When astronomers talk about the brightness of a star they will describe the star as a Magnitude 1.2 (Mag 1.2) or perhaps Magnitude -1.4 (Mag -1.4) so what does this mean?

Magnitude was a measure of the brightness of stars

A magnitude was estimated by eye as:
If a star was twice as bright then it was 1 magnitude brighter

Magnitude 1	Brightness	=	1	
Magnitude 2	Brightness	=	2	times fainter
Magnitude 3	Brightness	=	4	times fainter
Magnitude 4	Brightness	=	8	times fainter
Magnitude 5	Brightness	=	16	times fainter
Magnitude 6	Brightness	=	32	times fainter

So a magnitude 3 star is (1 x 2 x 2) = Mag 4
and a magnitude 4 star is (1 x 2 x 2 x 2) = Mag 8

Magnitude 6 was the faintest star seen by the unaided (naked eye)

Ancient astronomers estimated the brightness of stars by comparing a star's brightness to the brightness of other stars with a known and recorded (standard) brightness.

The ancient brightness scale used six steps of brightness from 1 (the brightest star) to 6 for the faintest star visible to the 'naked eye' in a completely dark and clear sky.

Magnitude is a measure of the brightness of stars

A more scientific method is now used based on Natural Logarithms

The base of the Natural Logarithm log(e) is 2.718281828459

The 1 to 6 magnitudes scale was kept but the steps were changed

The range was set as: a Mag 1 star is 100x brighter than Mag 6

So the brightness step was established by $\sqrt[5]{100}$ or about 2.512

In more modern times, it was decided to update the Magnitude scale to make it more accurate. The decision was taken to keep the familiar 1 to 6 Magnitude scale but to base the difference in brightness divisions on a scientific progression system. Basing it on the range of stars visible to the naked eye the brightest stars were set to be Magnitude 1 and the faintest stars visible to the unaided eye were said to Magnitude 6.

To calculate the brightness of each step in the magnitude scale the comparative brightness between a Mag 0 star and a Mag 6 was to be 100 times fainter. So the brightness difference between each magnitude was calculated by $\sqrt[5]{100} = 2.512$.

The brightness between two stars on this brightness scale was set at 2.51 times fainter than the next standard brightness star. This scale became known as the Star Magnitude Scale.

Magnitude is a measure of the brightness of stars

Magnitude 1	Brightness	=	1
Magnitude 2	Brightness	=	2.51 times fainter
Magnitude 3	Brightness	=	6.3 times fainter
Magnitude 4	Brightness	=	15.8 times fainter
Magnitude 5	Brightness	=	39.8 times fainter
Magnitude 6	Brightness	=	100 times fainter

