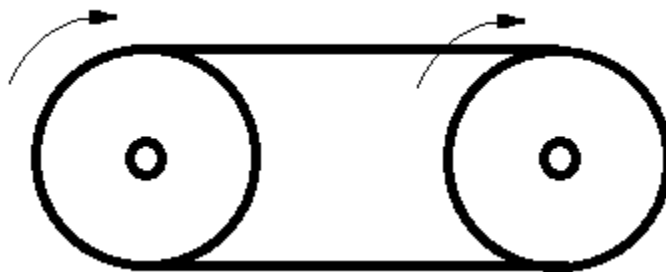Pulleys and Belt drives

Both pulleys and belt drives use a pulley wheel (Sheave) to do work.
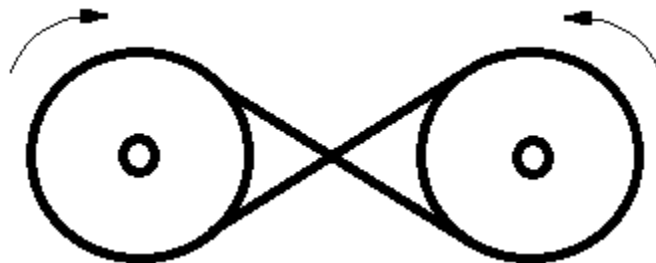
Belt drives

Belt drives are used to transmit rotary motion from a driver pulley wheel to a driven pulley wheel/s. The driver and driven pulley wheel/s are connected to each other using a belt/rope/chord, which transmits the force of rotation from the driver to the driven pulley.

In the normal position both the driver and driven pulley wheels rotate in the same direction as illustrated below:

In instances where pulley wheels are required to counter rotate, this can be achieved by twisting the connecting belt.
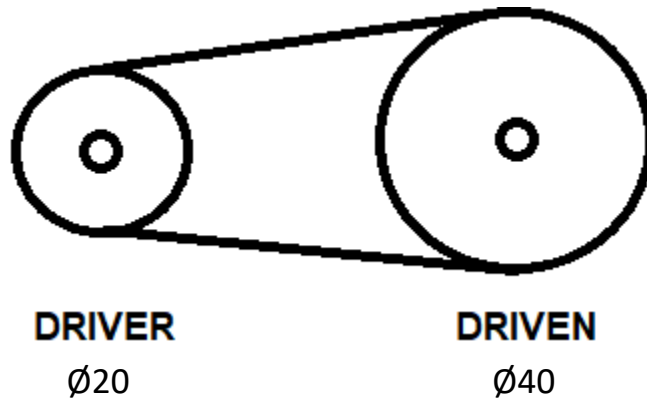
Belt drives can also be used to change the speed of rotation by changing the sizes of the pulley wheels. Speed ratio can be calculated using the formula:

$$Speed\ Ratio = \frac{Diametre\ Of\ Driven\ Pulley}{Diametre\ Of\ Driver\ Pulley}$$

For example:
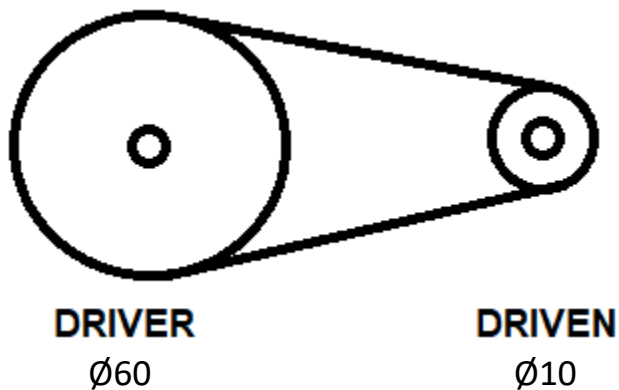
1. $Speed\ Ratio = \frac{40}{20}$

$= \frac{2}{1}$

$= 2:1$

DRIVER
Ø20

DRIVEN
Ø40

A speed ratio of 2:1 means that for every two rotations of the driver pulley wheel the driven pulley will rotate once.

