

# Science Olympiad - Road Scholar Between Two Seasons

## A Homemade Road Scholar Test

Number of Questions: 50

Test Version: 4 [Last Edit November 24, 2019]

Maps Required:

- Pennsylvania / New Jersey AAA Highway Map
- Grand Junction, Colorado: 30x60 minute Topographic Map
- St. Louis, Missouri: 1x2 degree Topographic Map

Topographic maps are available for download online from USGS or the uploaded files accompanying this test.

Due to its availability online on the scioly.org test archive, this test and its questions are for educational use only and shall not be used or reused in official competition.

This test was written by Ladue Middle School Science Olympiad.

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Good luck, and most importantly: learn something and have fun!

Names: \_\_\_\_\_  
\_\_\_\_\_

Score: \_\_\_\_\_ / 173

## Between Two Seasons

### Road Scholar Practice Test

Carson lived his life alone, in his own house in Bellefontaine, Missouri. He was basically a hermit, but had one fellow friend, Francis. Francis, a very social friend, always tried to convince Carson to come outside and talk with others and enjoy the outside nature, but each time he did, Carson chose to stay in his own, secluded house.

Carson and Francis were fellow cartographers in their young adult life. They knew everything about maps, from topography to oceanography to even aeronautical. Gradually, when they retired, Carson isolated himself as Francis enjoyed life to the fullest. While Carson studied more topography, Francis had fun socializing with his friends.

One rare early morning when Francis and Carson were talking among themselves, Francis asked if Carson remembered the beauty of the four seasons in the outdoors that Carson always refused to go to.

"I..." Carson stumbled, "okay. I forgot. Remind me again."

"Spring, summer, autumn, and winter."

"Right. I admit that I have forgotten the beauties of those seasons."

"Well, currently it is spring. Would you like to remind yourself of how spring looks?"

Carson rolled his eyes. Here we go again. "No thank you, I'm content with my knowledge."

"Why can't you have a variety of knowledge, instead of just topography?"

This time, Carson had to admit, Francis had a good reason. But he still declined.

"Why don't I take you out to witness spring, summer, and winter?"

Carson considered this for a moment. He hated to go outside, but he found an irresistible need to remind himself of that beautiful picture lost in his mind of each of the four seasons. Should he, or should he not? This question filled his mind.

Francis suddenly interrupted. "Why don't we go on a vacation?"

"Uh..... no."

Francis once again frowned the frown that always succeeded this response. "Fine then, I shall leave you here in solitude."

As Francis, once again disappointed, walked out the door, Carson stopped him. "Wait! I think I shall like to go with you."

Francis' face lit up. "Shall we go now?"

Carson brought his maps along with his luggage. He brought along his St. Louis topographic map and his Grand Junction topographic map. In Francis' car, he instinctively looked over his maps.

1. Carson notices that he took the wrong Grand Junction map. What scale is the map presented in?
  
2. Carson also notices that the St. Louis map might be very outdated.
  - a. In what year was this map's area field checked?
  
  - b. In what year was the magnetic declination indicated on the map calculated?
  
3. Help Carson find Bellefontaine. He knows that it's located in Washington County. What township and range is Bellefontaine located in?
  
4. As Carson gazes out the window, awed at the beauties of the spring season, Francis drives North to De Soto. From there, Francis travels on the road that leads northeast out of the town. After Francis passes the town of Victoria, what state highway should Francis turn right onto in order to directly reach the Festus - Crystal City area?
  
5. Carson notices that Festus is close to the southern terminus of an interstate highway. Find the sum of this number and the elevation of the airport in Festus.
  
6. What is the distance from the mentioned interstate's intersection with the highway described in problem 4 to Downtown St. Louis?
  
7. "Actually, we're not going to downtown St. Louis. We're going to the airport." Carson, now quite annoyed by Francis' willingness to get him outside, searched for it on the map. "Are we taking Interstate 244?" "No," Francis replied, "I-244 is long gone. It was renumbered as the highway located north of its northern terminus." What number is assigned to that interstate highway?

8. In 40 minutes, they had arrived at St. Louis Lambert International Airport.
  - a. On this map, what is the name of the airport?
  
  
  
  
  
  
  
  
  
  
  - b. What is the latitude and longitude of the most easterly endpoint of the four runways?
  
