How to draw contour lines

Instructions

You should first go back and download and print the PDF file that contains the worksheets you need to complete these exercises.

With those worksheets in hand, you can work through the information on this presentation without having to print the Powerpoint file.

Topographic contours connect points with the same elevation. The trick to drawing these lines is to discover where the points are that you need to connect. This set of exercises will illustrate how to determine where those lines should go by looking for clues in three situations:

If you know elevations at 3 or more points

If you know the route of a stream

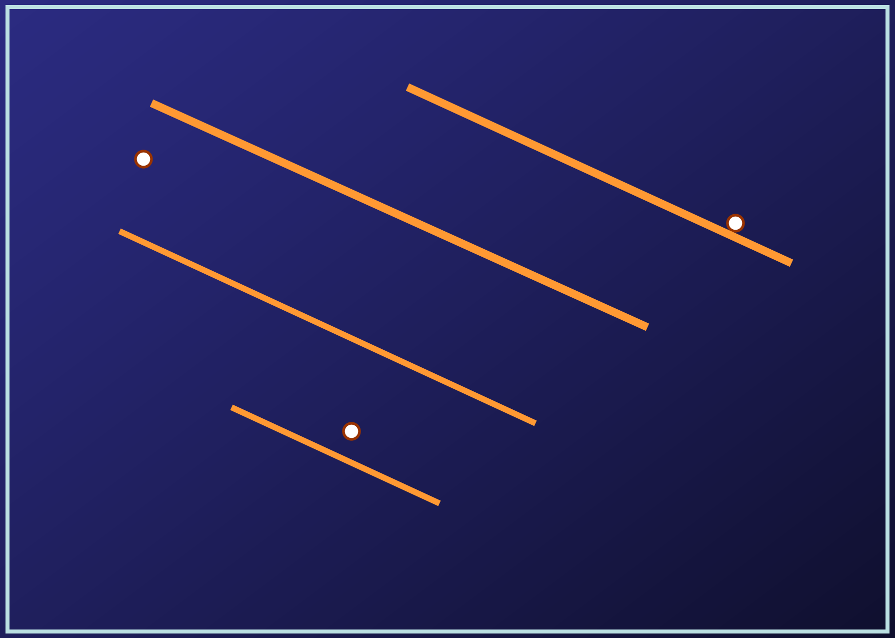
If you know the location of depressions or lakes

Contouring 3 data points

Contouring 3 elevation points

For the simplest topographic map you need to know the elevations at three points (benchmarks). Three points define a smooth inclined plane without bumps or grooves. The contours you draw for this surface will be straight parallel lines.

e.g.



Work through the following steps using this map

Download the PDF file that contains the worksheets for this exercise

Step One (always):

Select a contour interval. Given the range of numbers on the map provided, a CI of 5 or 10 meters would be appropriate.

For the sake of this discussion, choose your CI = 5 m and plan to draw contours at 20, 25, 30, 35, 40, 45, and 50 m elev.

Step Two:

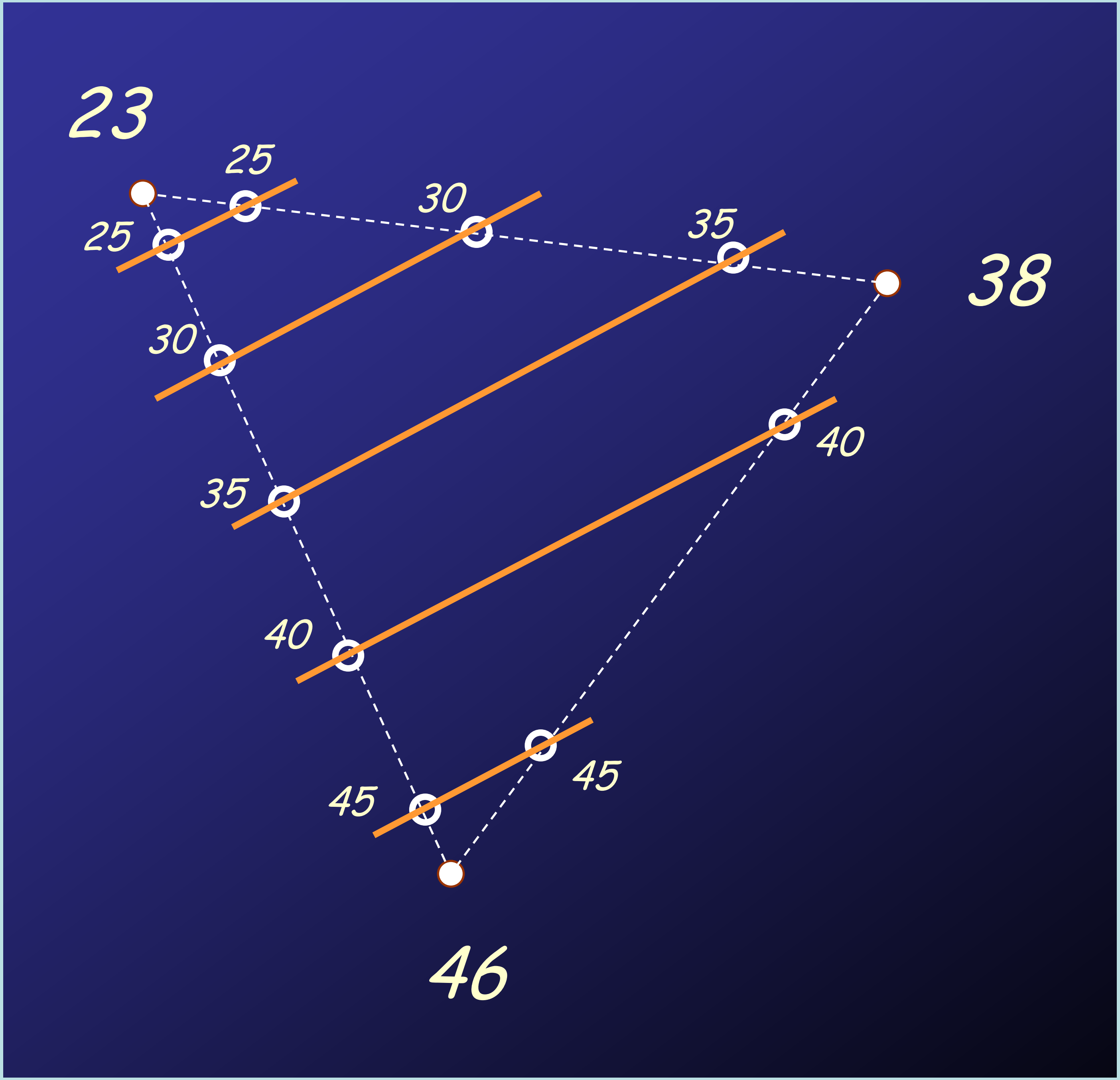
Interpolate between points. Pick any two points that are close and mentally (or with pencil) connect them with a straight line (a light sketch line that is not to be a final contour line). Assume that the elevations on the ground along that line are spaced uniformly. Decide which multiples of 5 (=CI) would occur between the end points. Place dots along the line where you estimate those elevations would be. Label the dots.

Step Two (continued):

Repeat this process between all 3 points of known elevation. Notice that you will not place the same number of points on different lines.