2. $Speed\ Ratio = \frac{10}{60}$

$= \frac{1}{6}$

$= 1:6$

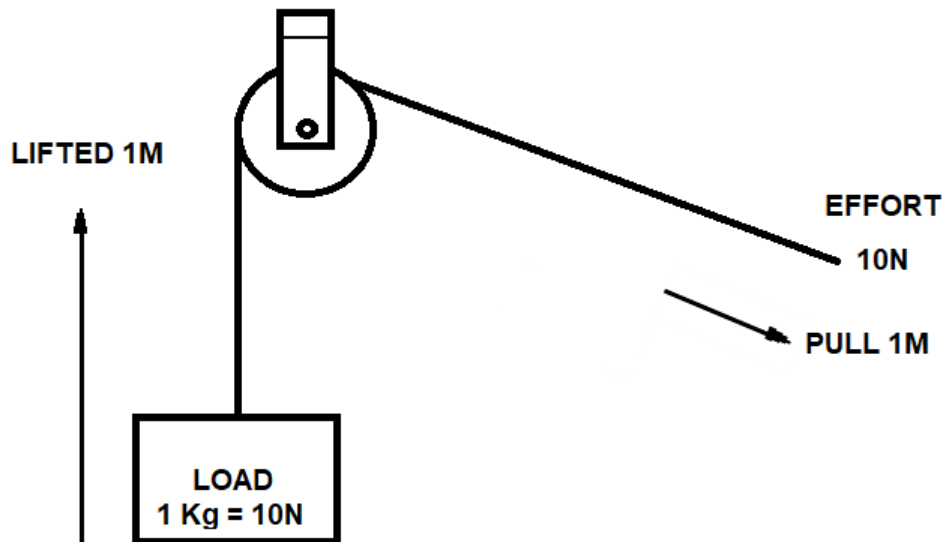**DRIVER**
Ø60

DRIVEN
Ø10

A speed ratio of 1:6 means that for every rotation of the driver pulley wheel the driven pulley will rotate six times.

Pulley systems

A pulley system is another example of a system that uses a pulley wheel (Sheave) to do work. A Pulley system is used to lift a load. There are two main kinds of pulley systems;
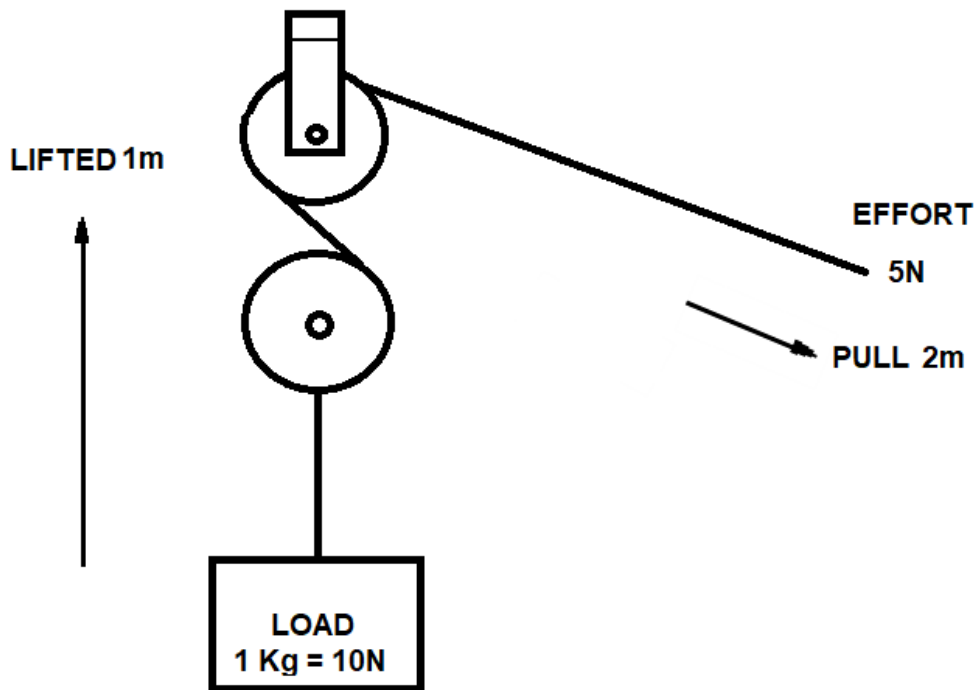
A simple pulley system:

A simple pulley system consists of one pulley wheel and one fall (falls are all the ropes in the pulley system except the rope that you pull at). A simple pulley system has a Mechanical advantage of 1.

$$Mechanical\ Advantage = \frac{LOAD}{EFFORT}$$

$$= \frac{10}{10}$$

$$MA = 1$$

A compound pulley system consists of more than one pulley wheel and therefore has more falls. This means that Mechanical advantage would increase and the lifting of a load becomes easier, however more rope would have to be pulled in order to lift the load.

A compound pulley system:

LIFTED 1m

EFFORT

5N

PULL 2m

LOAD
1 Kg = 10N

1. Calculate the mechanical advantage of the compound pulley system above.