Zombie 17 COACH ANSWERS (Questions and answers with explanations) Part 2

44. The Brain Building looks fairly new. Based on the map, what is the most recent year in which it could have been constructed?

Answer: 2003

Since the map was published in 2003, it would not show a building constructed after that. The Rock Island 2003 map does not have a revision date in its title line; if it had been revised, structures or other changes between the original date and revision date would be shown in purple. Questions about a purple building are thus answered by the date range between the original map date and the revision date.

45. What is the latitude at the Abnormal Brain Bank at the northeast corner of the Brain Building? Express as degrees, minutes, and seconds. Don't forget North or South!

Answer: latitude = 42° 23' 47" N (range 44- 50")

Background: - Latitude/Longitude

Latitude is the angle on the earth north or south of the equator. 90°North (the North Pole) is "straight up" from the equator; 0° is the equator. Latitudes in the continental United States vary from about 24° N (Key West) to 71° N (in Alaska).

Longitude is the angle East or West of the Prime Meridian (0°) in Greenwich, England. Worldwide, longitude values can be between 0° and 180° East or West. In the continental United States including Alaska, longitude can vary between about 44° W (Maine) and 173° W (Alaska). The Aleutian Island chain actually extends to East longitude.

An individual longitude meridian goes only halfway around the Earth - its opposite line, on the other side of the Earth, has a different value. Latitude lines go all the way around the Earth with the same value. This results in there being 360 degrees of numbered longitude but only 180 degrees of numbered latitude, even though they both cover the same area.

Units: Latitude and longitude are measured in degrees, minutes and seconds. They can also be expressed in decimal degrees and as positive (north or east) and negative (south or west) numbers. Make sure you understand what format a given question is asking.

Some rough numbers, using longitude at the equator: (Latitude would be slightly different)
One degree covers about 69 miles on the earth.
Each degree is divided into 60 minutes. One minute is a little over one mile on earth.
One minute is divided into 60 seconds. One second is about 100 feet on earth.
Values for minutes and seconds cannot be higher than 59 (60 is 00 of the next higher minute or degree). E.g., 75 seconds = 1 min, 15 seconds.

A full notation for latitude would thus be something like 18 degrees, 35 min, 49 sec North. More properly you would write this as: 18° 35' 49" N. You must include North or South!

To calculate the latitude of any given point on a topo map:

To find latitude and longitude of any given point on a USGS topo map, you do a fairly simple proportion problem. However, you must measure carefully and remember that latitude and

longitude are usually expressed in degrees, minutes and seconds. (they can also be shown as decimal degrees) You must be able to work with map Sector Grids (Question # 24).

Here is the Rock Island Sector Grid: The Brain Bank is in sector Southwest 7.

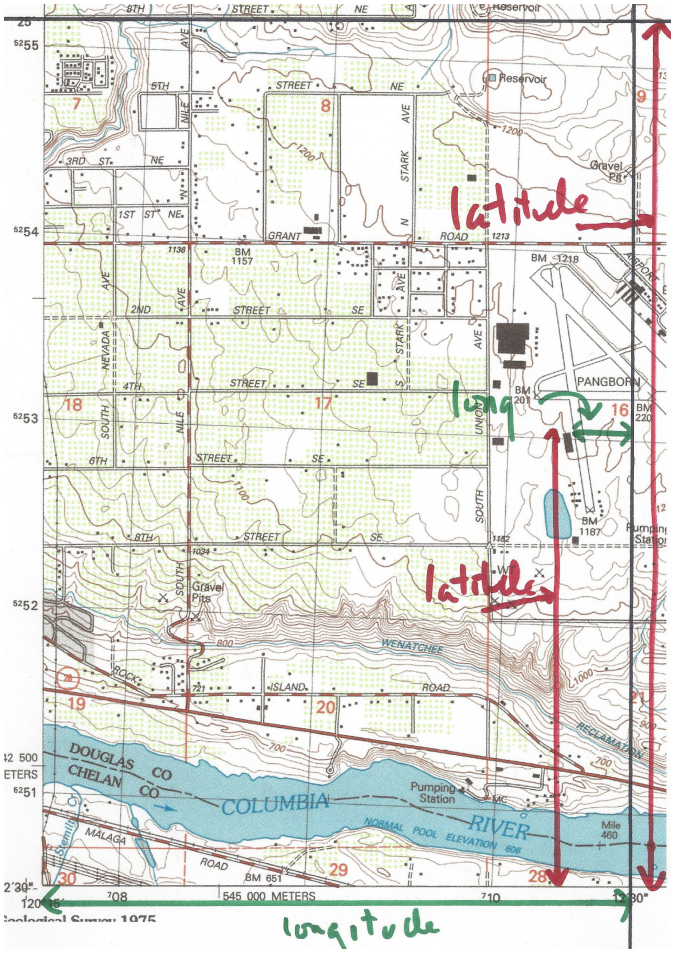
47° 30' (00") (North)