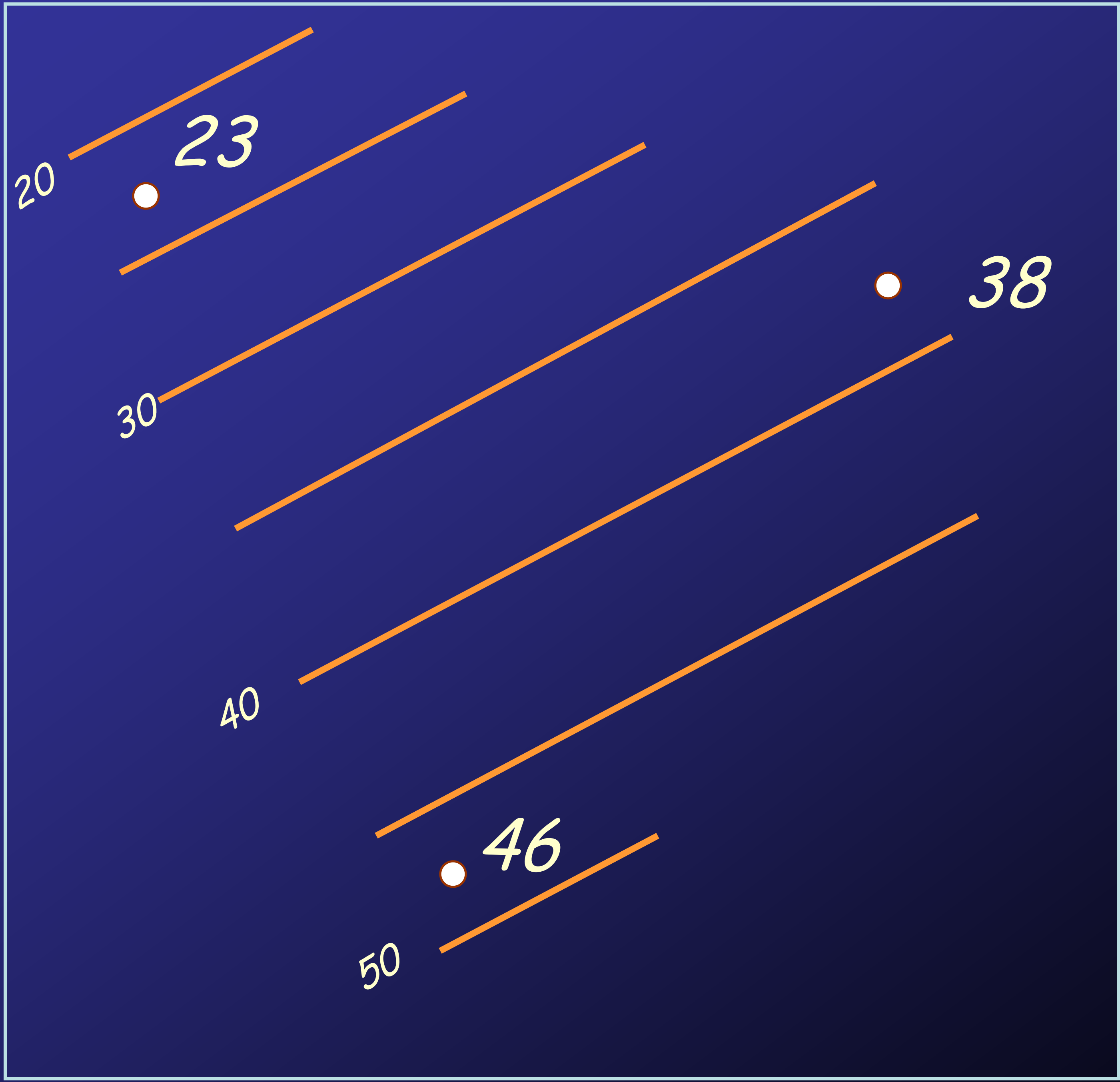
You should end up with only two dots that have the same value. Connect dots of equal elevation using a straight line. If you did this step accurately all of your contour lines should be parallel.

The working copy of my map looked like this for a while ....



On the next slide is my final map for this problem, after erasing light sketch lines. I labeled the elevations of every other line but you could label more or fewer contours.

I also felt secure in adding contour lines just beyond the edges of the area with measured elevations; the ground surface probably continues to be planar for some distance laterally.



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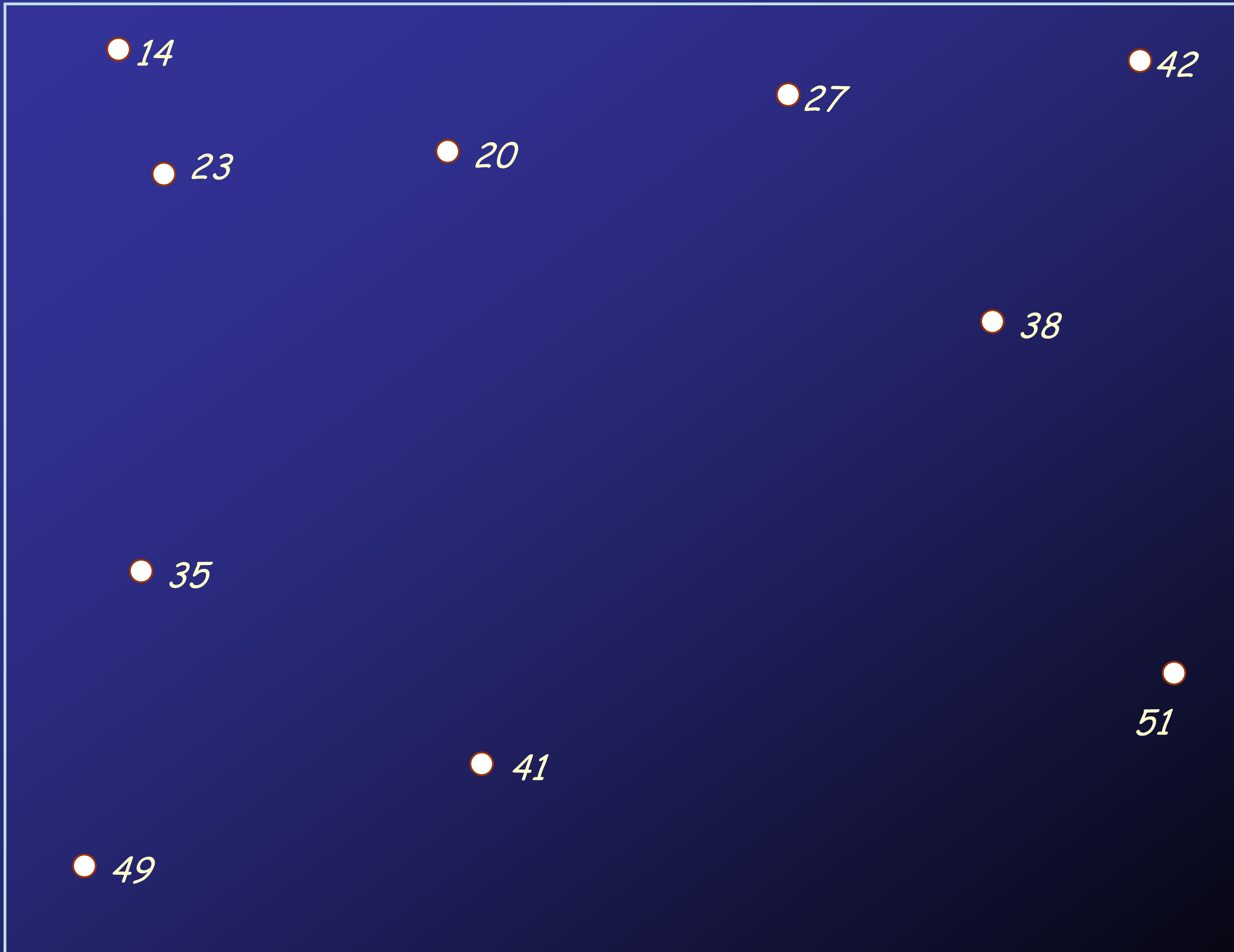
Contouring with several known elevations

Contouring with several known elevations:
Except for really simple landscapes, three points will not accurately describe the shape of the ground. At sites where you know many elevations, you can draw a more reasonable map. There your approach should be the same as before:

- Select a CI
- Place dots on the map at points along lines between known benchmarks
- Connect the dots with smooth curved lines

You will discover as you draw lines that contours never cross or split. Also, contours never pass between two benchmarks unless those known values bracket the value of the contour. For example, the 100-m contour probably does not go between neighboring benchmarks of 98 and 92 m elevation.

