The Sky at Night

The Moore Winter Marathon - Observing Guide
(Items 1-25: Naked Eye/Binocular)

Written and illustrated by Pete Lawrence

1 Pleiades cluster in Taurus

Rating - *Easy*

Best seen with - *Naked Eye*

2 Hyades cluster in Taurus (Caldwell 41)

Rating - *Easy*

Best seen with - *Naked Eye*

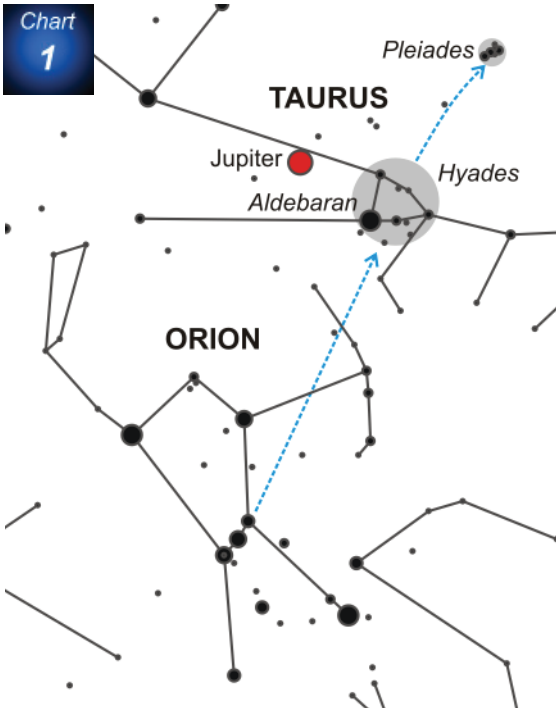
Visibility - *up most of the night*

Items **[1]** and **[2]** are both in the same constellation of Taurus the Bull. The Pleiades **[1]** is a beautiful young cluster of stars which represents the shoulder of the bull. The Hyades **[2]** are a much older, closer and a more dispersed cluster of stars representing the bull's face. The Hyades cluster looks like a *"V"* on its side and has a bright star called Aldebaran lying at the end of the southern arm of the *"V"*.

Locating The Pleiades **[1]** and Hyades **[2]** is easy thanks to an old friend – Orion the Hunter. Locate Orion in the southern half of the sky. You may have to catch him in the early hours at the start of October but he will rise at a more convenient time during November and into December.

Locate his belt, formed from three similar brightness stars arranged in a distinctive line. Follow the line formed by the belt stars northwest (that's up and to the right as seen from the UK) to arrive at the bright orange star Aldebaran. The "V" shaped Hyades extend off to the west of Aldebaran – an easy pattern to see with the naked eye or when using binoculars.

The Pleiades **[1]** can be seen by extending the line from Orion's belt through Aldebaran and keep going, bending it down slightly as you go. Both objects are easy naked eye targets.



3 Triangulum Galaxy (M33)

Rating - *Hard*

Best seen with - *Binoculars*

Visibility - *up for a large part of the night Nov-Dec, best viewed just after darkness falls during Jan*

After the relative ease of items **[1]** and **[2]**, the next entry may leave you scratching your head. The Triangulum Galaxy, (M33), **[3]** is large and, on paper, quite bright. However, the brightness reports are misleading because they refer to how bright the object would be if you concentrated all of its light into a point source, like a star.

In the case of M33, a spiral galaxy in the constellation of Triangulum the Triangle, the galaxy's light is spread over an area roughly equivalent to a region 1.5 x 2.5 full Moons in size. Despite it being listed as a relatively bright object, spreading its light over a sizeable area of the sky means that its surface brightness is low and this is what makes it a challenge.

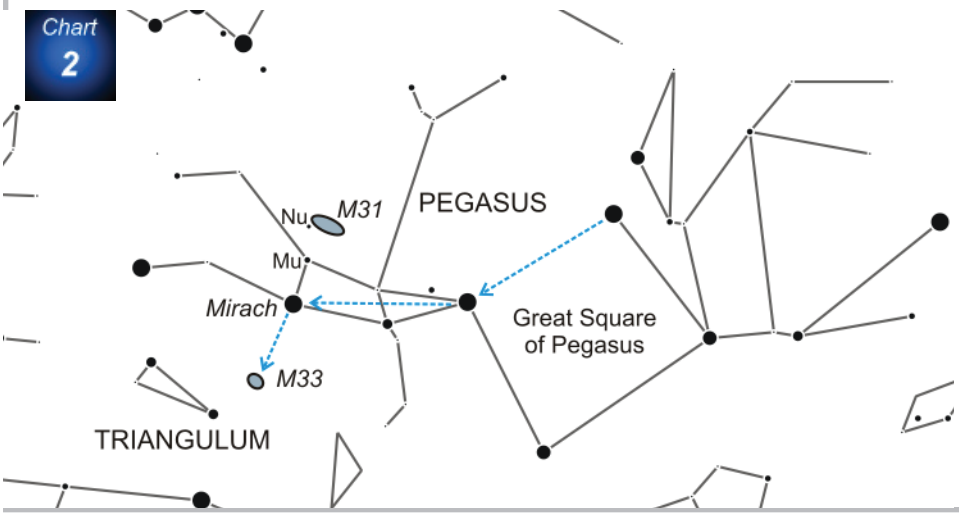
If you have very clear and very dark skies, you might be able to see M33 with just your eyes but it has to be said that this is very hard. A better way is to use binoculars but even here, the object can be elusive.