  
  
  
  
  
  
  
  
  
  - c. Upon arrival in the airport's Terminal 2, Carson notices that the runway on his map that runs in a north-south direction is not there. What is the azimuth from the south end of that runway to the north end?
  
  
  
  
  
  
  
  
  
  
  - d. As Carson and Francis waited for their flight, they became bored. For fun, they found the UTM coordinates, latitude, and longitude of the center of the orange star next to Rolla National Airport. Write their resulting measurements below.
  
  
  
  
  
  
  
  
  
  
9. Francis and Carson board their flight for Philadelphia International Airport. What is the latitude and longitude of the center of the airplane symbol designating this airport, located south of the city of Philadelphia on the New Jersey - Pennsylvania Highway Map?
  
  
  
  
  
  
  
  
  
  
10. Carson notices that the name of "Philadelphia" appears twice on the map, once in a blue color and once in a red color. What do each represent?

11. As their airplane approached the airport, Francis told Carson that they would be exploring Atlantic City.
  - a. Ideally, from what exit should the two enter I-95 with their rental car?
  
  - b. Why is the diamond at this interchange colored gray?
  
12. Onboard, the captain makes a disheartening announcement. Due a minor accident blocking the destination airport's runways, the plane is being rerouted to Northeast Philadelphia Airport. Assuming the plane maintains a constant speed of 180 mph before its final approach, how long would it take to travel between the two airplane symbols of the two airports mentioned?
  
13. Carson notices two larger rivers and a creek directly below them on the ground as they approach the airport. What parks surround Schuylkill River and Pennypack Creek?
  
14. Francis wants to visit Battleship New Jersey, the most decorated battleship in US history, retired in 1991. For what famous figure is the street next to it named after?
  
15. Francis then reminded Carson that they would be experiencing summer in in New Jersey at Atlantic City and Cape May. From Battleship New Jersey, how could the two get to Highway NJ-42? Provide your answer as if you were giving directions.
  
16. The two see a sign marking the beginning of the Atlantic City Expressway. Below the sign is a logo that says "E-Z Pass." "Aw, do we really have to pay tolls?" Francis whined, "We're traveling the whole way on this highway! What's the maximum price we're supposed to pay?"

17. On the highway, Carson realizes that he doesn't know what projection this map is based on, and rushes to find it. What projection was used to create the map?
18. As they exit the highway into Atlantic City, Carson notices that the road type quickly changes as Francis drives into the city center. Into what two types of roads did the Atlantic City Expressway transform into?
19. Carson and Francis had finally arrived at their destination, but they were hungry for lunch. They parked next to the Donald Trump-owned Plaza Hotel, and went to the Pier Shops at Caesars. They then walked East, exploring the sights as Francis showed Carson what summer looked like on the beach.
- a. Carson notices an attraction with an odd name. What company broadcasts their weird museum exhibits in their Atlantic City branch?
  - b. Francis tells Carson that they will be staying in the hotel ahead to the left. The building on the right currently displays a big sign saying "Hard Rock Casino." Who was the previous owner of this hotel, at the time of the map's printing?
  - c. As night fell and the sunlight left the hotel room, Carson reflected on the fun he had today with Francis on the beach. He looked North, reflecting on his enjoyments from today. He realized that he had finally went into the public again! He still had one question: what other roads and mapped landmarks (other than already described) are named after presidents?

20. Next morning, Francis woke Carson up. "Quick, we've got more summer to admire! Let's go check out the sunrise and then keep going." Carson got up, got dressed and ready, and then they both went on the hotel deck to eat some breakfast. On the Northeast side of the city, Carson sees another body of water. What is the *straight line* distance, in miles, from its namesake city to Atlantic City?
21. As they got into the car, Francis said, "The cost of the toll on New Jersey Turnpike is even worse. Could you list the highways that make up the road paralleling the turnpike on the east, right next to the East coast of New Jersey, going all the way to Cape May?"
22. As Francis drove, Carson admired the beautiful scenery outside on the wonderful, sunny day. He reflected back to his memories as a young man, when he had dreams of joining the military. What branch of the military has a training center located east of Cape May?
23. After Carson and Francis explored the Cape May Lighthouse, they went back to Erma, where Francis said he had a friend at the local (but unmapped) Cape May Airport. Carson was again annoyed at Francis' travel plans, but kept quiet and awaited the wonders of winter as he calculated the distance of travel from Cape May to Erma. What is this value to the nearest whole number in miles?
24. The provided private jet, a Bombardier Learjet LR40, stood parked as Carson and Francis boarded. Carlos sat down and admired the plane's interior design. Francis greeted his friend, and sat down to observe Carson's Grand Junction map. Flight plans indicated that they would be landing in Grand Junction Regional Airport / Walker Field. What kind of border does one of the runways of this airport cross?

