

# EPro8 Challenge

Engineer Problem Solve Innovate

## Rowing Machine

A rowing machine is one of the most efficient forms of exercise equipment because it works all parts of the body at the same time.

You will construct a rowing machine.

It will be adjustable so that rowers of different strength can all get a good workout.



### Seat and Bungy.

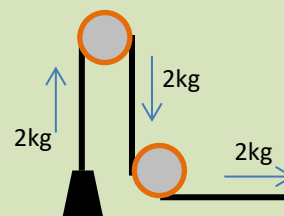
Criteria	<p>A frame is approximately 1.3m long, 400mm wide and 200mm tall. A seat is at one end of the frame. The seat is reinforced with extra legs. The rower sits on the seat and can pull a handle horizontally a distance of at least 800mm. A string of rubber bands is attached horizontally from the handle to the far end of the rowing machine.</p>
----------	--

#### Hint

Add an extension at the far end so that the rubber bands are attached at the same height as the rowers hands. This way the rubber band will be pulling horizontally.

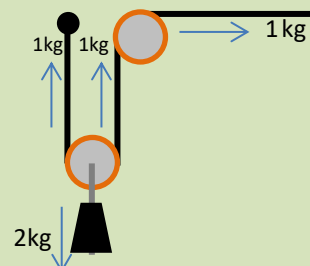
## Constant Force

Criteria	The rower sits on the seat and pulls a handle at least 800mm horizontally. The force required to pull the handle is the equivalent to 2kg of weight.
Hint	<p>Gravity will pull a weight downwards. Pulleys are used to change the direction of force in a rope.</p> <p>For example a vertical force can be converted into a horizontal force using a pulley.</p> <p>The pulleys will need to be mounted to a frame. Think carefully how tall the frame will need to be to allow the handle to be pulled 800mm.</p>



## Weakling

Criteria	The rowing machine is reconfigured so that the handle can be pulled 800mm horizontally using a force equivalent to approximately 1kg.
Hint	<p>Pulleys can be used to reduce the load. To do this, loop the rope between pulleys on the weight and pulleys on the crane.</p> <p>In this example the 1kg weight is spread on to 2 ropes, so each rope takes half of the load (1 kg). The force required to lift the 2kg weight is now 1 kg.</p>



## Muscle Man

Criteria	The rowing machine is reconfigured so that the handle can be pulled at least 800mm horizontally using a force equivalent to 4kg.
Hint	<p>Use the same concept of multiple pulleys but this time the pulleys attached to the handle rather than the weight.</p> <p>You will need to change the height of the frame as twice as much rope will be pulled through as you pull on the handle.</p>

Rower's Speed	
Criteria	Count how many strokes you can complete in 30 seconds.
	Calculate how many strokes you could complete in one hour.
	We will assume that each stroke is the equivalent of 8m travelled. Calculate the rower's speed in km/hr.

After you have attempted this challenge watch the tutorial to see our solution at [www.EPro8Challenge.co.nz/Tutorial](http://www.EPro8Challenge.co.nz/Tutorial) and enter the Challenge Code **RWNG**.