So consider the same area you just contoured, but now with more elevation measurements. Draw topographic contours.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Hold ON! Do NOT go on to the next slide unless you have tried to contour these data !!
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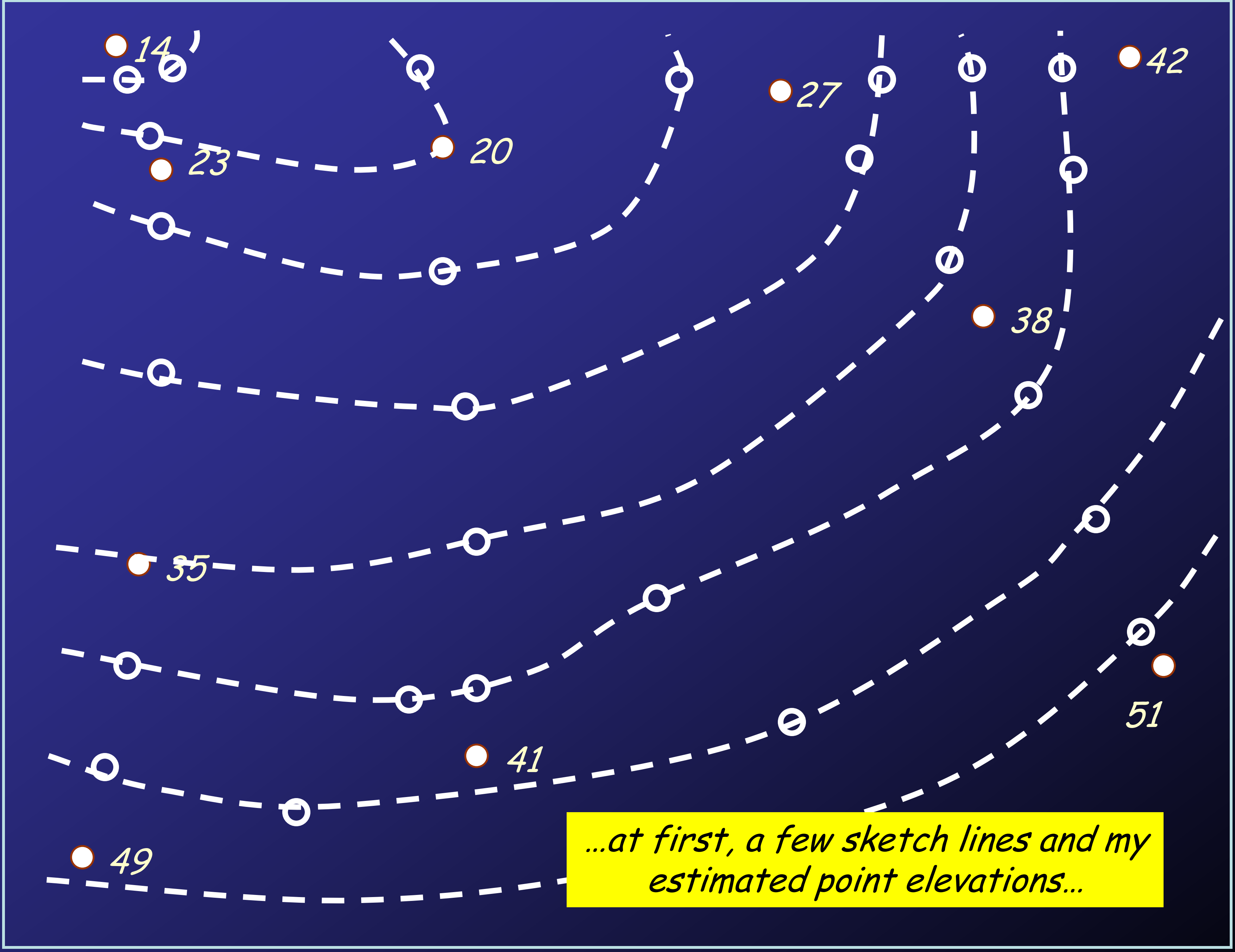
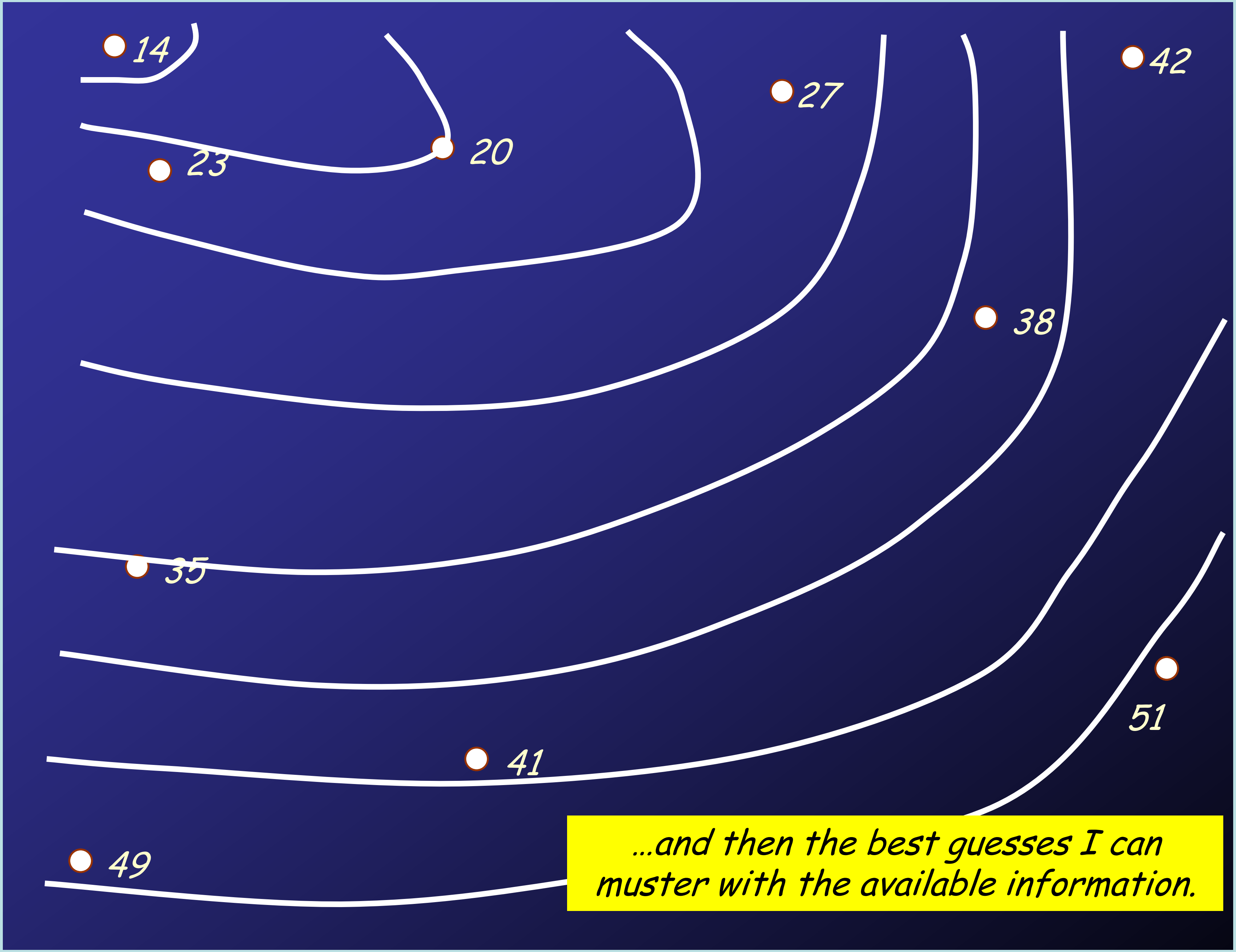


…at first, a few sketch lines and my estimated point elevations…



...and then the best guesses I can muster with the available information.