Northwest 1	North 2 …	Northeast 3 (47°) 27' 30"
West 4	Central 5	East 6 (47°) 25' (00")"
Southwest 7 ***Brain Bank****	South 8	Southeast 9

47° 22' 30" (North)

Solving the problem:

See sector grid above and reduced size mapscan of Southwest 7 below:



Note: This scan is marked up. Don't mark up any maps in an actual Road Scholar event!

To get latitude of Brain Bank : Start with the southern sector line-this is your "base line"
1. Measure in mm along the map's neat line from 47° 22' 30"N to (47°) 25' (00") N. This distance is equal to 2.5 min times 60 seconds = 150" of latitude.
Using the downloaded version of the Rock Island map, the distance from southern line of SW7 to northern line is 194 mm.
2. Measure the distance from base line 47° 22' 30" N to your target (the Brain Bank corner) in mm. This is 101mm.

3. Set up a proportion from steps above:
baseline to target in mm / baseline to top line in mm = seconds to target / 150"

4. Solving the proportion gives the distance from the base line of 47° 22' 30" N to the target in seconds of latitude.

101/194 mm = seconds to target/150 seconds = 77" or 1' 17" above southern line for sector SW7.

5. Add 1' 17" to the base line of 47° 22' 30" N and you have the exact latitude.

6. **Answer: Latitude = 42°, 23', 17" N**

One common source of error is that you are adding degrees, min, second, all of which are in groups of 60 rather than groups of ten. If seconds add up to 75, you must convert that to 1 min 15 seconds. There are a variety of special map overlay grid tools that make this easier, but never walk into a competition and rely on a new tool you bought yesterday. First learn how to use it! Check *mapatools.com, benmeadows.com, and forestry-suppliers.com, maptools.com.*

For practice you can use Google Earth to check your results—their numbers may not be exactly the same as yours even if your measurements and math are perfect, but you should be within a few seconds. Be aware that when Zombies arise, the Internet may not work.

46. What is the longitude at the Abnormal Brain Bank at the northeast corner of the Brain Building? Express as degrees, minutes, and seconds. Don't forget East or West!

Answer: longitude = 120° 12' 46" W (range 42 - 50")

Longitude is determined the same way as latitude, except you are using a north-south base line and measuring to the west. Always work with the base line to the east of your target. Since longitude in the US increases as you move west, so you will always be adding numbers rather than subtracting.

NOTE: Do not draw your baseline on the map. Use a piece of paper or the eastern neat line to establish the baseline.

1. Start with the eastern sector line (baseline) for SW7. Measure distance along neat line from (120°) 12' 30" (W) to the western sector line - in this case, the map western neat line 120° 15' (00" W). Always work east to west - the math is easier. This is 132 mm.

2. Measure the distance from base line to the Brain Bank corner in mm. It's 14 mm.

3. Set up a proportion from steps above:
baseline to target in mm / baseline to western line in mm = x" / 150"

4. Solving the proportion gives the distance from the base line (120°) 12' 30" (W) to the target in seconds of longitude.

14/132 mm = x/150 seconds = 16" west of the eastern baseline for sector SW7

5. Add this to the base line of 120° 12' 30" W and you have the exact longitude.

6. **Answer: 120° 12' 46" West (range 42- 50")**

47. What is the UTM Easting value at the Abnormal Brain Bank at the northeast corner of the Brain Building?

Answer: Easting = Zone 10, 710333 mE (range last three digits 300 - 370)

Background: - UTM

The Universal Transverse Mercator (UTM) System is a grid system similar to latitude and longitude, and is used to precisely locate features on the earth. UTM was originally developed by military agencies from about 1940 to 1980.

