

Gearing with Lego

<u>Number of Teeth</u>	<u>Radius (in Lego units)*</u>
8	2.5
16	5
24	7.5
40	12.5

$$\begin{aligned}\text{Gearing Ratio (GR)} &= (\text{driver gear radius})/(\text{followers gear radius}) \\ &= (\# \text{ teeth on driver gear})/(\# \text{ teeth on follower radius})\end{aligned}$$

GR of a chain of gear stages = product of the GR of all individual stages

$$\# \text{ turns of follower gear} = (\# \text{ turns driver gear}) * GR$$

$$\text{follower gear torque} = (\text{driver gear torque})/GR$$

$GR < 1$ → Gearing Down →

 follower gear speed < driver gear speed
 and follower gear torque > driver gear torque

$GR > 1$ → Gearing Up →

 follower gear speed > driver gear speed
 and follower gear torque < driver gear torque

* The distance between (the centers) of two consecutive holes on a Lego beam is assumed to be 5 units

Pulleys and belts

<u>Pulley Name</u>	<u>Radius (in mm)⁺</u>
Half Bush	2.9
Small	4.35
Medium	10.95
Large	17.1

Measured (approximate) Ratios Among Pulleys

<u>Pulley Size</u>	<u>Half Bush</u>	<u>Small</u>	<u>Medium</u>	<u>Large</u>
Half Bush	1:1	1:1.5	1:3.8	1:6
Small	1.5:1	1:1	1:2.5	1:4
Medium	3.8:1	2.5:1	1:1	1:1.6
Large	6:1	4:1	1.6:1	1:1

⁺ This measurement is approximate and represents the radius of the circle/disk defined by the outer groove of the pulley.