So a magnitude 3 star is (1 x 2.51 x 2.51) = 6.3x

and a magnitude 4 star is (1 x 2.51 x 2.51 x 2.51) = 15.8x

a magnitude 6 is (1 x 2.51 x 2.51 x 2.51 x 2.51 x 2.51) = 100x

The faintest stars seen with the 'naked eye' are magnitude +6

Sirius in Canis Major is the brightest star at magnitude -1.46

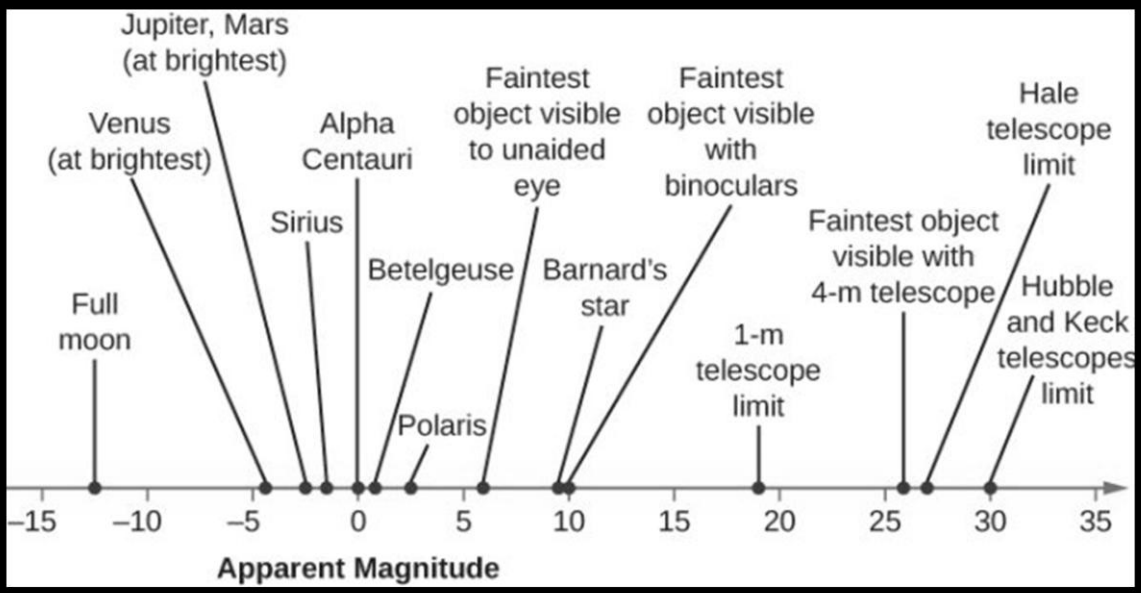
The brightness between two stars on this brightness scale was set at 2.51 times fainter than the next standard brightness star. This scale became known as the Star Magnitude Scale.

It can be seen in the slide above that the difference in brightness is 2.512 x brighter or fainter. So a 6th magnitude star will be 2.512^5 fainter than a 1st magnitude star (actually 100 times fainter).

Put another way it is 1 x 2.512 x 2.512 x 2.512 x 2.512 x 2.512 = 100 times fainter. (1 multiplied by 2.512 five times). Objects brighter than magnitude 0 are given a minus number viz. -1.46.

Stars from Mag 0 to Mag 1 are called 1st magnitude class stars and those from Mag 5 to Mag 6 are called 6th magnitude stars. But individual stars will have a more accurate decimalized magnitude like +3.25 or – 1.02.

Magnitude of objects in our sky



The magnitude of the Sun is -26.8

The chart above shows the Magnitude of some well known celestial object for comparison.

Magnitude is a measure of the brightness of stars

There are two ways to measure the magnitude of a star:

APPARENT MAGNITUDE is how bright the star looks to us

ABSOLUTE MAGNITUDE is how bright the star is (Intrinsic)