UTM has three basic differences from the lat/long system:
1. UTM coordinates are in actual metric distances (in meters) on the earth's surface rather than in angle measurements of degrees, minutes, and seconds. That allows "distance math" to be done as regular base ten calculations, so it is much easier to use on the ground and more computer/calculator friendly.

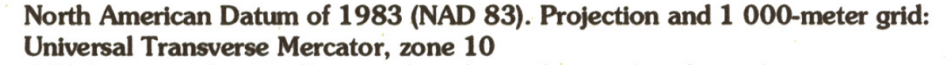
2. UTM is based on a Mercator projection and treats each piece of the Earth as a flat surface. Mercator maps always get very distorted near the north and south poles; UTM solves this by ignoring all areas north of 80° N and South of 80° S. That's pretty far north and south; you will not encounter these areas on road maps (no roads!) or USGS topo maps used in Road Scholar.

3. Instead of 4 directions - N, S, E, W, UTM uses only "Eastings and "Northings".

UTM divides the Earth into 60 zones of 6° of longitude (360° total). Zones start at the International Date Line and are numbered going eastward only, not east and west. The 48 contiguous U.S. states are in zones 10 to 19. At first glance UTM is all big scary numbers. However, its application to a specific USGS topo map is actually quite simple.

On USGS maps:

The UTM zone is shown in lower left corner. Mapscan below is Rock Island, WA.



On 7.5-minute quadrangle maps, the UTM Easting and Northing grid lines are marked at intervals of 1,000 meters, either by blue ticks in the margins of the map or with full black grid lines. The 1,000-meter value of the ticks is abbreviated for every tick or grid line. The full meter value is

shown for ticks nearest the southeast and northwest corners of the map. See mapscan of northwest corner of the Rock Island map.

Note the 709 marking (709000), which assumes the (000) for the thousand meters.

Reading the UTM Grid

On the UTM grid below (see next page) , the value of line A-A is 357,000 meters East. The grid value of line B-B is 4,276,000 meters North. Point P is 800 meters east and 750 meters north of the grid lines. Therefore, the UTM grid coordinates of point P are 357800 mE and 4276750 mN.

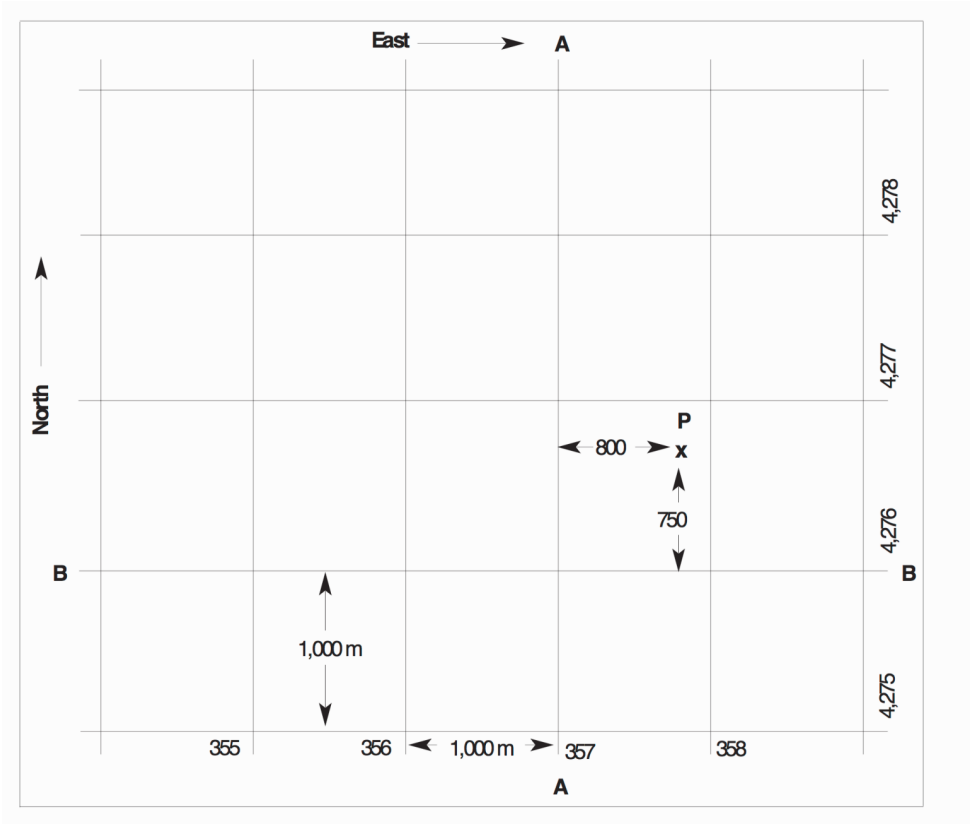
Problem Solution:

For the Brain Bank - measure and set up a proportion just like for latitude/longitude.

Easting: Start with measuring east from the vertical Easting grid line west of the target.
Northing: start as in latitude with measuring north from the horizontal Northing grid line south of the target.

For both, measure the distance between the grid lines. Since values of UTM units do not change as do longitude distances, UTM boxes are always the same size: 42 mm on a 1:24,000 map.

UTM Grid



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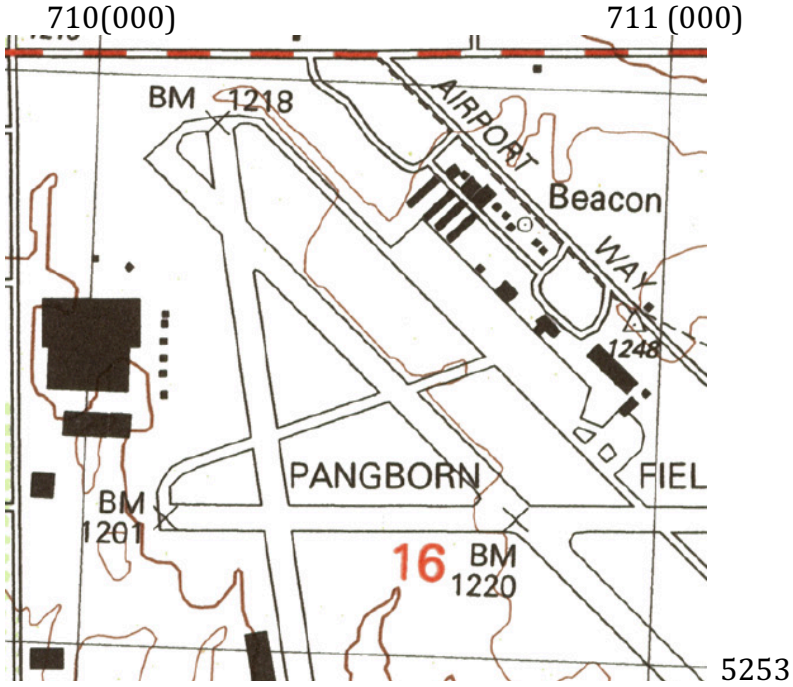
See enlarged mapscan below: the Brain Bank is just inside the lower grid line.



Brain Bank

Notice that the UTM grid lines are not perfectly North-South on the map. The map is set on "True north", but UTM uses grid north. See declination from question # 40.

On the enlarged scan, the Easting measurement is 25 mm east of the 710,000 grid. The distance between the 710,000 grid and the 711,000 grid is 75 mm.

Easting proportion is: 25 mm/75 mm = x / 1000 m = 333 meters.

Answer: Easting = 710333 mE (This is in UTM zone 10, as noted on map)

In measuring for Easting, you always work to the east, just the opposite of longitude where you always measure to the west in the western hemisphere.

48. Based on the activity shown in the images, which ship will be loaded at a faster rate - the one on the left or the right? Why do you think so?

Answer: left ship will load or unload faster because four cranes are in operation on the left ship but only one on the right ship.

In many satellite image uses, understanding what is visible is much more important than just the objects in the image. This question involves reasoning and interpretation of the images. Containers are loaded and unloaded from ships using large cranes usually mounted on tracks at the port. Comparing the two ships, the right ship has one crane visible but the left has four, so the left ship will load or unload faster. Check You-Tube "How are container ships loaded?" Other satellite images may ask about cars in a parking lot, shadows to determine time of day or compass direction.

