

```
> restart;
```

```
> r := t -> a*<sin(theta(t)),cos(theta(t))>;
```

$$r := t \mapsto \begin{bmatrix} a \sin(\theta(t)) \\ a \cos(\theta(t)) \end{bmatrix}$$

```
> sys_vec := m*diff(r(t),t,t) =~ < 0, m*g> - tau(t)*r(t)/a;
```

$$\left( \frac{d^2}{dt^2} \theta(t) \right) \cos(\theta(t)) - a \left( \frac{d}{dt} \theta(t) \right)^2 \sin(\theta(t)) = -\tau(t) \sin(\theta(t)), m \left( -a \left( \frac{d^2}{dt^2} \theta(t) \right) \sin(\theta(t)) - a \left( \frac{d}{dt} \theta(t) \right)^2 \cos(\theta(t)) \right) = mg - \tau(t) \cos(\theta(t))$$

```
> sys_set := convert(sys_vec, set);
```

$$= \left\{ m \left( a \left( \frac{d^2}{dt^2} \theta(t) \right) \cos(\theta(t)) - a \left( \frac{d}{dt} \theta(t) \right)^2 \sin(\theta(t)) \right) = -\tau(t) \sin(\theta(t)), m \left( -a \left( \frac{d^2}{dt^2} \theta(t) \right) \sin(\theta(t)) - a \left( \frac{d}{dt} \theta(t) \right)^2 \cos(\theta(t)) \right) = mg - \tau(t) \cos(\theta(t)) \right\}$$

```
> solve(sys_set, {diff(theta(t),t,t), tau(t)}):
```

```
sys := simplify(%);
```

$$sys := \left\{ \frac{d^2}{dt^2} \theta(t) = -\frac{g \sin(\theta(t))}{a}, \tau(t) = m \left( a \left( \frac{d}{dt} \theta(t) \right)^2 + \cos(\theta(t)) g \right) \right\}$$

```
> select(has, sys, tau(t))[];
```

$$\tau(t) = m \left( a \left( \frac{d}{dt} \theta(t) \right)^2 + \cos(\theta(t)) g \right)$$

```
> select(has, sys, diff(theta(t),t,t))[];
```

$$\frac{d^2}{dt^2} \theta(t) = -\frac{g \sin(\theta(t))}{a}$$