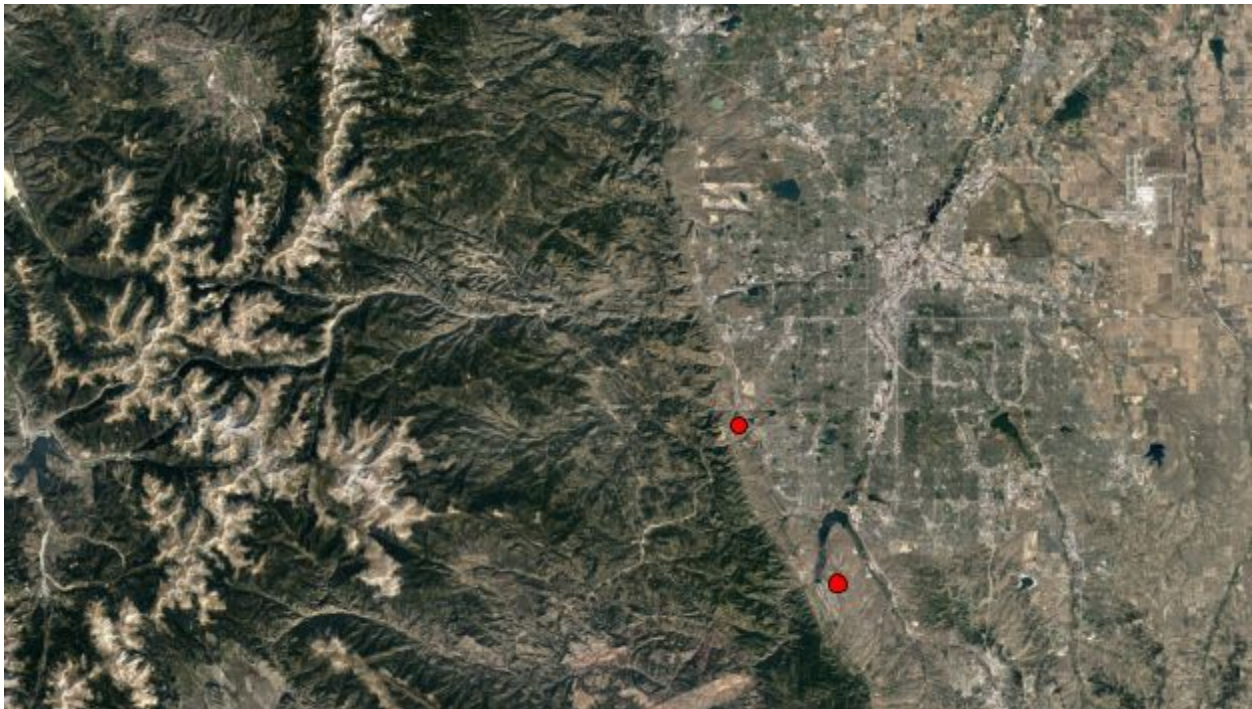
25. A skimming of the map showed that certain land lines were omitted from this map. Why is this so?
26. After 5 hours of flying, the duo landed at Grand Junction Regional Airport. At the eastern end of the runway, Francis notices a stream. What is its gradient from the contour north of its source lake to its intersection with Highline Canal?
27. Francis and Carson deplaned and rented a car. They put on their jackets and drove onto I-70 from Exit 31. Conforming to the speed limit of 70 mph, how long would it take to get to Exit 49: CO-65, in minutes? It is recommended that you calculate the exact distance.
28. Francis and Carson need to follow Highway CO-65 in order to reach their destination. Carson looks out the window to observe the winter around him.
- From CO-65, how many gaging stations will Carson be able to see? Assume that nothing hinders Carson's ability to see these.
  - Carson can also see a creek flowing down from the mountain on the South. What is the stream gradient of Big Wash from its source to its intersection with the 1500 m contour line?
  - Find the PLSS of the designator of this Chalk Mountain. List  $4 \frac{1}{4}$  intervals.
29. Their destination, Powderhorn Ski Resort, is where the duo will be staying for a week. Calculate the slope gradient of the *east* ski lift.