There have been military operations carried when shadows of people suggested there was a sought after tall person hiding in an area where most people were short.

49. Using a scale of 1:3000, how long is the ship on the left? Express to the nearest whole meter.
Answer: 312 meters (Range 280-340)

This is a scale question with measurement and calculation. The size of the image on your screen/paper will determine your measurements and answer. Check to make sure that the left hand ship image is a total of 116 mm up/down along the edge.

Measure the ship. It should be 104 mm long. 104 mm= 0.104 m. Using the stated scale of 1:3000, 0.104 m x 3,000 = **312m**

Profile Problems

50. Label the Y axis with elevations. The contour interval is 20 feet.
51. Plot and draw the profile along the black UTM grid line.
52. Label points A, B, and the stream. Use "highest possible" elevation values for all three points.

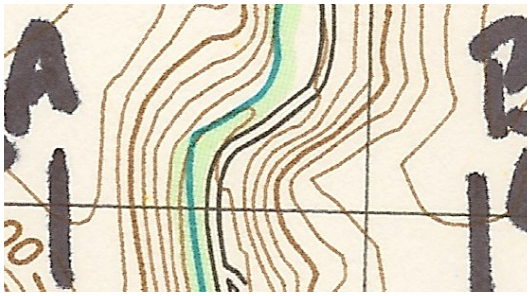
Background: Topographic Profiles

Profile problems require careful marking of map points and transferring them onto a graph, but no calculation is directly involved. Profiles can be hard for teams because they tend to be at the end of the event when you are short of time and rushing. Some teams have one member start with profiles and map drawing while the other starts with the "regular" problems.

Solving the problem:

1. In a Road event, you will normally get a scan of the topo map to draw a profile. This is so that the map can be enlarged if lines are close together, and so you are not marking up the real map.

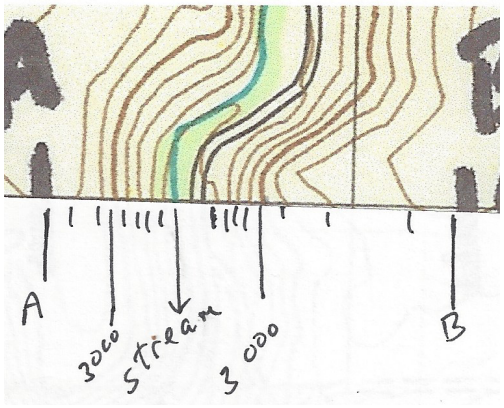
Find the scanned section on the actual map to give context for topo line elevations.See cropped mapscan for Ques 50-52 below:



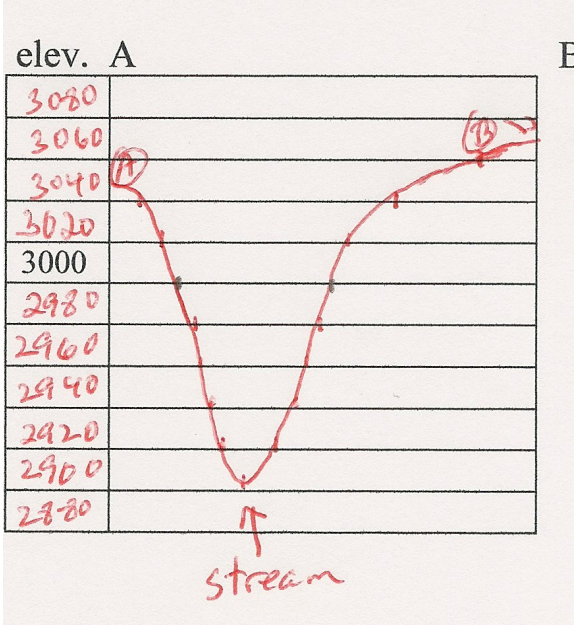
2. Graduate the axis per instructions. In this case, the 3000 ft index elevation is marked and the interval is stated as 20 ft.

3. Place a piece of unlined white paper along the profile line. Carefully mark the end points and transfer contour lines onto you white paper. Make sure nothing slips! Mark the index lines longer so you can find them a minute later.See mapscan below:

Profile section with white paper, marked for contours



4. Move your marked white paper to the graph grid and carefully transfer marks again from white paper to graph. Connect with a smooth line and you have the solution.