Look for the faintest smudge in the region indicated in our chart. Interestingly, the best way to locate it is first to locate an object which isn't in the Marathon – The Andromeda Galaxy or M31.

To see this first locate the Great Square of Pegasus, a pattern of four middle brightness stars that sits just over half way up the sky, due south at 22:00 BST mid October, 19:00 GMT mid November and 17:00 GMT mid December.

Join the top right star to the one in the top left corner, and then extend that line by the same distance again, heading up slightly, to locate Beta Andromedae or Mirach. Turn 90 degrees from this line so you're heading up the sky until you come to fainter Mu Andromedae, then keep going to locate Nu Andromedae which is fainter still.

M31 is right next to Nu Andromedae. If you can see it, draw a line from M31 through Mirach and keep going for the same distance again to arrive at the part of the sky in which M33 can be found.



4 Messier 35 cluster in Gemini

Rating - *Easy* **Best seen with -** *Binoculars*

Visibility - *Up for most of the night*

5 Beehive Cluster (M44), in Cancer

Rating - *Easy* **Best seen with -** *Binoculars*

6 Messier 67 - cluster in Cancer

Rating - *Easy* **Best seen with -** *Binoculars*

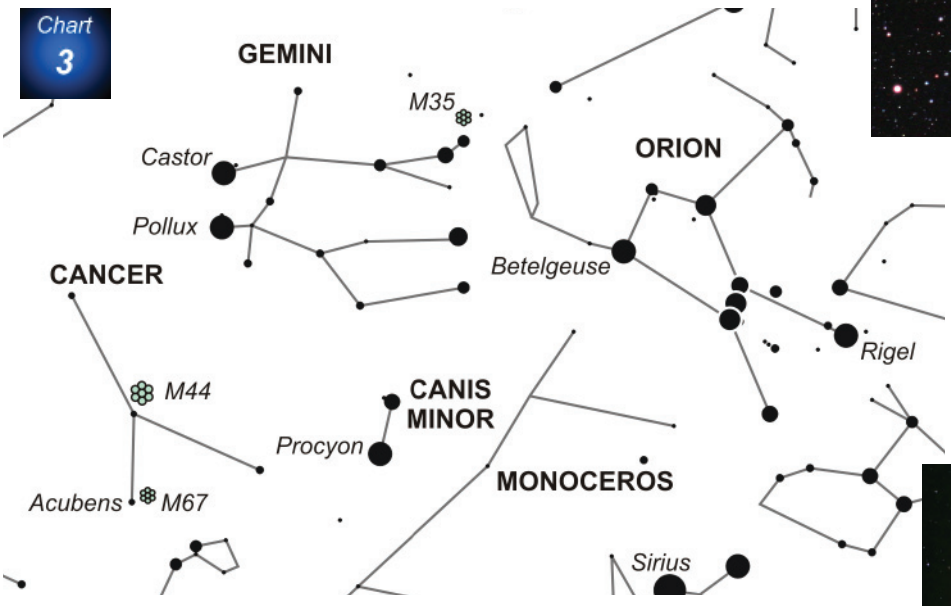
Visibility - *Up for a good part of the night but need to view close to midnight during Nov*

Clusters abound in the Moore Winter Marathon and there are some excellent examples, some of which can be seen with the naked-eye and some which will require binoculars. A good example of a binocular cluster can be found at the foot of Gemini the Twins. Known as Messier 35, this is a lovely object roughly the same apparent diameter in the sky as the full Moon, which shows curves and lines of stars threading through the cluster. Look out for a pattern which has been said by some to resemble the Space Shuttle coming in to land! Whatever you can see, if you find M35, that's item **[4]** ticked off the list.

At the heart of Cancer the Crab is another wonderful object than can, if the skies are good and transparent, be seen with the naked eye as an area of mistiness. Binoculars reveal the true glory of M44, The Beehive Cluster which also goes under the name of *Praesepe*. In ancient times it was said that if M44 couldn't be seen, there was bad weather on the way. In modern times this could also mean that you have bad light pollution! As soon as you've seen it, you can tick off item **[5]**.

Another cluster located close to the rather dim primary star of Cancer – Alpha Cancri also known as Acubens – is M67, marathon item number **[6]**. This is one of the oldest known clusters with an age estimated to be between 3-4 billion years, or similar to the age of the Solar System. As a target, you'll need a pair of binoculars to see it and be prepared for something much fainter than M44. If you place Acubens towards the left hand edge of a binocular field of view, M67 should be visible towards the middle.

M35



M67

M44

7 Jupiter

Rating - *Easy* **Best seen with -** *Naked Eye*

Visibility - *Up for most of the night*

Did you manage to locate items **[1]** and **[2]** – The Pleiades and Hyades? If so, you can't have failed to have seen brilliant Jupiter just to the east of the Hyades. It's so bright that it shines like a beacon in the night sky. If so, that's item **[7]** ticked off the list. Check out the chart on page 2 to confirm your sighting.