Contouring across stream valleys

Contouring around streams

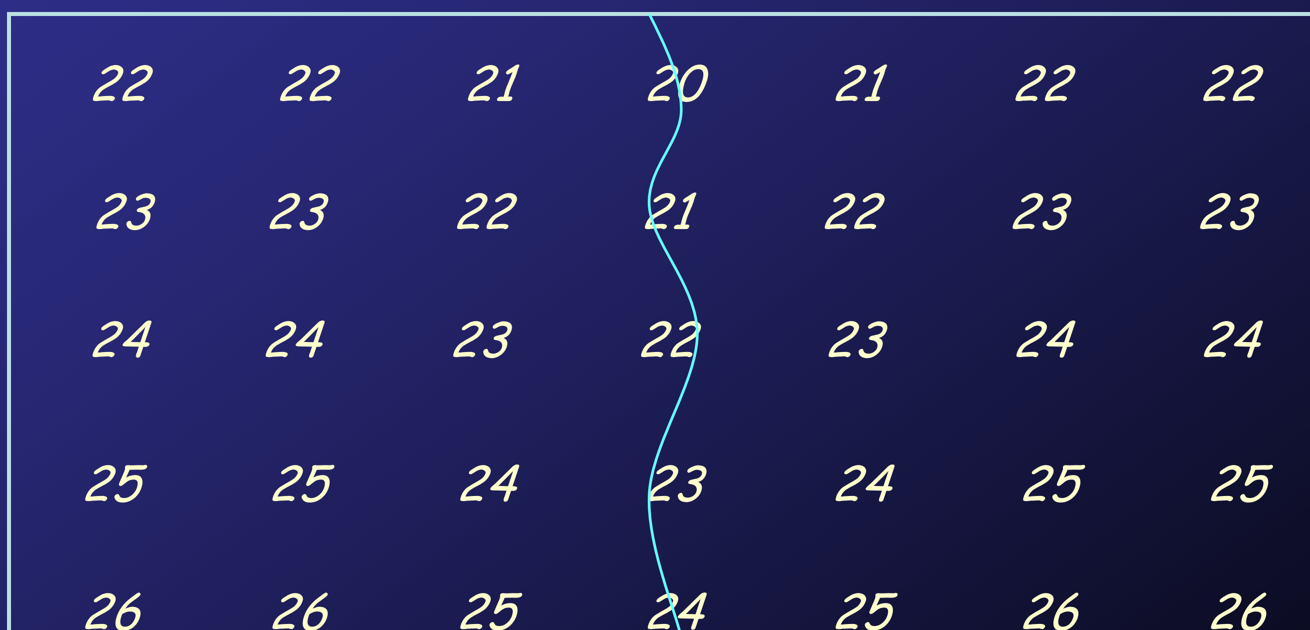
The presence of streams drawn across the map gives you a lot of information about the shape of the landscape.

You know the location of the lowest places in the landscape – the valley bottom.

You know the location of the sloping ridges (interfluves) that separate valley bottoms.

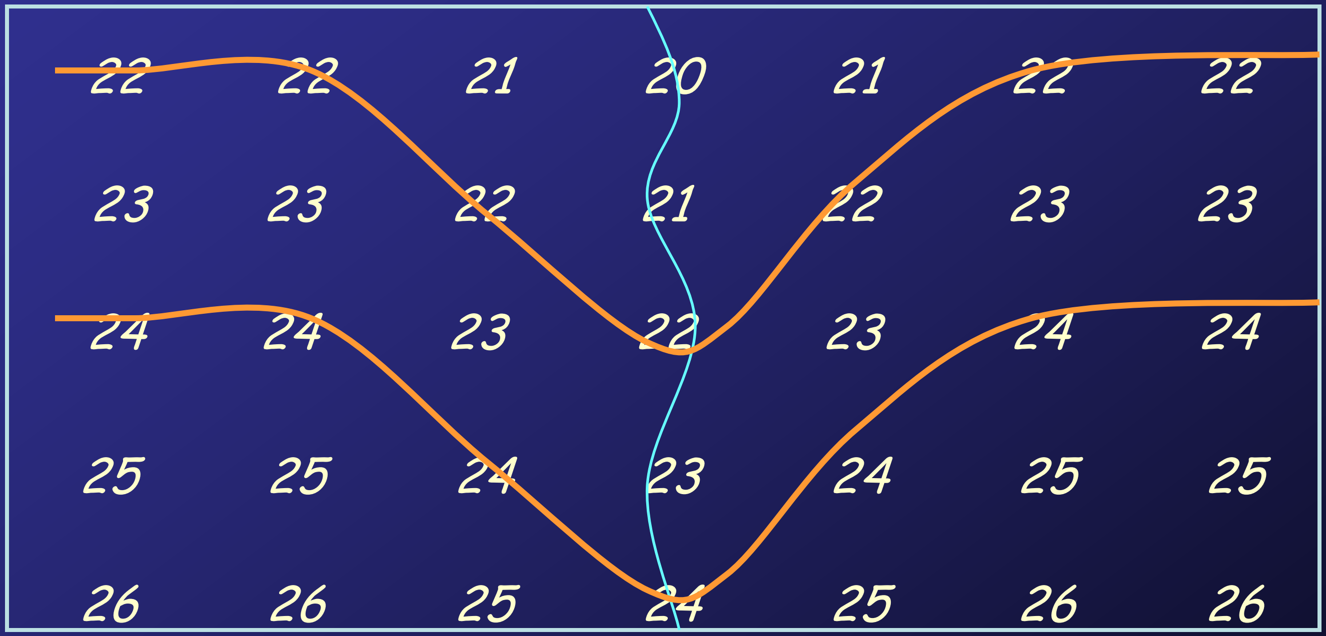
You usually can tell which direction is downhill by seeing the stream junctions.

Contours that cross a valley form a specific pattern that you need to recognize and know how to draw – they form a vee that points upstream. To discover this pattern yourself, contour this map of a stream valley and a grid of elevation points. Use a CI = 2 meters.