30. "Maybe we should go camping at that town in the east sometime," suggested Francis. "Absolutely not," replied Carson, "What's its name, anyway?"

a. Calculate the UTM of the graticule tick mark SW of the "Point" that derives its namesake from the town described above.

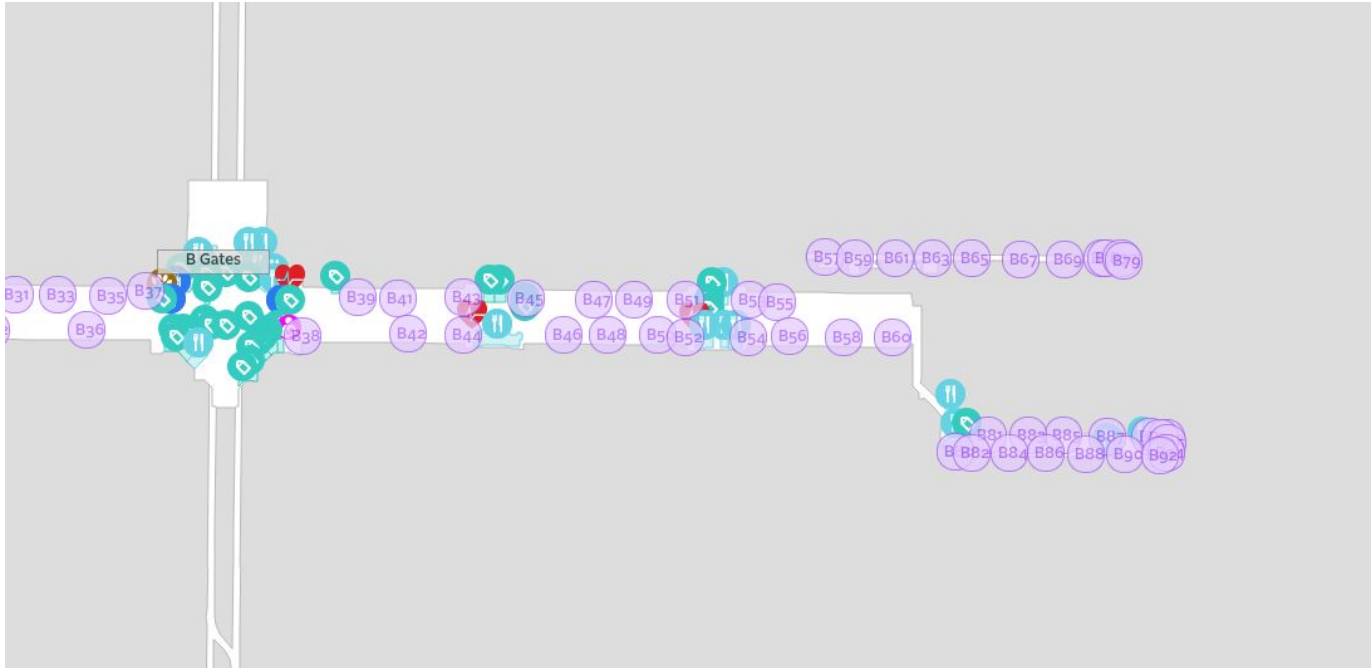
31. Carson had fun skiing and regaining his joyful memory of winter during the week. But, everyone has to take a break from fun. Carson spent this break studying the area around him. For the following questions, refer to the satellite map of a portion of eastern Colorado below: (*derived from Google Maps*)



a. Find the two lakes, marked with a red circle, on the western half of the southeast quarter that have a "V" shape. Given that 1 inch = 16 miles, how far apart are the "vertices" of these two lakes?

b. In the Northeast corner, there seems to be a white square with several lines coming out. What is this feature most likely to be?

