Q.: What magnification can I get from a telescope? (Question 001)

A.: This is one of the first questions beginners will ask. (Later they will learn that there are more important things to ask, like "what scope aperture should I start with?").

Focal length of the objective (mirror, lens) = **F**
Focal length of the eye piece = **f**

Magnification (or Power is) **M = F/f**

E.g. a Newtonian type telescope (mirror) might have **F** = 1200 mm
Let the eyepiece have **f** = 30 mm
Your magnification comes to **M** = 1200/30 = 40X

Beginners should try to get started with simple telescopes. There is a learning curve and simple is the best start (not every amateur will recommend that, many novices don't heed this advice, and then telescopes end up in some closet never to be used again). Lower magnifications make a telescope easier to handle by a beginner. **BUT…**

There is a lower limit to M. Let it be $\mathbf{M_{low}}$
The light bundle which exits the eyepiece is called exit pupil and its diameter **d** has to be close to the pupil diameter of the eye. If it is larger not all collected light will be utilized by the eye. Let's take care of this…

Diameter of the telescope exit pupil = **d**
Diameter of the telescope objective = **D** (in our examples we will use **D** = 200 mm)
Magnification = **M**

The magnification is also given by **M = D/d** (and from this **d = D/M;** larger **M** means smaller **d**)

The dark adapted pupil of the eye has $\mathbf{d_{eye}}$ = 8 [mm]. So if we make the telescope exit pupil **d** also 8 [mm], and since we know the objective **D** = 200 [mm], as a consequence the low magnification limit comes to $\mathbf{M_{low}}$ = 200/8 = 25X (Lower magnification leads to light loss).

There is an upper limit to M. Let it be $\mathbf{M_{upper}}$. Several factors constrain $\mathbf{M_{upper}}$.

The empirical formula is $\mathbf{M_{upper} = D}$[mm] **/** 0.8 [mm]. So $\mathbf{M_{upper} =}$ 200/0.8 = 250X

This does not consider air turbulence and optical deficiencies.

Please refer for f/Ratio of a telescope to Question 002