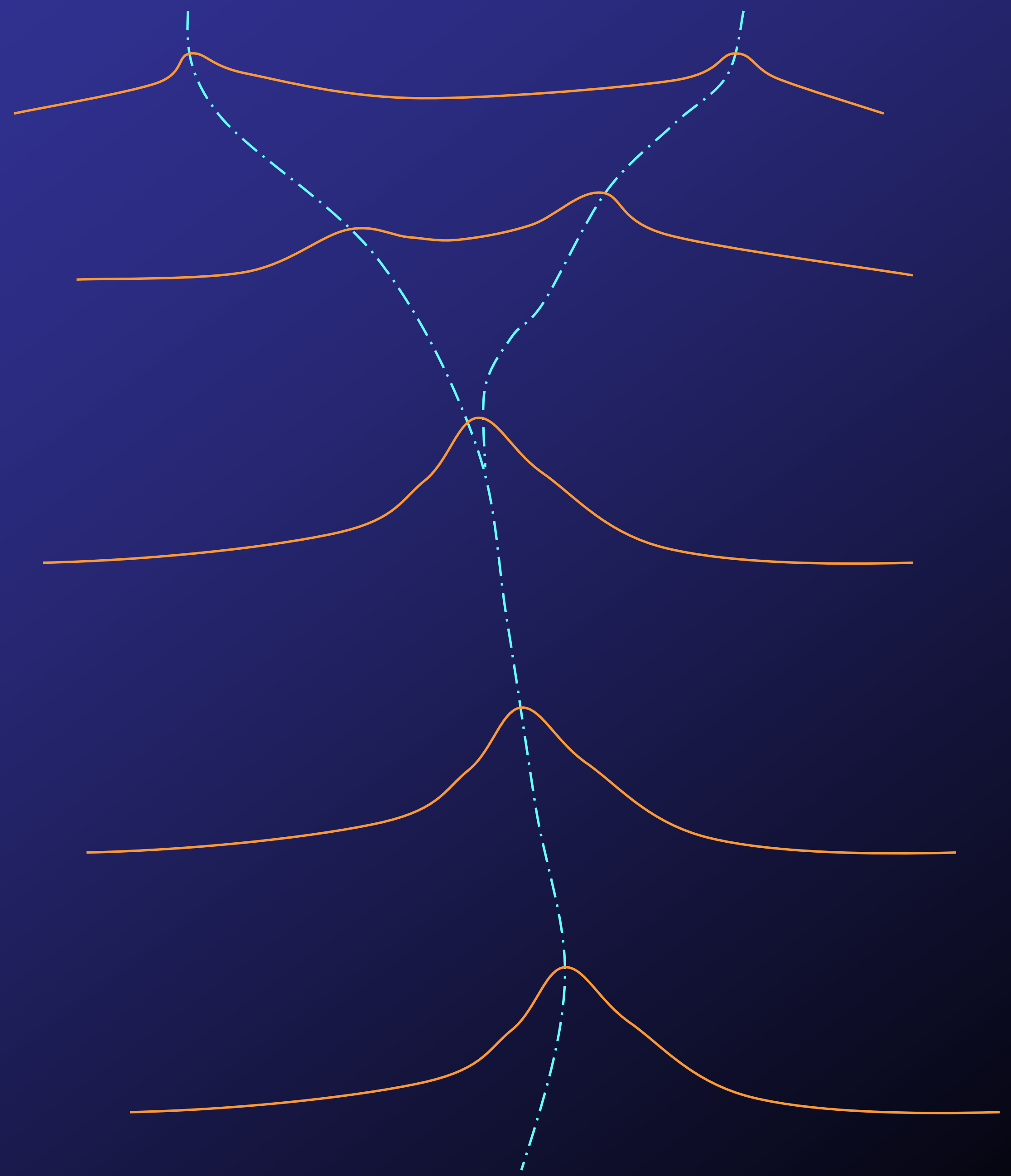
"Imagine you are standing on one side of a steep valley, trying to cross to the other side. If you are stubbornly lazy and do not want to walk up a steep hill on the other side of the stream, you can walk all the way across the valley and stay at the same elevation. Turn upstream and walk along the valley side staying on a level path until you reach the stream. Then turn down stream and walk down the valley side on a level plane until you reach the side of the valley across from where you started. The path you travel across the valley is a vee."

One possibility for the last map would be this one (assuming the benchmark for each elevation measurement is in the middle of the number):

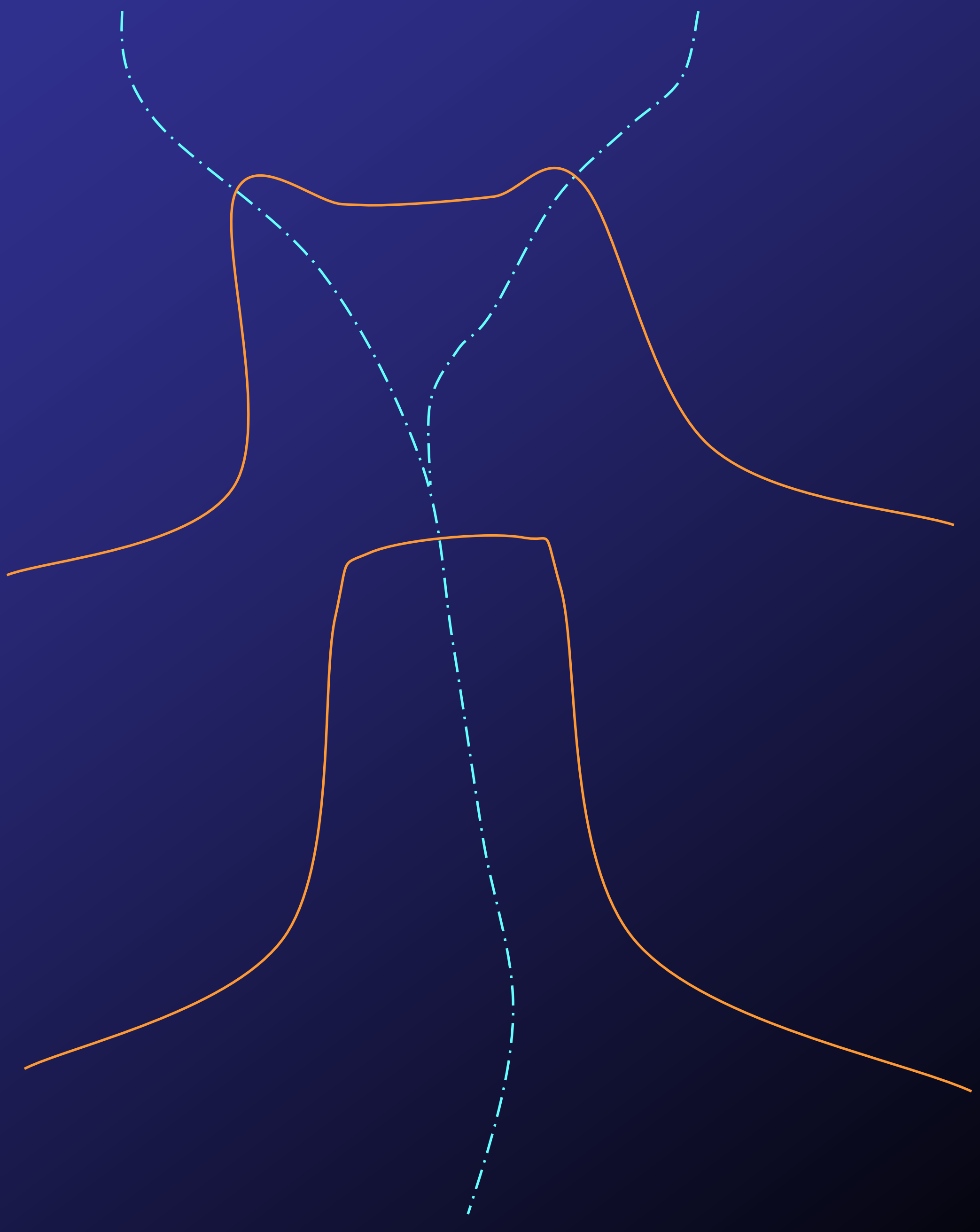


Consider the following 3 streams with the same channel pattern.

