Virtual Astronomy Club Handy Astronomy Formulae

Formula Name	Formula	Why We Use It / Notes	Example
Exit Pupil Diameter (mm)	Telescope Aperture (mm) ÷ Magnification	Shows you how big the circle of light that leaves your eyepiece and hits your eye will be. This should be no more than 7mm.	If your telescope is 4″ (100mm) in diameter and you have a magnification on 80x, the size of the exit pupil is 100 / 80 = 1.25mm
Field of View (true)	Apparent field of view ÷ Magnification	Each eyepiece has an 'apparent field of view', e.g. 55°. Dividing that by the magnification it produces in your telescope tells you how much of the sky you'll see with that eyepiece.	If your eyepiece has an apparent field of view of 50° and gives a magnification of 40x (see formula for magnification, below) then your true field of view is 50 / 40 = 1.25°
Focal Ratio	Focal length of telescope ÷ Telescope aperture	Lower focal ratios are known as 'fast' and considered best for low magnification, wide field observing. High rations are 'slow' and best for planetary and high magnification. Medium is around f/6-f/10.	If your telescope has a focal length of 700mm and the diameter of your main mirror or lens is 4″ (100mm), then your focal ratio is 700mm/100mm = 7
Magnification	**Telescope focal length (mm) ÷ Eyepiece focal length (mm)**	**Working out the magnification of any object we look at as a combination of our telescope and eyepiece. Longer focal length scopes give higher magnification with the same eyepiece.**	If your telescope has a focal length of 500mm and your eyepiece has a focal length of 10mm, the magnification that combination will give you is 500mm / 10mm = 50x
Minimum Magnification	Telescope Aperture (mm) ÷ 7	Below this level of magnification, the exit pupil exceeds the diameter of your on pupil, so you can't see the whole image.	If your telescope has a diameter of 4 inches (100mm), then its minimum (useful) magnification is 100 / 7 = 14.3x
Resolving Power	120 ÷ Telescope Aperture (mm)	This number tells you the smallest separation between two stars which can be resolved in arcseconds.	If your telescope's main mirror or lens has a diameter of 4″ (100mm), then your resolving power is 120mm/100mm = 1.2
Stellar Magnitude Limit	2 + (5 × Log (telescope aperture in mm))	Complex formula which tells you the faintest star magnitude your telescope will reveal.	Start with your objective diameter in mm. Assume a 4″ scope has a 100mm objective. Enter 100 into a calculator and press the [log] button. Next, multiply the answer by 5 and, finally, add 2. A 100mm lens has a stellar magnitude limit of 12.
Theoretical Maximum Magnification	Telescope Aperture (inches) x 50	The theoretical maximum magnification you can achieve with a telescope before the image breaks down. The same formula for metric is aperture in mm x 2	If your telescope has a diameter of 4 inches, then its theoretical maximum magnification is 50 x 4 = 200x

Conversions

- To convert from mm to inches, divide by 25.4
- To convert from inches to mm, multiply by 25.4