Map Drawing Problem- Ques # 53 to 55:

Mommy and I bought the Lazy Z Brain School in Wyoming a little while ago. It's made up of one PLSS Section. The Snake River enters the map at the Northeast corner and meanders through it following a bearing of S 45°W. The valley around the Snake is level at 2000 ft elevation and a half-mile wide. After that the Northern Valley edge rises steeply to 2200 ft, but the Southern edge rises more gradually to 2110 ft. We have a home and a school building in the SE ¼ of the SE ¼, at an elevation of 2110 ft. Our students can wander around the valley, and we develop brains with good taste at the school!

53. Draw the Snake River as it meanders through the Brain School PLSS Section.
54. Draw Northern and Southern valley edge contours; label elevations.
55. Draw the house and school using USGS symbols. Mark the school's elevation.

You may leave any guide lines you draw—you do not have to clean them up.
Use a scale of 120 mm= 1 mile 1 mm= 44 feet Contour interval 20 feet

Background

Map drawing problems are the Road Scholar equivalent of Write It, Do It. Instead of being given a map and asked to pull information from it, you are given information and asked to draw a map. This is a more sophisticated part of the event. In order to do map drawing, you need all the basic skills of any Road Scholar event- you must be able to measure, calculate, read map symbols, and understand grid systems. You must be able to draw angles correctly, whether they are given in azimuths or compass bearings. In short, you have to synthesize all your skills and apply them to the given problem in an integrated fashion. Mistakes in one part of the map usually cause mistakes in another part. Ouch!

Because of the nature of drawing maps, they tend to take up a lot of time- usually at the end of an event when you are rushed. Many teams have one student start with profile and map drawing while the other works on the map reading problems.

You will be given a square with a designated size, usually one square mile. Ordinarily you will be given a specified scale to use; if not you can figure it out by measuring the size of the square and dividing by 5,280 feet per mile. As with other measurement, make all your measurements in millimeters for better accuracy.

If the event writer gives you a one-mile square, that is pretty much a loud ringing alarm saying, "Wow! Here go a lot of PLSS descriptions!". One common problem format is the type in Zombie Bedtime Rhymes-- a general description of streams, hills, roads, and buildings in the square with PLSS descriptions. Another common format is a property deed with boundary descriptions in azimuths and distances. An example of this, from a different event, is included here.