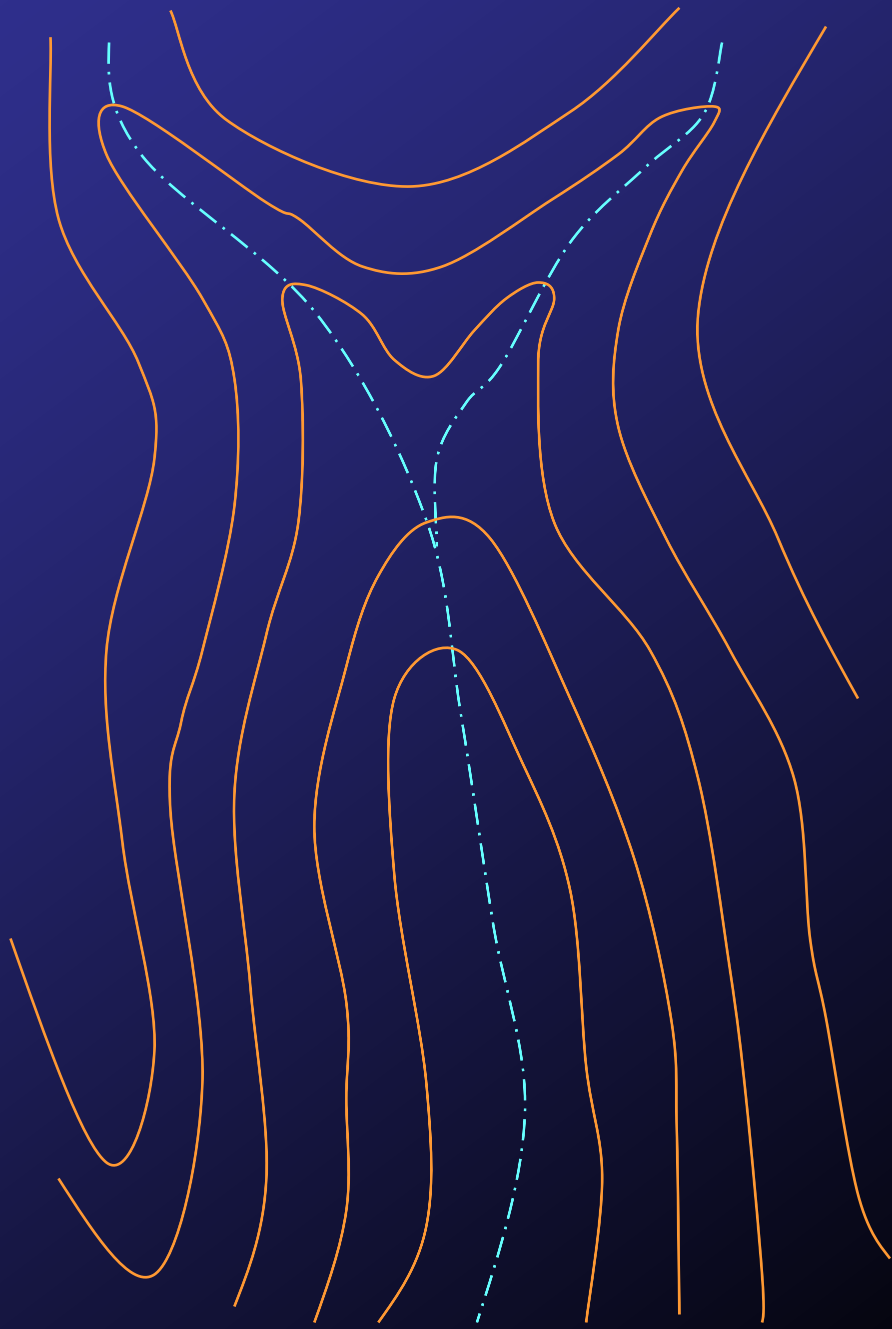
This one is for a small valley cut into the side of a larger valley side.



This valley has developed a broad valley bottom

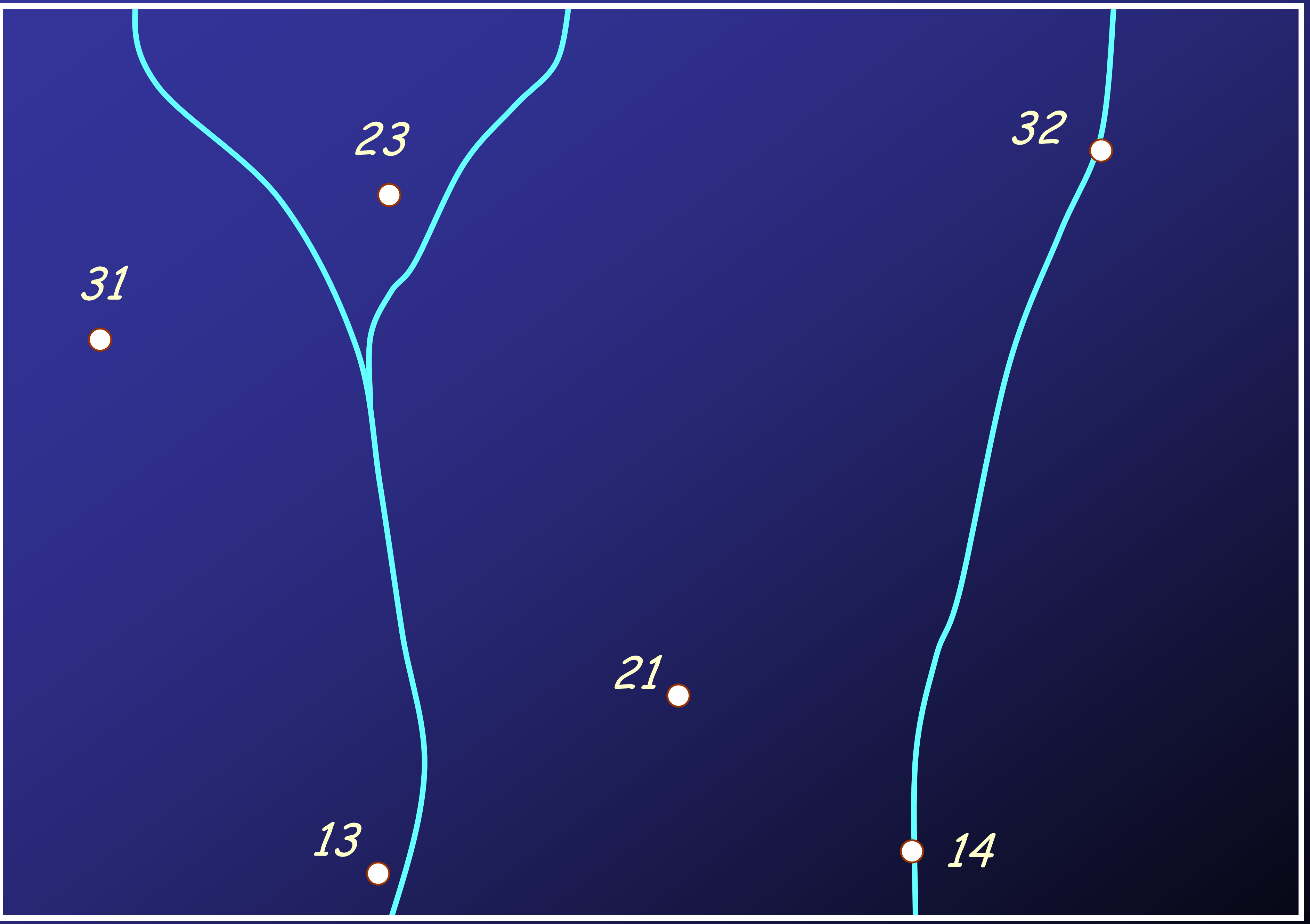


This is a steep-sided valley incised deeply into the landscape. As all of these cases might be equally possible when you draw your maps, you will need to rely on clues from the pattern of elevations and your experience to know which pattern is best.



In this next exercise, you will draw contours in an area with two creeks and several known elevations. Look over the area to estimate the depth of incision of the valleys. Note that the elevations of the streams and on the interfluves are similar; thus the hills are not steep and valleys are not deep. The contour pattern will be relatively simple, probably gentle sweeping arcs.