8 Messier 36 - cluster in Auriga

Rating - *Medium* **Best seen with -** *Binoculars*

9 Messier 37 - cluster in Auriga

Rating - *Medium* **Best seen with -** *Binoculars*

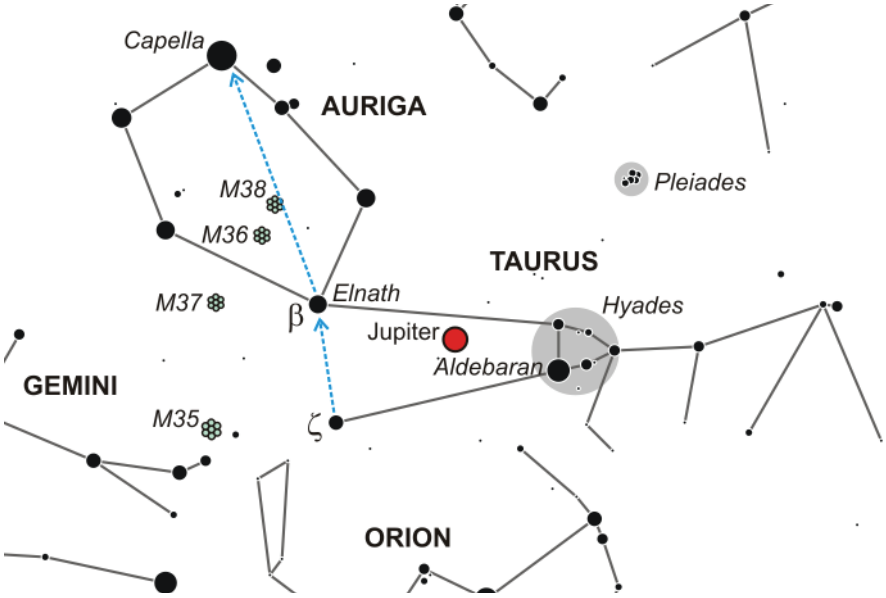
10 Messier 38 - cluster in Auriga

Rating - *Medium* **Best seen with -** *Binoculars*

Visibility - *Up for most of the night*

Items **[8]**, **[9]** and **[10]** are all pretty close to one another in the sky. Binoculars are the order of the day (or rather night) here and the best way to locate them is to first identify the constellation of Auriga and then sweep through it with binoculars. You can find Auriga from the Hyades cluster – item **[2]**. Locate the Hyades and extend the arms of the *"V"* away from the pointed end of the "V". Eventually you'll come to two stars – Zeta (ζ) Tauri and Beta Tauri, otherwise known as Elnath. Elnath is the upper star and represents the upper bull's horn tip. Now if you draw a line from Zeta Tauri through Elnath and keep going for nearly 3x the distance, eventually you'll arrive at a bright star called Capella. Point your binoculars at a point approximately 1/3rd the way along a line joining Elnath to Capella and there you should see M38 and southeast of it, M36. Place M36 to the right of your binocular field of view and M37 should be somewhere close to the left hand edge. That's 3 items in the Marathon ticked off in an instant!

Chart 4



11 Messier 41 - cluster in Canis Major

Rating - *Easy* **Best seen with -** *Binoculars*

Visibility - *Nov best seen 01:00-04:00, Dec 23:00-02:00, Jan 21:00-midnight*

Item number **[11]** is M41, a lovely star cluster visible to the naked-eye in really dark skies. To locate it, find the belt of Orion and extend the line it makes southeast (from the UK that's down and to the left) to identify the brightest star in the entire night sky – Sirius.

Once found, look below Sirius to locate M41. It lies 8 full Moon widths south of the star. With binoculars, place Sirius at the top of the view and look towards the bottom, moving the binoculars down a fraction if necessary.

