```
> with(VectorCalculus):
> n := ⟨-sin(θ), cos(θ)⟩
```

$$n := -\sin(\theta)\,e_x + (\cos(\theta))\,e_y \tag{1}$$

```
> ee := ⟨cos(θ), sin(θ)⟩
```

$$ee := (\cos(\theta))\,e_x + (\sin(\theta))\,e_y \tag{2}$$

```
> gg := -g·n
```

$$gg := (g\sin(\theta))\,e_x - g\cos(\theta)\,e_y \tag{3}$$

```
> RR := R·n
```

$$RR := -R\sin(\theta)\,e_x + (R\cos(\theta))\,e_y \tag{4}$$

```
> aaM := aM·ee
```

$$aaM := (aM\cos(\theta))\,e_x + (aM\sin(\theta))\,e_y \tag{5}$$

```
> am := aaM + ⟨w, 0⟩
```

$$am := (aM\cos(\theta) + w)\,e_x + (aM\sin(\theta))\,e_y \tag{6}$$

```
> NN := ⟨0, N⟩
```

$$NN := (N)\,e_y \tag{7}$$

```
> eq1 := m·am - NN - m·gg
```

$$eq1 := (m\,(aM\cos(\theta) + w) - m\,g\sin(\theta))\,e_x + (m\,aM\sin(\theta) - N + m\,g\cos(\theta))\,e_y \tag{8}$$

```
> eq2 := M·aaM + NN - RR - M·gg
```

$$eq2 := (M\,aM\cos(\theta) + R\sin(\theta) - M\,g\sin(\theta))\,e_x + (M\,aM\sin(\theta) + N - R\cos(\theta) + M\,g\cos(\theta))\,e_y \tag{9}$$

```
> x1 := m (aM cos(θ) + w) - m g sin(θ)
```

$$x1 := m\,(aM\cos(\theta) + w) - m\,g\sin(\theta) \tag{10}$$

```
> x2 := m aM sin(θ) - N + m g cos(θ)
```

$$x2 := m\,aM\sin(\theta) - N + m\,g\cos(\theta) \tag{11}$$

```
> x3 := M aM cos(θ) + R sin(θ) - M g sin(θ)
```

$$x3 := M\,aM\cos(\theta) + R\sin(\theta) - M\,g\sin(\theta) \tag{12}$$

```
> x4 := M aM sin(θ) + N - R cos(θ) + M g cos(θ)
```

$$x4 := M\,aM\sin(\theta) + N - R\cos(\theta) + M\,g\cos(\theta) \tag{13}$$

```
> solve({x1 = 0, x2 = 0, x3 = 0, x4 = 0}, [w, aM, R, N])
```

$$\left[\left[w = \frac{g\sin(\theta)\left(\cos(\theta)^2 m + M\cos(\theta)^2 + m\sin(\theta)^2 + M\sin(\theta)^2\right)}{M\cos(\theta)^2 + m\sin(\theta)^2 + M\sin(\theta)^2},\ aM = -\frac{\sin(\theta)\,m\,g\cos(\theta)}{M\cos(\theta)^2 + m\sin(\theta)^2 + M\sin(\theta)^2},\ R\right]\right] \tag{14}$$

$$= \frac{M g \left(\cos(\theta)^2 m + M \cos(\theta)^2 + m \sin(\theta)^2 + M \sin(\theta)^2\right)}{M \cos(\theta)^2 + m \sin(\theta)^2 + M \sin(\theta)^2}, N$$

$$= \frac{m g \cos(\theta)\, M \left(\cos(\theta)^2 + \sin(\theta)^2\right)}{M \cos(\theta)^2 + m \sin(\theta)^2 + M \sin(\theta)^2} \Big]\Big]$$

> $simplify\left(-\frac{\sin(\theta)\, m g \cos(\theta)}{M \cos(\theta)^2 + m \sin(\theta)^2 + M \sin(\theta)^2}, trig\right)$

$$-\frac{m g \sin(\theta)\, \cos(\theta)}{m + M - \cos(\theta)^2 m} \qquad \textbf{(15)}$$