Try your hand at contouring this area.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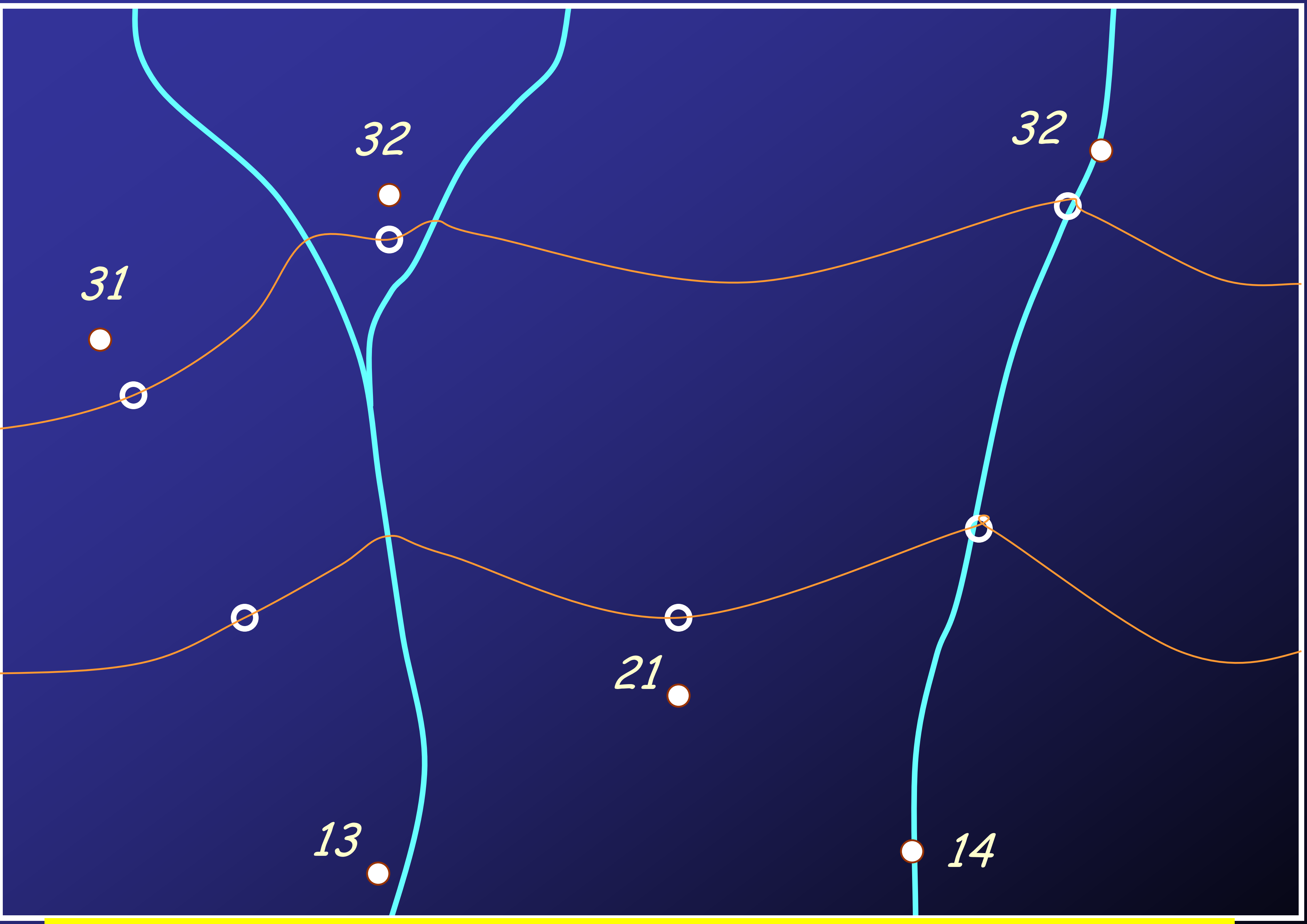

Notice that the stream passes through the point of each vee

Now let's try a bigger one. The following map area contains the same elevation points as an earlier map but it also has streams.

Try your hand at contouring this area.

HINTS: It will be easiest to "pick values between points" for areas on interfluves (between streams) . Remember that the elevation of a point in a valley between two interfluves will be lower than the elevations on the hillside.

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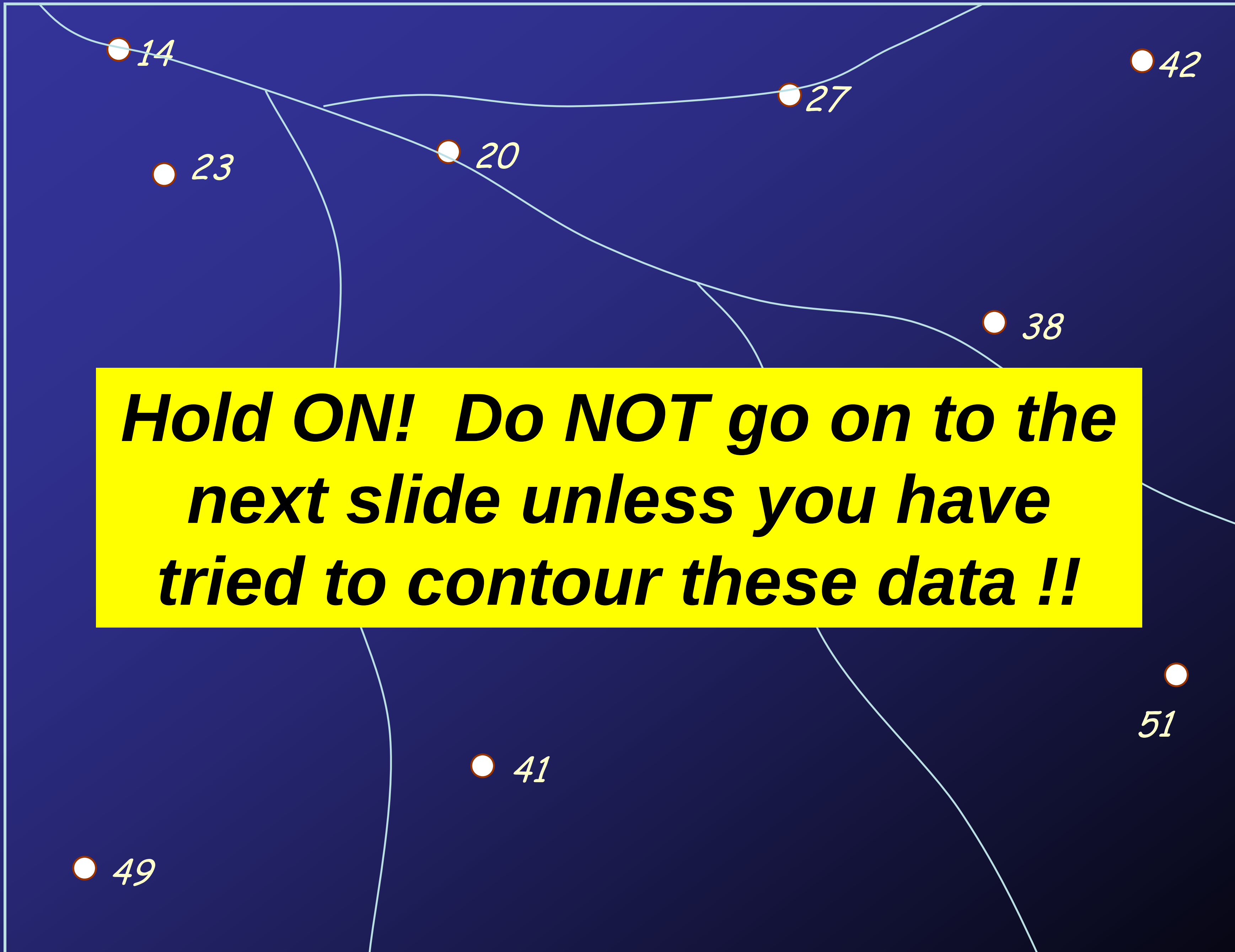

Hold ON! Do NOT go on to the next slide unless you have tried to contour these data !!

What follows is my best guess using the available information.

I left on the locations of the points where I estimated the elevations; notice how all the lines of these estimated points do not cross stream valleys.

If you can visit the area or see it in stereovision on aerial photos, you should be able to improve the map.

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Contouring around depressions

Contouring around depressions

Depressions exist where some portion of the land surface is lower than all surrounding land. To walk out of a depression in any direction you have to walk uphill. If the depression contains a lake, the shoreline would be a contour.