Absolute Magnitude is how bright stars are at a set distance

The conventional distance is 10 parsecs or 32.6 light years

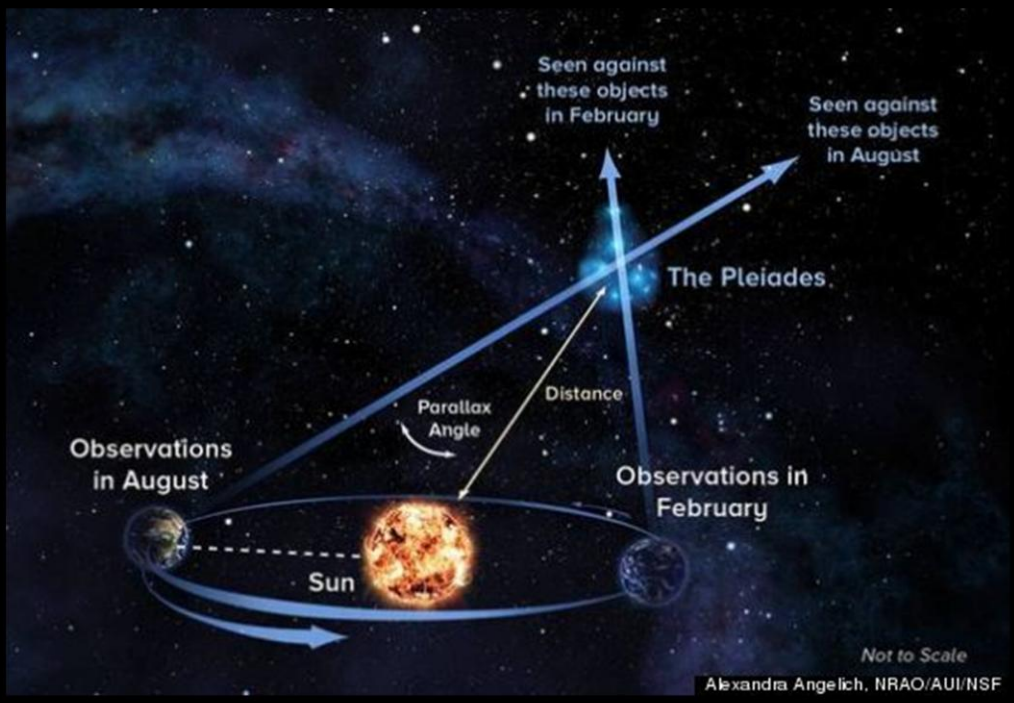
There are two magnitude scales used in astronomy these are termed: Apparent Magnitude and Absolute Magnitude.

Apparent Magnitude is a scale of how bright an object appears to be in the sky as we perceive it optically and telescopically.

Absolute Magnitude is a scale indicating how bright an object actually is and how bright it would appear if it was at a standard distance from the observer.

This standard distance has been set at 10 parsecs which is equivalent to 32.6 light years.

Measuring a Parallax angle (parsec)



1º = 60 arc-minutes (60') = 3600 arc-seconds (3600")

Parallax is the method used to measure the distance to astronomically near objects. The method utilises the branch of mathematics called Trigonometry. This uses the length of a side and an included angle of a right angled triangle to measure a distance. Parallax uses the Earth's distance from the Sun as the known length of a side (150 million kilometres). Shown as the dotted line on the diagram above. The position of the object is recorded against the background stars. Three months later Earth will be at the position shown by the dotted line (150 million km to the left). The angle to the object is measured and the Earth to object distance can be calculated.

Magnitude of brightest stars

	Star (constellation)	Absolute Magnitude	Apparent Magnitude	Distance from Earth (light-years)	Temperature (°C)
1	The Sun	+4.8	**-26.72**	-	5700
2	Sirius (in Canis Major)	+1.4	**-1.46**	8.6	12000
3	Canopus (in Carina)	+0.5	**-0.72**	74	7000
4	Rigel Kentaurus (Alpha Centauri, in Centaurus)	+4.4	**-0.27**	4.3	5600
5	Arcturus (in Bootes)	+0.2	**-0.04**	34	4500
6	Vega (in Lyra)	+0.6	**+0.03**	25	18000
7	Capella (in Auriga)	-0.4	**+0.08**	41	5200
8	Rigel (in Orion)	-8.1	**+0.12**	900	18500
9	Procyon (in Canis Minor)	+0.28	**+0.38**	11	6000
10	Archenar (in Eridanus)	-1.3	**+0.46**	75	6500
11	Betelgeuse (in Orion)	-7.2	**+0.50**	1500	3500
12	Hadar (in Centaurus)	-4.3	**+0.61**	300	4200
13	Altair (in Aquila)	+0.5	**+0.77**	17	9000
14	Aldebaran (in Taurus)	-0.2	**+0.85**	65	4500
15	Antares (in Scorpius)	-4.5	**+0.96**	400	3300
16	Spica (in Virgo)	-3.55	**+1.04**	260	22185
17	Deneb (in Cygnus	-7.2	**+1.25**	1500	12000
18	Vans Maanens	+ 12.8	**+17.34**	14.1	7200