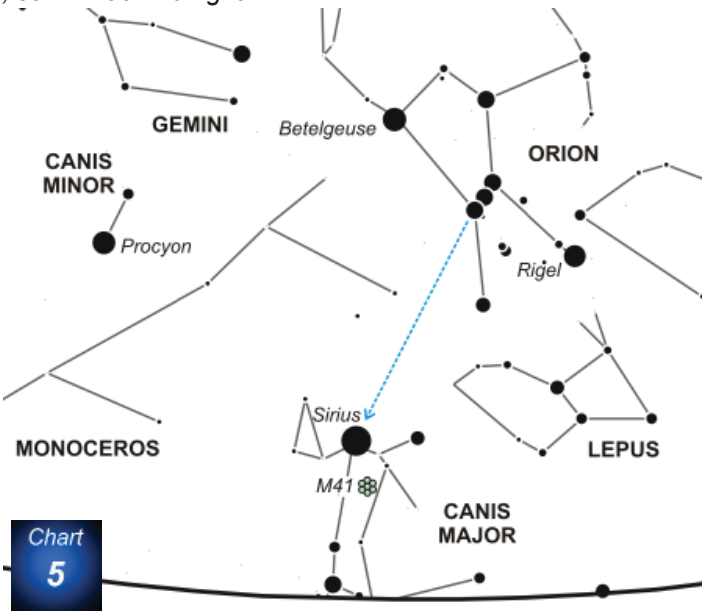


Chart 5

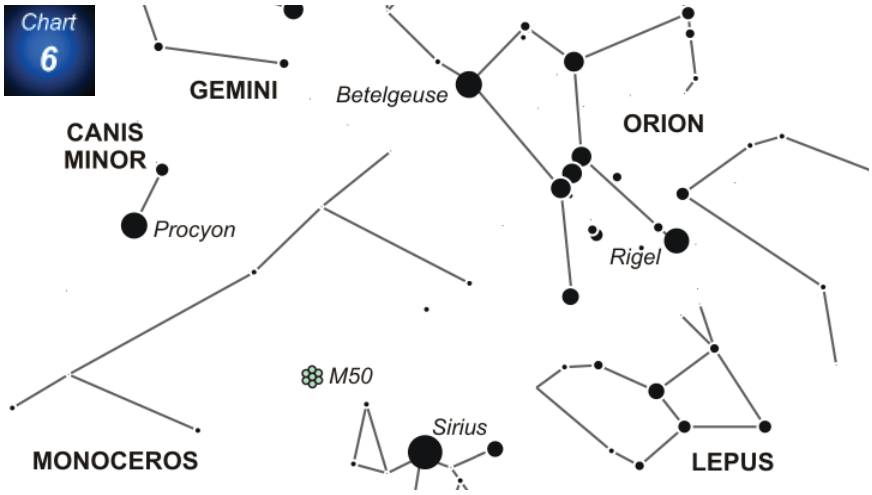
12 Messier 50 - cluster in Monoceros

Rating - *Medium* **Best seen with -** *Binoculars*

Visibility - *Nov best seen 02:00-05:00, Dec midnight-03:00, Jan 22:00-01:00*

M50, item **[12]**, is another binocular open cluster, this time located in the rather ill-defined constellation of Monoceros the Unicorn. Thankfully you can locate it using two easy to find bright stars known as Sirius and Procyon; both are marked on our chart.

M50 lies approximately 2/5ths of the way along the line starting from Sirius. M50 has been described as having a shape like a heart – see if you can make it out.



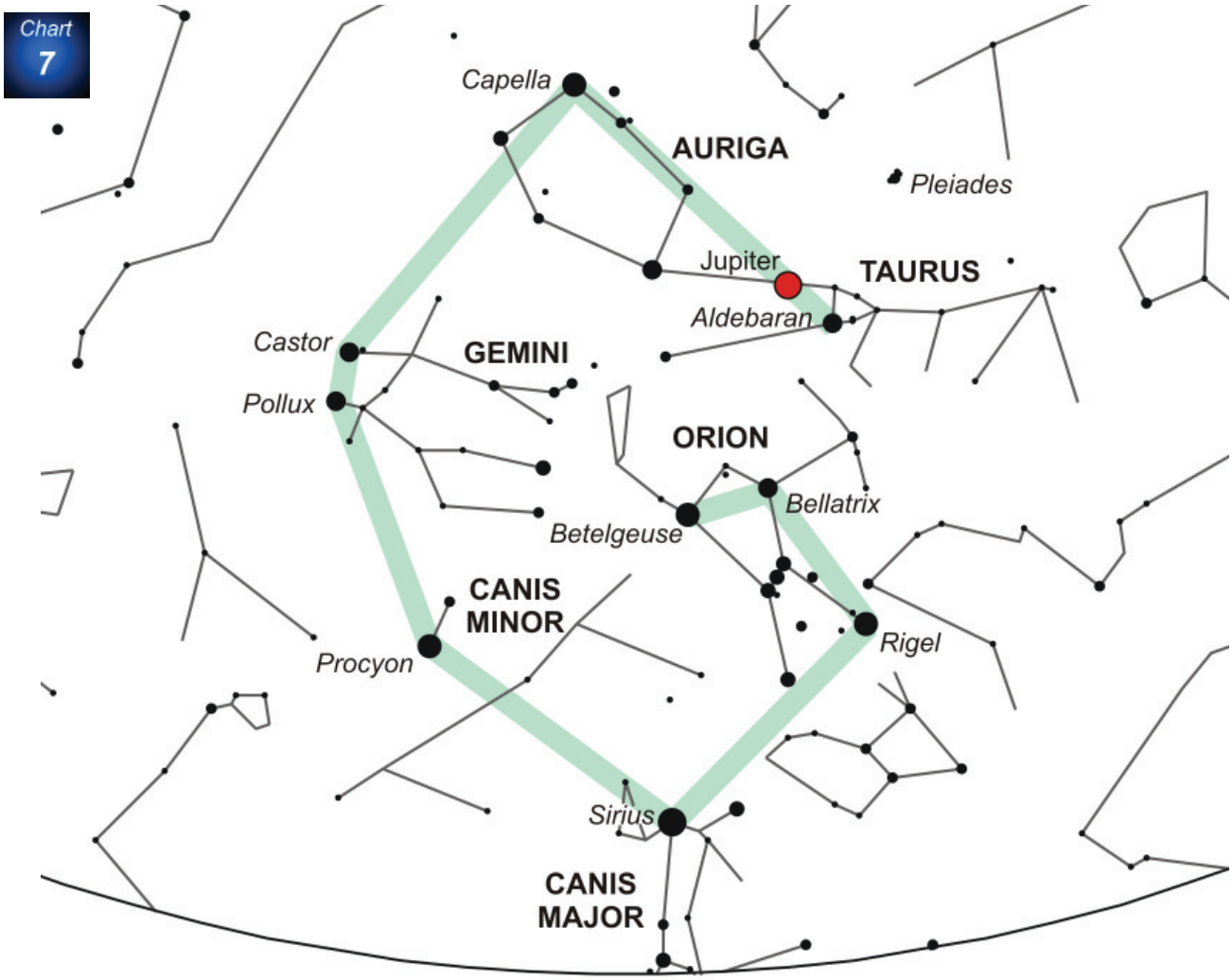
13 The Celestial 'G'

Rating - *Easy* **Best seen with -** *Naked Eye*

Visibility - *Nov best seen 21:00-05:00, Dec 19:00-03:00, Jan 18:00-01:00*

Item **[13]** is The Celestial-G an unofficial pattern of stars referred to as an asterism. It has no serious meaning but does represent a fun way to identify several bright naked-eye stars. It starts at the bright orange star Aldebaran, which we told you how to find on page 2. It then heads up to Capella, before moving on to the heavenly twins Castor and Pollux, the two brightest stars in Gemini.