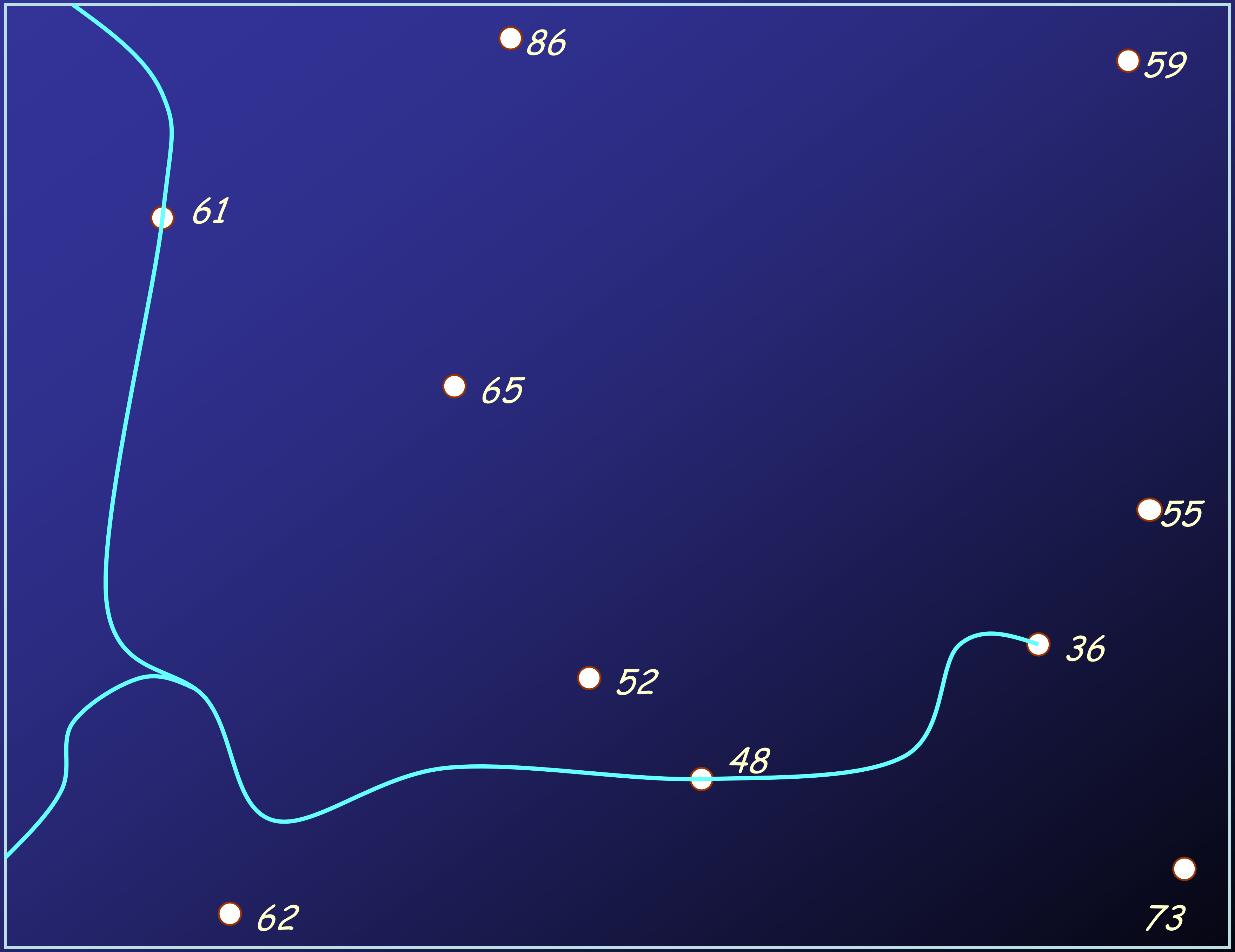
Contours around a depression have hachure marks – short tick marks perpendicular to the contour pointing downhill into the depression.

Draw topographic contours on this area.

10	20	32	35	40	49	55
10	19	31	26	38	48	55
9	17	24	8	31	45	55
12	20	30	24	35	46	54
14	22	34	35	41	50	57

Your map may look something like this one. Notice that for every contour inside of the depression, there is a contour of the same value outside of the depression.

Now draw a map of the contours
in an area of
irregular depressions.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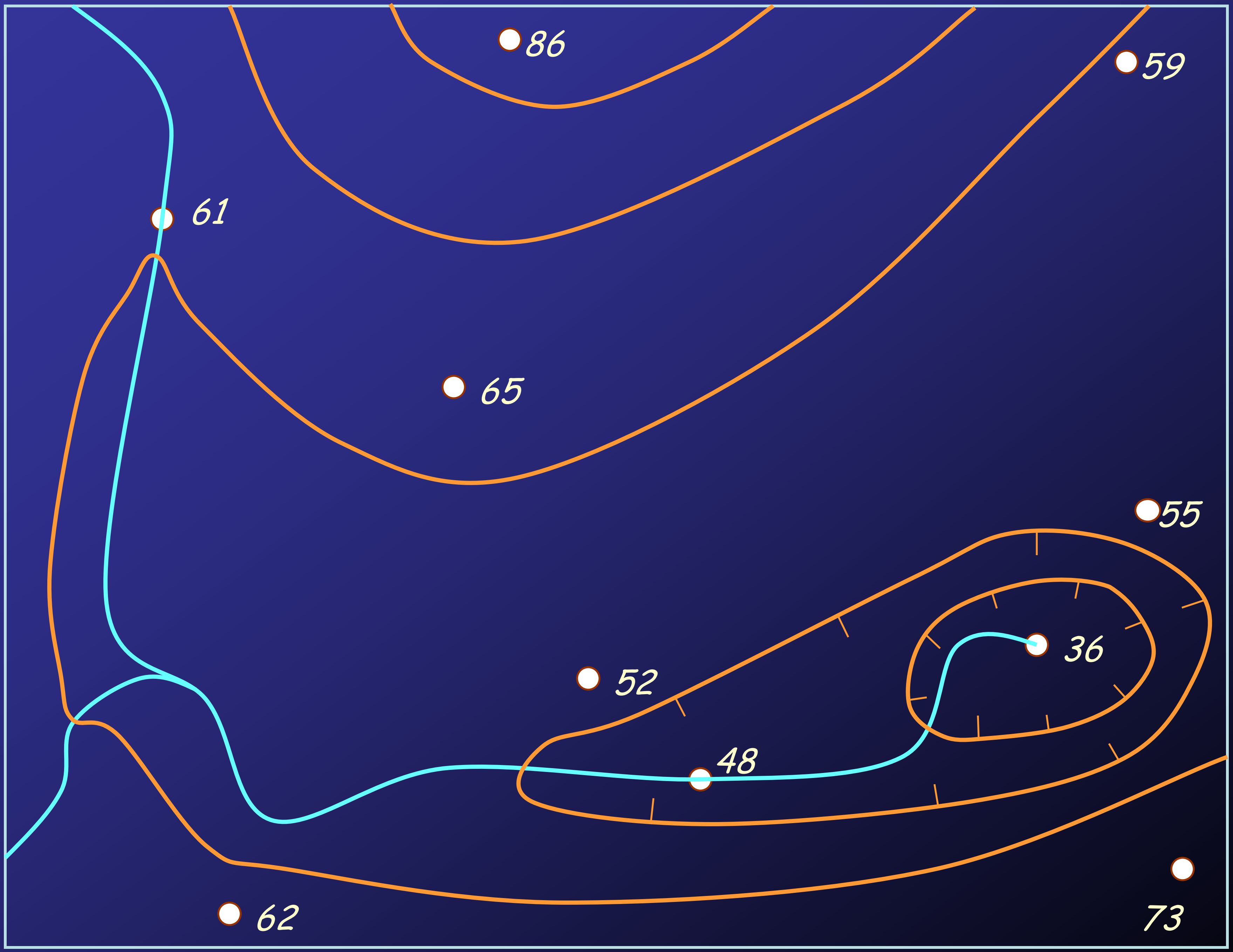
One possible solution to the data: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If you can do this last one, you have learned how to contour well!

The End.