- c. The town of Fraser is located in the Northwest. Does the town sit on a plateau?
32. That day, Francis also asked Carson if he knew how steep this area could get. "I'll show you a profile," replied Carson, "let me find a place." Looking back at the map, Carson found the perfect place within seconds. Recreate his profile along the 2nd vertical line from the West border of the area forming Township 7S and Range 99W. In addition to your regular labels, also label the regions of Cow Ridge, Kimball Mountain, and Horse Mountain.
33. Eventually, the time came to leave the ski resort. Carson found himself enjoying this experience; he didn't want to lose it. However, Carson could now recall autumn's beauties, and he really needed to get back to his home. Off they went to Denver International Airport (Carson had to be reminded that Stapleton was not used anymore), back onto CO-65 North. However, they turned right onto a different road (the one after CO-330), and Carson suddenly became concerned. Why?
34. "Don't worry," Francis assures, "Exit 62 exists." When they finally get on highway I-70, how many water landforms have they passed since the duo departed onto CO-65 that day?



35. Refer to the Denver International Airport Concourse B Map above:

- a. The plane departs from gate B82 to St. Louis. From the middle of the concourse (the center of the octagon under the box that says "B Gates"), and assuming the scale of 1:2400, approximately how many meters do they have to walk from the center of the concourse?
- b. There are blue icons in the center of the concourse, between gates B43 and B45, between gates B51 and B54, and before gate B81. Give *one type* of product you can buy at any of these locations.

36. When their plane reaches St. Louis Lambert Airport, Carson notices a railroad north of the airport that he had not seen before. Now owned by Norfolk Southern, what company used to own this railroad before it merged with its current owner?

37. After a long vacation and Carson's exposure to the seasons, he was tired. He drew a profile in the St. Louis 1:250,000 topographic map along the northern borders of the townships T48N R8W and T48N R9W. Carson then fell asleep afterwards, craving for a rest. Draw what Francis would see if he took a safe glance at Carson's work.

By the time they were back, Carson wanted to go back to his secluded life again. "But, I'll be ready for another time outside. Just give me a little rest."

Francis, again disappointed that they had to go back to this point, said, "Really? Oh well. I guess I can never change your habits. You'll see me again sometime."

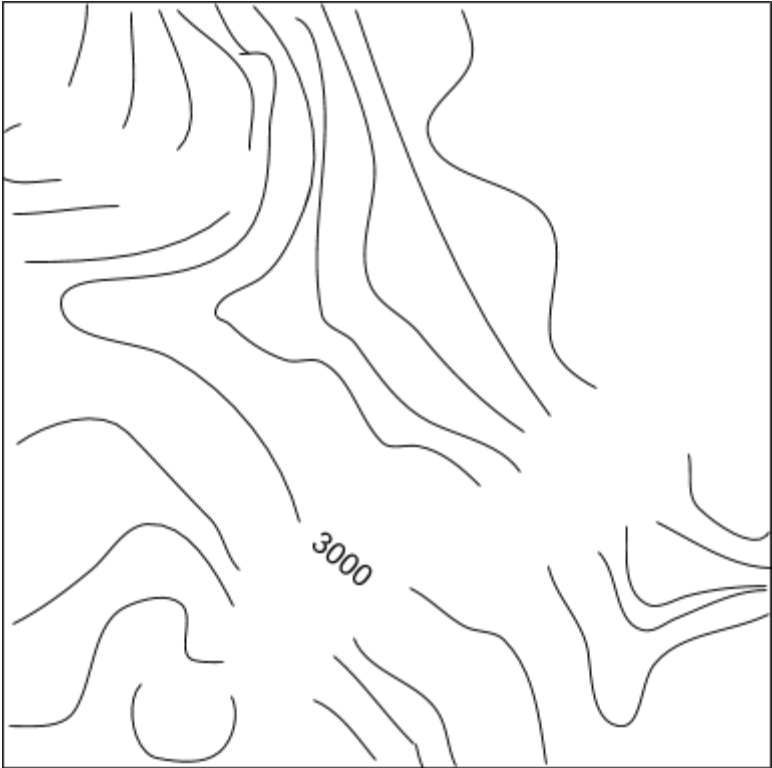
"Alright. Goodbye, and good night!" With that, Carson closed the door. Francis walked back to his car, took a look at Carson's front window, and then drove away, knowing he would be back to take Carson to see the sights of autumn.