It then heads down to Procyon in Canis Minor before moving on to Sirius in Canis Major. Nearly there. Next, head up to Rigel in Orion, then Bellatrix which represents his western shoulder, and end with Betelgeuse which represents his armpit! If you've managed this – take a rest, you've just had quite a long cosmic round trip!



14 Messier 34 in Perseus

Rating - *Medium*

Best seen with - *Binoculars*

15 Alpha Persei Moving Cluster

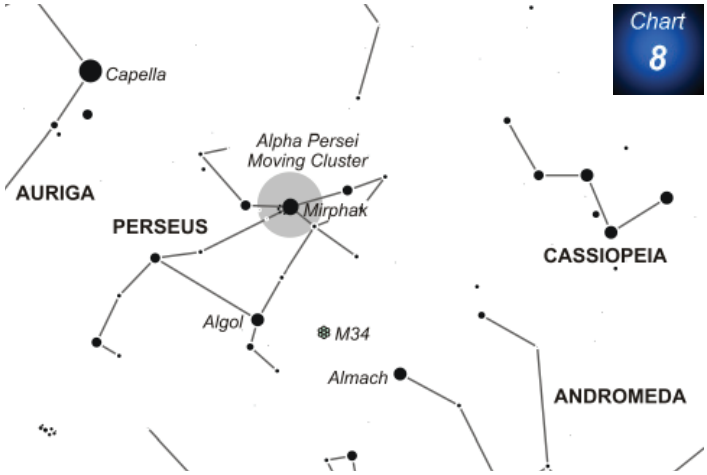
Rating - *Easy*

Best seen with - *Binoculars*

Visibility - *Nov - well placed all night, Dec-Jan best seen after night falls*

Items **[14]** and **[15]** are both located in the constellation of Perseus the Greek Hero. M34, item **[14]**, is an open cluster which is right on the edge of naked-eye visibility so you'll really need a pair of binoculars to secure it. It can be found roughly midway between the stars Beta Persei (Algol), and Gamma Andromedae (Almach).

Item **[15]** is the Alpha Persei Moving Cluster (Melotte 20) which can be found by locating the brightest star in Perseus, Alpha Persei or Mirphak. With the naked eye it's just possible to see some of the stars which form a faint semi-circle of stars below Mirphak. Take a look at the region with binoculars and you'll see a lot of stars here. This is an open cluster of stars believed to be between 50-70 million years old.



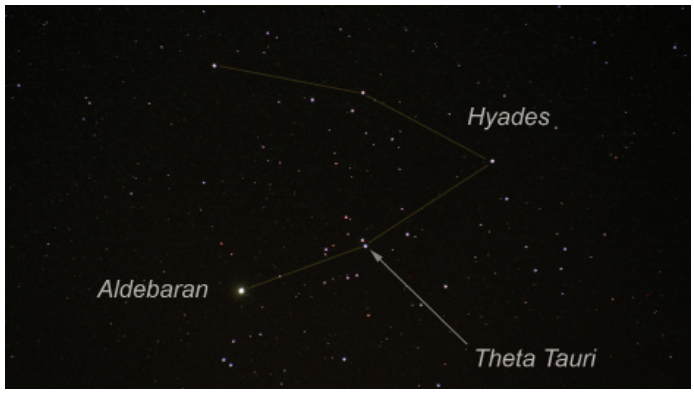
16 Theta Tauri - double star

Rating - *Easy*

Best seen with - *Naked Eye*

Visibility - *Visible for most of the night*

Moving away from clusters for a moment (don't worry, there are some more coming up!), our next item is Theta Tauri **[16]** an optical double star – that is the components, although they appear close, are not gravitationally linked. It can be found in the Hyades cluster (item **[2]**, shown on chart 1). Simply draw a line from the bright orange star Aldebaran to the pointed part of the *"V"* pattern that the Hyades make, and look half way along that line. Using just your eyes, the double should be quite obvious.



17 Kemble's Cascade, Camelopardalis

Rating - *Medium*

Best seen with - *Binoculars*

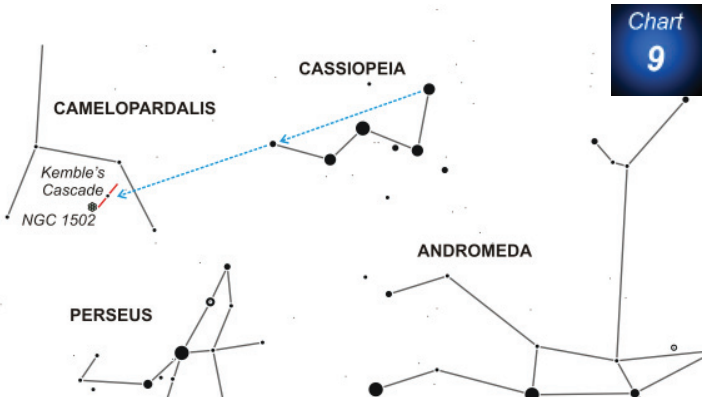
Visibility - *Nov - well placed all night, Dec-Jan best seen after night falls*

Item **[17]** is an asterism of some 20 stars arranged in a rather attractive line. Known as Kemble's Cascade, this is a chance alignment of stars in the constellation of Camelopardalis, the Giraffe.

