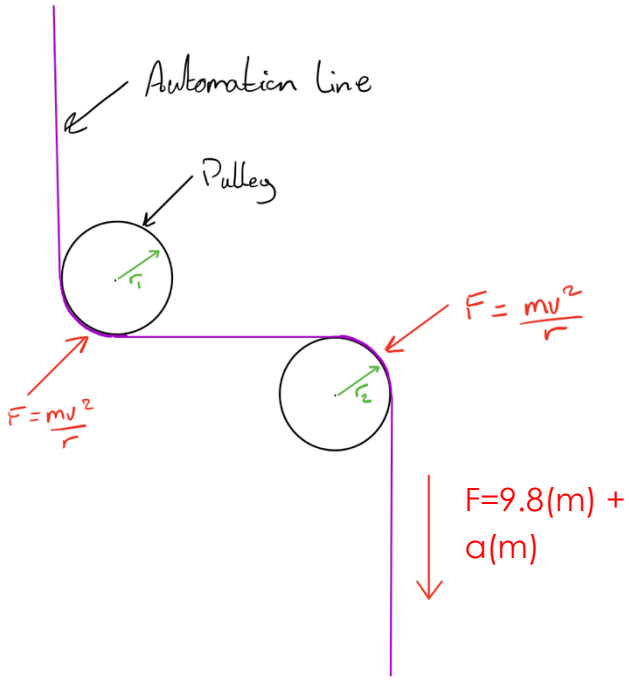
The New Athenaeum automated winch system is rated to allow for a force of 200kg travelling at 1.5ms$^{-2}$ (excluding the force of gravity) and halting to a stop. The maximum force that the automation winch can handle is as follows:

| | | | |
|---|---|---|---|
| F=ma | + | F=mg | m=200kg |
| =200(1.5) | + | =200(9.8) | g=9.8ms$^{-2}$ |
| =300N | + | =1960N | |

$\Delta F = 300 + 1960 = 2260N$

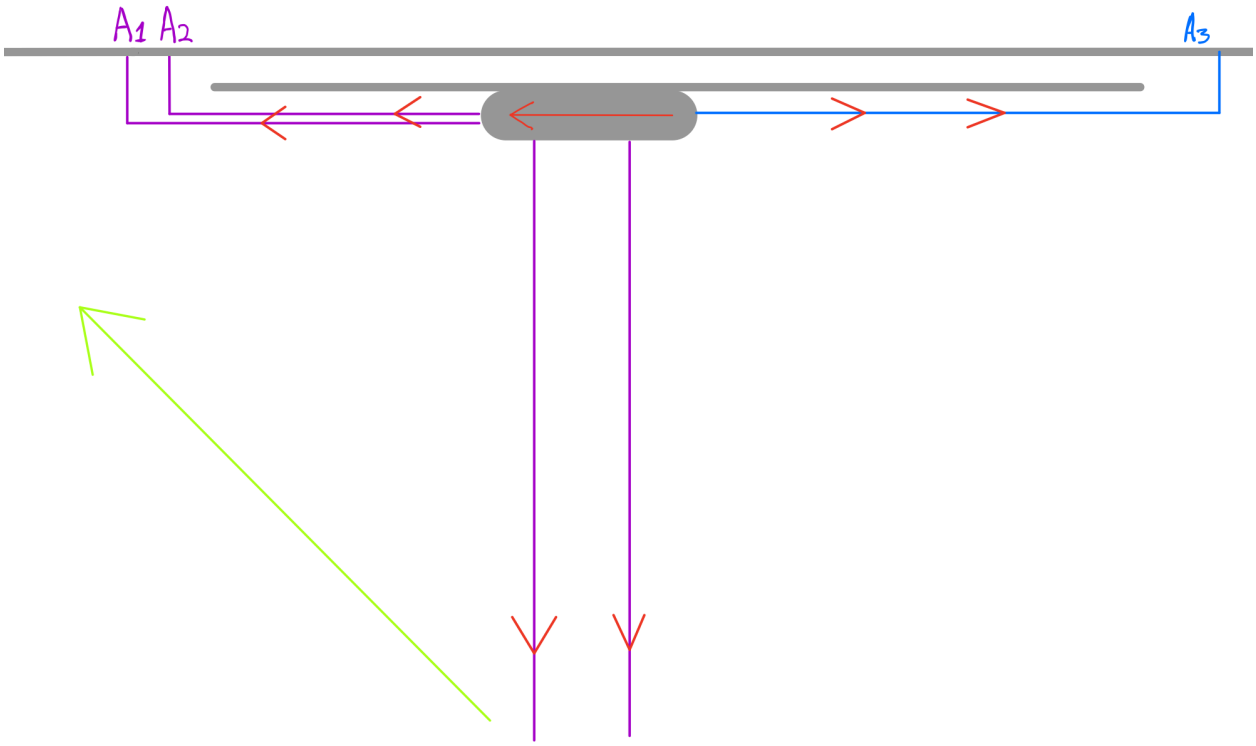
The maximum force that each automation winch can handle is **2260N**.

This force is reduced by friction in the system. Each pulley, as it turns, takes a force towards the centre of the pulley. This is a rotational motion force and is a percentage of the frictional force. The frictional force cannot be calculated directly as it is dependant on the pulley motion and the rope friction against the sheath. The diagram below shows how to calculate the central force applied to the pulleys in motion:



The automated flying system will take use of three automated winches; one of each of the two performers for lit]ft and drop movements and one for the tracking system.

The return track motion can be achieved by using the weight force of the actors with a addition of a lift vector:




If there is a mass on the end of the lift lines then the carrier on the unirail track is experiencing a force to the left and a fraction of a force down. This means that if there was no force towards the tracking winch then the carrier would slide left. With a lock applied to the tracking line, an opposite force is then applied keeping the carrier in place. This lock allows the character lines to lift without any form of tracking. To achieve the diagonal track and lift motion, there

must a force in upward and a force to the right that does not exceed the upward force. Both forces are created by simply lifting the character lines as the only force that has to be considered for the movement is their weight. The track can be controlled by applying an opposite but smaller force towards the tracking winch – one that does not outdo the lifting force.

The force that must be overcome by the automation winches is the character weight (and a negligible friction force). Let's say for example the characters wight 70Kg each. The weight force the system has to overcome is as follows:

F=ma = [70x9.8] x 2

= 1372N

The maximum force that can be applied to a single automation winch is 2260N, leaving a remaining usable limit of 888N on a single winch.

The only way the system would fail is if there was an external mechanical force applied that would cause the automation winches to act against each other.