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Back at his home, Carson wanted to draw a mini model of a ski resort. He outlined a square, shown on the following page. Follow the following instructions along with him:

1. This map is a scale of 1:61920 (1 in.:1 mi.). This map depicts 16 sections from T23N R15W, with section 4 located at the northwest corner. Label all necessary PLSS markings, including sections, section borders, township, and range.
2. Fill in the contours, given that the contour intervals are 30 ft.
3. Draw a 1-mile ski lift with the following endpoints and directions:
  - a. Azimuth  $25^\circ$ , from the center of the region SE  $\frac{1}{4}$  / 21 / T23N R15W
  - b. Azimuth  $110^\circ$ , from two miles north of the north endpoint of ski lift (a).
  - c. Azimuth  $140^\circ$ , from two miles east of the north endpoint of ski lift (a).
  - d. Azimuth  $265^\circ$ , from the midpoint of the line segment formed by the east endpoints of ski lifts (b) and (c). **Make this ski lift two miles.**
4. Draw a trail from the eastern endpoint of ski lift (d) for 1 mile at an azimuth of  $5^\circ$ .
5. Draw a light duty road from an azimuth of  $340^\circ$  from the endpoint of the trail.
6. This road also runs from this endpoint to the other side at an azimuth of  $120^\circ$ . Both of the segments described in (5) and (6) run off the map.
7. Draw an intermittent lake with a diameter of 0.5 miles at the center of section 1.
8. Draw a trail which circles the lake at a distance of 0.125 miles away from the lake. Connect the trail to the road with another trail tangent to the circle at its northwestern point and perpendicular to the road.
9. Draw and label a depression contour around the trail around the lake.

Between Two Seasons Road Scholar Sample Test  
Student Created Map Answer Sheet



## Between Two Seasons: Answer Key

Numbers in brackets [x] indicate points awarded for the given answer, or its parts.

No partial credit should be given unless otherwise indicated.

- i.e. An answer matching "Topographic map [3]" would earn 3 points.
- I.e. An answer in the range of "10.2 - 13.4 miles [2]" would earn 2 points.

1) [1] 1:100,000

2a) [1] 1963

2b) [2] 1965

3) [2] Township 38 North [1]; Range 3 East [1].

Township 5 South [0.25]

4) [1] MO-21A (accept equivalent MO state highway indicators; do not accept MO-21)

5) [2] 490 (I-55 + 435 ft)

6) [2] 34 miles

7) [1] Interstate 270 (accept I-270, do not accept US-270)

8a) [1] Lambert St. Louis

8b) [5]  $38^{\circ} 44' 15'' - 38^{\circ} 44' 25''$  N;  $90^{\circ} 20' 45'' - 90^{\circ} 20' 55''$  W [2.5 points each]

$38^{\circ} 44' 05'' - 38^{\circ} 44' 35''$  N;  $90^{\circ} 20' 32'' - 90^{\circ} 21' 08''$  W [1.5 points each]

$38^{\circ} 43' 55'' - 38^{\circ} 44' 45''$  N;  $90^{\circ} 20' 20'' - 90^{\circ} 21' 20''$  W [0.5 points each]

-1 point for incorrect notation, not writing N, or not writing W.

Tiebreaker Answer:  **$38^{\circ} 44' 20''$  N  $90^{\circ} 20' 50''$  W**

8c) [3]  $6.75^{\circ} - 7.25^{\circ}$  [3 points] Tiebreaker Answer:  **$7^{\circ}$**

$6.25^{\circ} - 7.75^{\circ}$  [2 points]

$5.5^{\circ} - 8.5^{\circ}$  [1 point]

8d) [5] Latitude and Longitude:

$38^{\circ} 07' 10'' - 38^{\circ} 07' 20''$  N;  $91^{\circ} 47' 00'' - 91^{\circ} 47' 10''$  W [2.5 points each]

$38^{\circ} 07' 00'' - 38^{\circ} 07' 30''$  N;  $91^{\circ} 46' 47'' - 91^{\circ} 47' 23''$  W [1.5 points each]

$38^{\circ} 06' 50'' - 38^{\circ} 07' 40''$  N;  $91^{\circ} 46' 35'' - 91^{\circ} 47' 35''$  W [0.5 points each]

-1 point for incorrect notation, not writing N, or not writing W.