Now Camelopardalis isn't the easiest of constellations to find and this makes finding Kemble's Cascade via the constellation stars itself rather difficult. Never fear though because the Sky at Night has a cunning plan to help you locate it.

The star at the centre of the cascade is visible with the naked eye. To locate the star, first find the "W" shaped constellation of Cassiopeia. Once you've identified that, draw a line from the right hand star of the "W" to the left hand one. Keep going for the same distance again and, as luck would have it, you'll be looking directly at the brightest star in Kemble's Cascade.

Using a pair of binoculars, look at the star and marvel at the line of fainter stars either side of it. At the southern end of the line lies an open cluster known as NGC 1502. Kemble's Cascade has been described as looking like a waterfall of stars pouring into into the cluster.



18 Double Cluster, Perseus (Caldwell 14)

Rating - *Easy* **Best seen with -** *Binoculars*

Visibility - *Nov - well placed all night, Dec-Jan best seen after night falls*

After you've found Cassiopeia, draw a line from the middle star in the "W" to the one to the left of it (imagining the *"W"* drawn the right way up). Keep the line going for approximately 1.5x the distance again and you'll arrive at not one, but a pair of beautiful open clusters known collectively as the Double Cluster or *"Sword Handle"*. You can see both objects with the naked eye given good, dark skies, but binoculars really bring out their amazing beauty. Both together, they form item **[18]** in the Moore Winter Marathon.

19 Fornax (constellation)

Rating - *Hard* **Best seen with -** *Naked Eye*

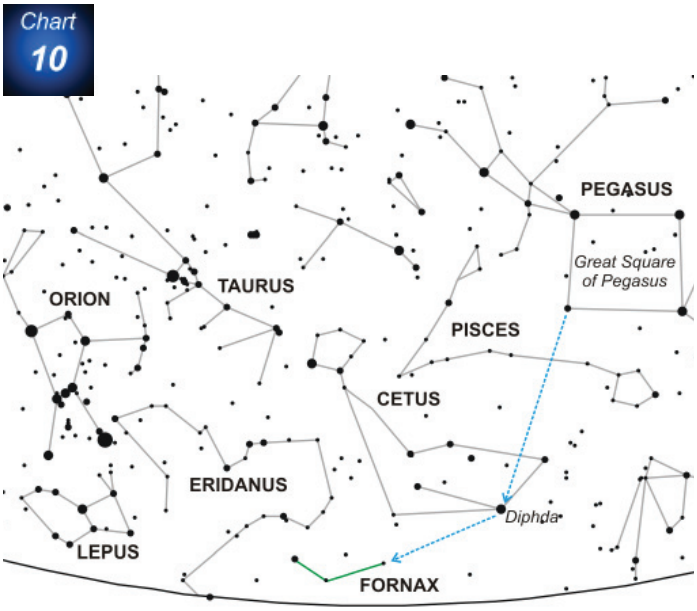
Visibility - *02:00 BST during October, 23:00 GMT in November, 21:00 in December and 19:00 in January*

The next two objects are patterns of stars in the sky. First up, or perhaps we should say down because it's quite a low thing to find, is a rather obscure constellation called Fornax the Furnace **[19]**. It sits below part of Eridanus the River and Cetus the Whale and is marked by three rather dim stars.

The best time to try is when the brightest star in Perseus, that's Alpha Persei or Mirphak, is virtually overhead. Look for Fornax close to the southern horizon.

The reason it's in the Marathon is that it's the constellation that the Hubble Space Telescope was pointed towards to take the Hubble Ultra Deep Field (UDF) – the deepest photograph into our Universe ever taken. Unfortunately, the reason why this part of the sky was picked was that it was deemed to contain nothing that interesting so don't get your hopes up for Fornax.

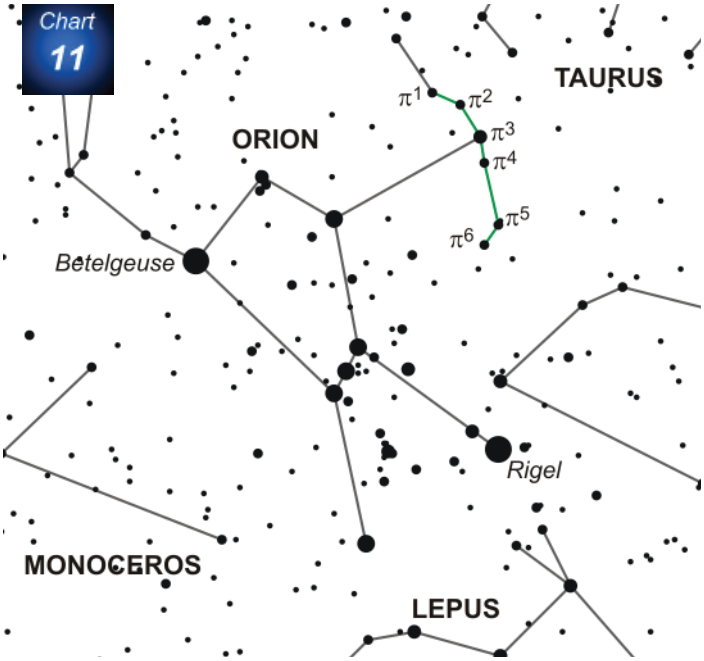
The Hubble Ultra Deep Field has recently been superceded by the Hubble eXtreme Deep Field (XDF) combining exposures taken over a 10-year period looking at a tiny part of the constellation of, yes, you guessed it, Fornax! Actually part of the UDF.