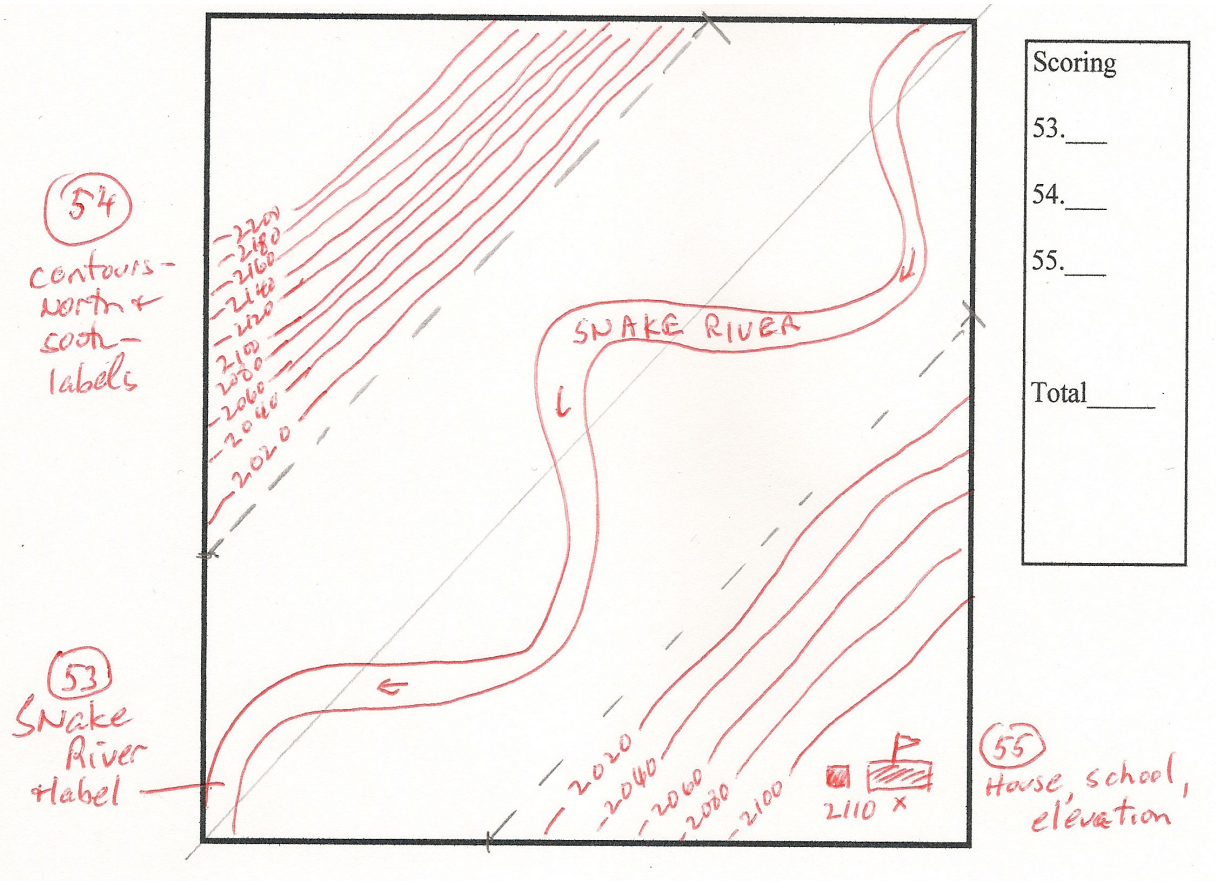
If you have a one- mile PLSS Section, start by measuring and dividing the square into four quarters. Measure each side, divide in half, make guide marks, and divide the one mile Section into quarter sections so you have a reference for drawing. After that, take each item as asked and draw it, while double checking your angels and distances.

Answers: to 53, 54, 55

53: Original guide line and Snake River with meanders, flowing in S 45°W (or Azimuth 225°). Arrows show flow.

54. 1/2 mile wide flat valley drawn with dashed borders as guide lines, North slope steeper and up to 2200ft, South more gradual to 2100 ft. Both at 20 ft intervals .

55. House (an occupied building shown in solid) and school (striped with flag). elevation marked at 2110 ft; no addition contour line needed until 2120 ft. School in correct PLSS location.



The following is an example of a complex property description problem from another event- "The Right Stuff", about astronauts:

Hi! I'm Katherine Johnson. Back when John Glenn was going into space, I did all the math involved in plotting out his flight path--and I did it all by hand. Now I'm 99 years old and there's a cool movie about me titled Hidden Figures. John's son asked me to plot and draw a survey map of his new farm. He knows I can do the math, but can you? I'll read the property deed, and you draw out the boundaries. If you're really good maybe you'll be in a movie too! Just make sure your figures are not hidden- write them on the answer sheet.

The farm is located in part of a Public Land Survey System Section, Section 1, Town 34 North, Range 15 East. The grid below shows the entire Section, divided into quarters.

Questions:

11. Label the Norwest corner of the Section "A". Draw the Northern boundary line starting from "A" at an Azimuth of 110° for 4400 feet. Mark the end of the line with a "point in a circle" and label it "B".
12. Draw the Eastern boundary line starting from "B" at an Azimuth of 165 ° for 3080 feet. Mark the end of the line with a "point in a circle" and label it "C".
13. Draw the Southern boundary line starting from "C" at an Azimuth of 270° for 3000 feet. Mark the end of the line with a "point in a circle" and label it "D".
14. Using a broken line, draw the Western boundary line starting from "D" back to "A". Label this line with its compass bearing. (This is not the Azimuth, but the old-fashioned compass bearing.

Compass bearings must start with either "North" or South".)

15. In the Northeast 1/4 of the PLSS section, there is a lake 600 feet in diameter just inside the property. Draw and label it.