Tiebreaker Answer:  **$38^{\circ} 07' 15''$  N  $91^{\circ} 04' 05''$  W**

[5] Universal Transverse Mercator (UTM):

(606,450mE - 606,750mE; 4,219,625mN - 4,219,875mN) [2.5 points each]

(606,300mE - 606,900mE; 4,219,375mN - 4,219,925mN) [1.5 points each]

(606,150mE - 607,050mE; 4,219,125mN - 4,219,975mN) [0.5 points each]

-1 point for incorrect notation, not writing N or E, or not including units.

Tiebreaker Answer: **(606,600mE; 4,219,825mN)**

Maximum Points: [10]

9) [5]  $39^{\circ} 53' 20'' - 39^{\circ} 53' 40''$  N;  $75^{\circ} 16' 20'' - 75^{\circ} 16' 40''$  W [2.5 points each]

$39^{\circ} 53' 00'' - 39^{\circ} 54' 00''$  N;  $75^{\circ} 16' 00'' - 75^{\circ} 17' 00''$  W [1.5 points each]

39° 52' 30" - 39° 54' 30" N; 75° 15' 30" - 75° 17' 30" W [0.5 points each]

-1 point for incorrect notation, not writing N, or not writing W.

Maximum Points: [5]

Tiebreaker Answer: **39° 53' 30" N 75° 16' 30" W**

10) [2] The blue color represents the name of the county. The red color represents the name of the actual city. [1] point for each part of the explanation.

11a) [1] Exit 15

11b) [1] The interchange is a partial interchange.

12) [2] 6 minutes and 9-11 seconds Tiebreaker Answer: **6 minutes and 10 seconds**  
[1] 6 minutes and 5-15 seconds

13) [2, 1 for each] Fairmount Park (Schuylkill River), Pennypack Park (Pennypack Creek)

14) [2] Dr. Martin Luther King Jr.

15) [3] Go east on Dr. Martin Luther King Boulevard. [1] Then, turn south onto Interstate 676. [1] Continue south until the fork of state highways 55 and 42, where one should keep left onto state highway 42. [1] Accept equivalent abbreviations for state highway.

16) [1] \$3.75

17) [2] Lambert Conformal Conic Projection

18) [3] The road first turns into a principal undivided road, and then turns into a local undivided road. [1] for each correct road type, [0.5] for each "undivided" label.

19a) [1] Ripley's Believe It or Not! (Accept just "Ripley's.")

19b) [1] Donald Trump

19c) [3, 1 for each] Madison Avenue, Lincoln Avenue, McKinley Avenue

20) [2] 6 miles

21) [3] County Road 629, County Road 619, County Road 621, State Highway 109.  
Accept equivalent. [2 - 0.5x] for x roads incorrect or missing; -0.5 for incorrect road type.

22) [1] The U.S. Coast Guard

23) [2] 5 miles

24) [1] UTE Principal Meridian

25) [2] There is insufficient data.

26) [1] for 3ft/1000ft - 3.5ft/1000ft  
[4] for 10.5ft/1000ft - 10.8ft/1000ft  
[3] for 10.3ft/1000ft - 11.0ft/1000ft  
[2] for 10.1ft/1000ft - 11.2ft/1000ft  
Tiebreaker Answer: **10.68ft/1000ft**

27) [1] for 15.4 minutes

[3] for 14.9-15 minutes

[2] for 14.75-15.15 minutes

28a) [2] 3 gaging stations

28b) [1] for 23.5ft/1000ft - 24.5ft/1000ft

[4] for 78.7ft/1000ft - 79.0ft/1000ft

[3] for 78.5ft/1000ft - 79.2ft/1000ft

[2] for 78.2ft/1000ft - 79.5ft/1000ft

Tiebreaker Answer: **78.9ft/1000ft**

28c) [3] NW ¼ / NW ¼ / SW ¼ / NW ¼ / 2 / T11S R97W

-1 for incorrect format. -0.5 for each incorrect section. Minimum 0 points.