20 The Pi's of Orion

Rating - *Easy* **Best seen with -** *Naked Eye*

Visibility - *Nov best seen 23:00-04:00, Dec best seen 21:00-02:00, Jan best seen 19:00-midnight*



This entry is part of the constellation of Orion the Hunter. Bright stars in the sky tend to be identified by Bayer letters, basically letters from the Greek alphabet. These letters roughly indicate the brightness of the stars in a constellation but for various reasons don't always do this successfully. So if everything went to plan, the brightest star would be Alpha, the second brightest Beta and so on. There are 24 letters in the Greek alphabet and often more than 24 brightish stars in a constellation. To spread the letters out a bit, close stars sometimes carry the same letter but are followed by a number. In Orion this happens with a few stars but is taken to extreme with the stars designated π (Pi) Orionis because there are no fewer than six of them! You can see where they lie from our chart.

To the naked eye, the stars look just like a bow from a bow and arrow. In mythology, they represent a lion skin held aloft by the mighty hunter. If you can see all six stars allow yourself to tick off item **[20]** in our list.

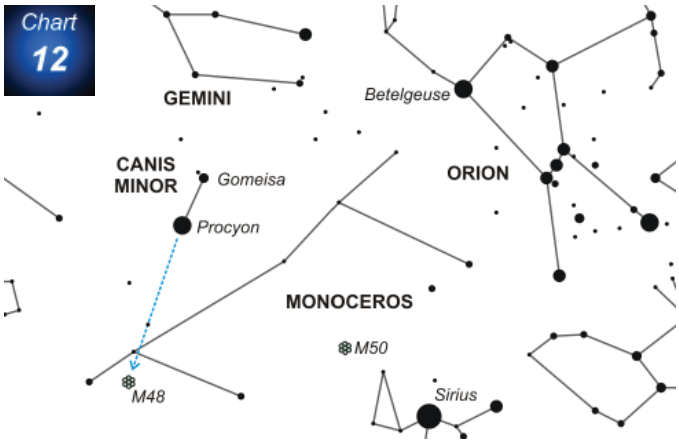
21 Messier 48, cluster in Hydra

Rating - *Medium* **Best seen with -** *Binoculars*

Visibility - *Nov best seen 03:00-05:00, Dec best seen 01:00-03:00, Jan best seen 23:00-01:00*

Back to the clusters and item **[21]** is a lovely open cluster in the constellation of Monoceros the Unicorn, known as M48. It's best located by locating the bright star Procyon. This is the primary star in the constellation of Canis Minor, a basic pattern of two stars representing the Little Dog.

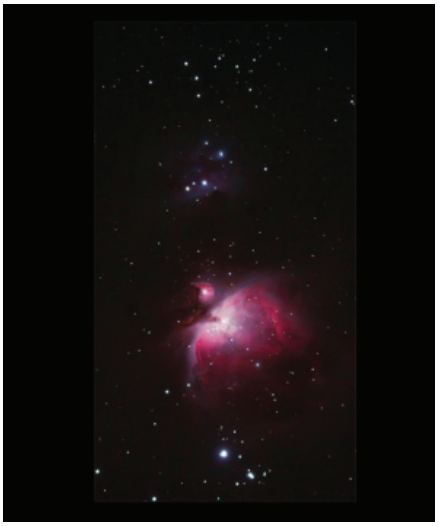
The other main star in the constellation is Beta Canis Minoris or Gomeisa which lies nearby. Draw a line from Gomeisa to Procyon and keep it going for approximately 4x the distance to locate M48. Binoculars will be needed here as, although the cluster is theoretically naked-eye, it's difficult to see without a bit of help.



22 Orion's Sword

Rating - *Easy* **Best seen with -** *Naked Eye*

Visibility - *Nov best seen 23:00-04:00, Dec best seen 21:00-02:00, Jan best seen 19:00-midnight*



Item **[22]** takes us back to mighty Orion. Locate his belt and look for the line of faint stars hanging below it. This is Orion's Sword and is made up of several clusters of stars and nebulae. The brightest nebula here is the wonderful Orion Nebula, M42, which sits right at the heart of the sword. The clusters and nebulae gives the sword a fuzziness when viewed with the naked eye.

Binoculars will resolve more detail, and however you view it, this is one of the most fascinating areas of the night sky. The Orion Nebula is part of a large star forming region. If you follow the Marathon into the telescope section, we'll point out some of the stars which have been born in the cluster.

