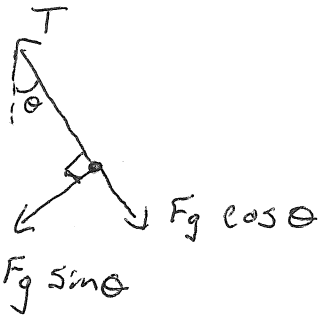
Pendulum



$$E_g = mgh$$

$$h = L - L\cos\theta$$

$$E_g = mgL(1 - \cos\theta)$$



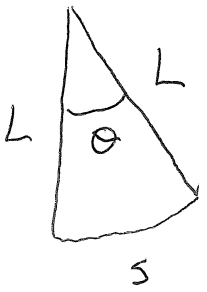
Component of force tangent to circular arc

$$F = F_g \sin\theta = mg\sin\theta$$

* For small angles $\sin\theta \sim \theta$

* In RADIANS

* $F = mg\theta$



s = arc length

$2\pi r$ = circumference

2π = # radians in circle

$$\frac{2\pi r}{2\pi} = \frac{s}{\theta}$$

$$r = \frac{s}{\theta} \qquad \theta = \frac{s}{r}$$

In our case

$$\theta = \frac{s}{L}$$

Then

$$F = mg\theta = mg\left(\frac{s}{L}\right)$$

Spring	pendolum
$F = kx$	$F = \left(\frac{mg}{L}\right)s$
$k =$ constant	$\frac{mg}{L} =$ constant
$T = 2\pi\sqrt{\frac{m}{k}}$	$T = 2\pi\sqrt{\frac{m}{\left(\frac{mg}{L}\right)}}$

$$\boxed{T = 2\pi\sqrt{\frac{L}{g}}}$$