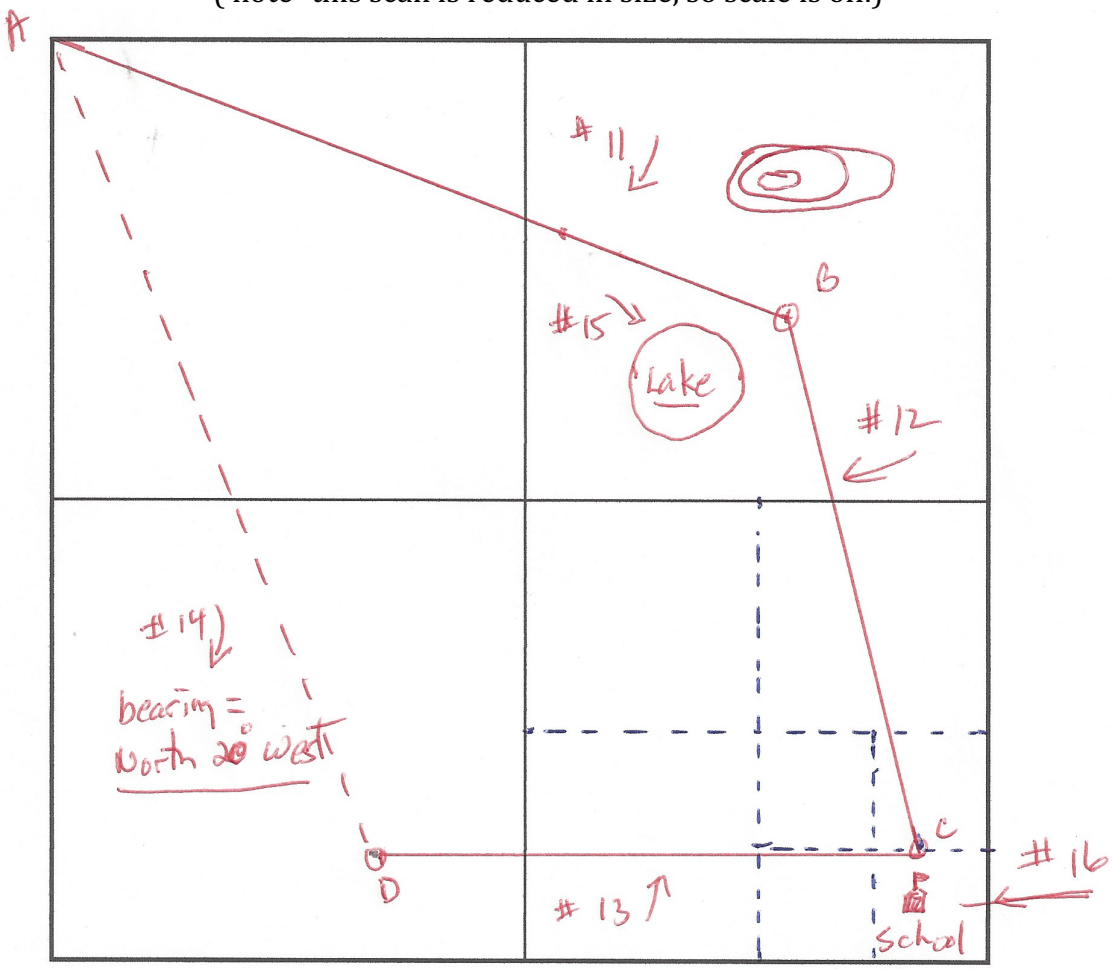
16. There is a schoolhouse outside the property, about 200 feet South of point "C". Draw and label it using the correct USGS symbol.

17. What is the five part PLSS description of the schoolhouse ?
Express your answer as: _____, _____, Section_____, Town___, Range ___

18. The map area is flat with an elevation of 435 ft, except for a hill directly North of point B. The hill is outside the farm's boundaries. It rises to an elevation of 465 feet, oval shaped with the Eastern side more gradual than the West. Using a contour interval of 10 ft, draw the hill.

Answers:

Scale 1mm= 40 feet Assume the box borders are true North- South and East-West lines.
(note- this scan is reduced in size, so scale is off.)



17. Schoolhouse: **SE 1/4, SE 1/4, Section 1, Town 34 North, Range 15 East**

In this type of problem, you must be extra careful in drawing the first few border legs because each leg requires both the Azimuth and the line length to be correct, or the next leg will start in the wrong place. A small mistake accumulates as you go along.