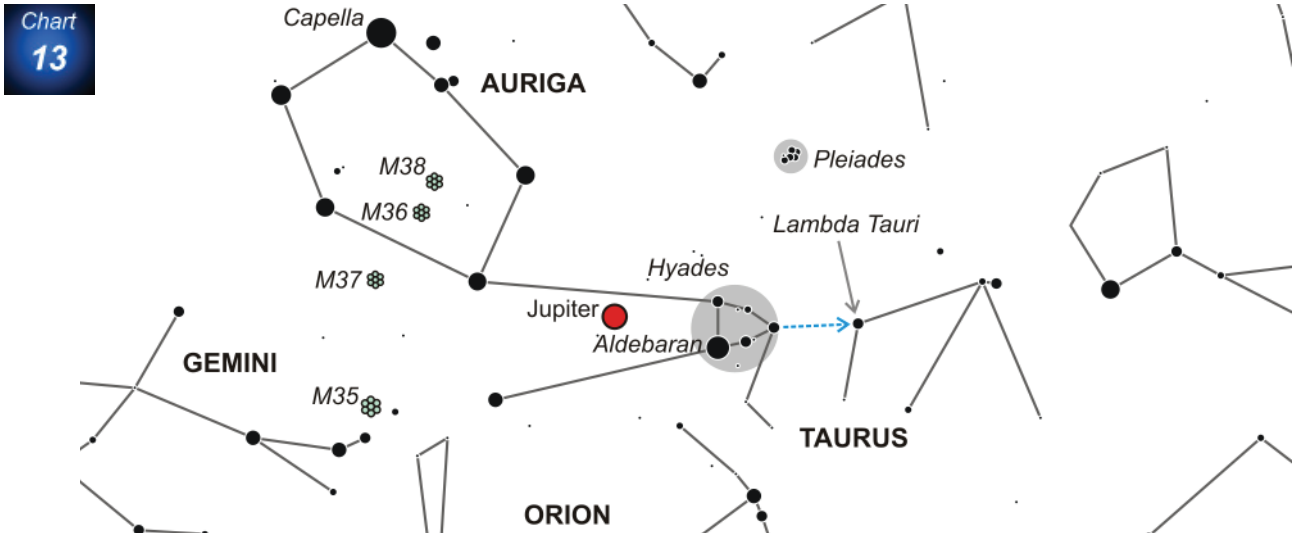
23 Lambda Tauri - variable star

Rating - *Easy* **Best seen with -** *Naked Eye*

Visibility - *Visible most of the night*

The next item is a star known as Lambda Tauri **[23]**. It's included in the Marathon because it's a variable star that changes brightness over a period of 4 days. The brightness change isn't that great but should be noticeable if you compare the star with others nearby. The reason why the brightness changes is that Lamdba Tauri has a companion.

As both stars orbit one another, each passes in front of the other eclipsing part of the other star's surface. As the orbiting stars are of different brightnesses, this causes a variation in the overall brightness of the system. Lambda Tauri is what's known as an eclipsing binary star and was the third such system discovered. Use the Hyades cluster (item **[2]**) to point to it.



24 M93, open cluster in Puppis

Rating - *Hard* **Best seen with -** *Binoculars*

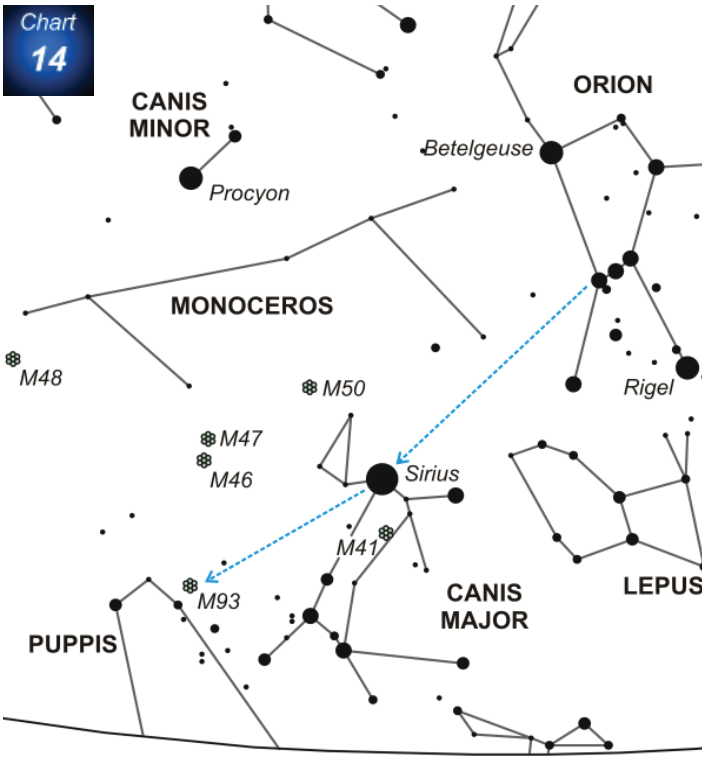
Visibility - *Nov best seen 23:00-04:00, Dec best seen 21:00-02:00, Jan best seen 19:00-midnight*

As you'll have no doubt gathered, there are a lot of open clusters of stars visible in the winter night sky with the naked eye and binoculars. In fact, as many of these objects are actually quite large, wide field, low power instruments such as your eye or binoculars make ideal viewing instruments for them.

Item **[24]** is an open cluster known as M93, located in the constellation of Puppis the Poop Deck, part of what was once a pattern of stars known as Argo Navis, The Ship. This huge region of the sky was broken up into several smaller constellations, most of which never rise above the UK's southern horizon.

To find it resort to the earlier trick used to locate Sirius in Canis Major. Identify Orion's belt, extend it southeast (from the UK, down and to the left) until you come to the brightest star in the night sky, Sirius. Keep the line going for about three-quarters the distance again and you'll be looking at the right part of the sky to pick up M93. You'll need binoculars to see it.

Its star layout has earned it various nicknames such as the Butterfly and the Starfish. Take a look and see what you think.



25 Orion's Belt (Collinder 70 cluster)

Rating - *Easy* **Best seen with -** *N/Eye & Binoculars*

Visibility - *Nov best seen 23:00-04:00, Dec best seen 21:00-02:00, Jan best seen 19:00-midnight*

Finally, if you've made it this far you've all but completed the Marathon because item **[25]** is Orion's Belt which has been used to locate many other objects already. Look carefully at the belt and see how many stars you can see there. With binoculars the count is actually quite impressive. This is beacuse the belt identifies yet another open cluster, known as Collinder 70.