29) [1] for 7.2ft/100ft - 7.8ft/100ft

[3] for 23.5ft/100ft - 23.8ft/100ft

[2] for 23.3ft/100ft - 24.0ft/100ft

[1] for 23.0ft/100ft - 24.3ft/100ft

30) [1] Skyway, Colorado

30a) (755,000mE - 755,200mE; 4,325,150mN - 4,325,350mN) [2.5 points each]

(754,900mE - 755,300mE; 4,325,050mN - 4,325,450mN) [1.5 point each]

(754,800mE - 755,400mE; 4,324,950mN - 4,325,550mN) [0.5 points each]

Tiebreaker Answer: **(755,075mE; 4,325,250mN)**

Maximum Points: [5]

31a) [1] 16 miles

31b) [2] The feature is an airport.

31c) [1] No

32) [17]: [6] for general shape. -1 for each missing hill/valley; minimum 0.

[1.5] for elevation labels from 1950m to 2500m. Units are not needed.

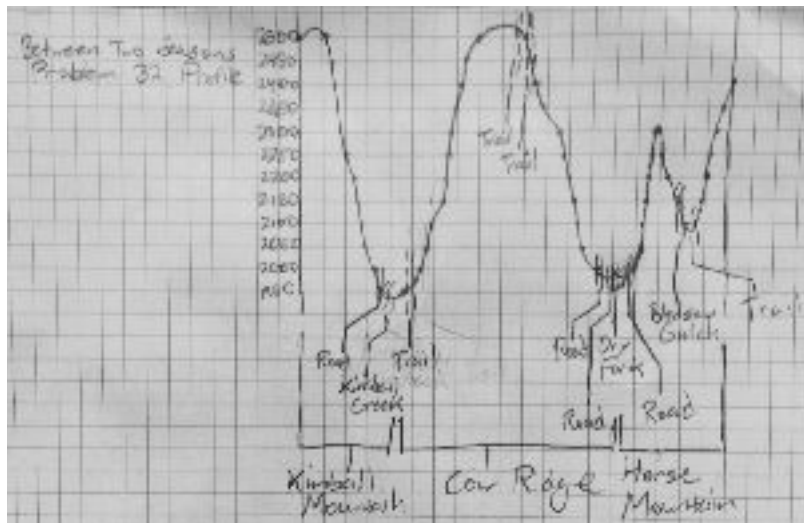
-0.125 for each label missing. No penalty for extra labels.

[0.5] for a starting elevation of 2500m, positive slope

[0.5] for an ending elevation of 2400m, positive slope

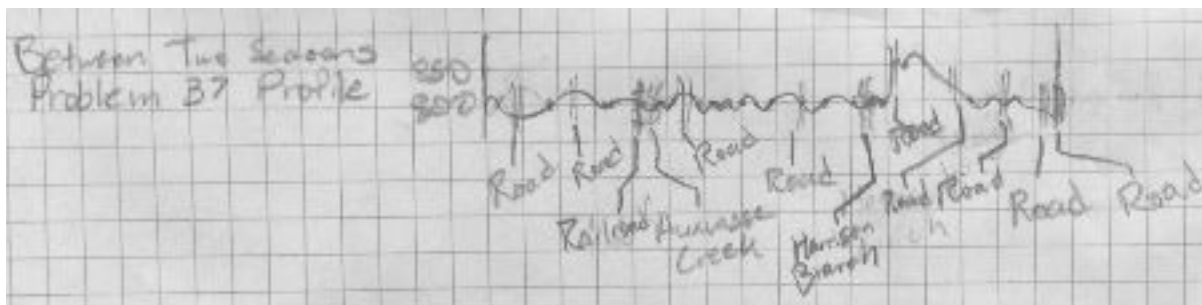
[5.5] for all roads, streams, or trails labeled correctly. [0.5] each, 11 total.

[1] for each of Cow Ridge, Kimball Mountain, and Horse Mountain areas labeled correctly





- 33) [2] The map indicates that the road ends at a dead end or does not have an interchange with I-70.
- 34) [2] 15 (streams)
- 35a) [2] 250-255 meters  
[1] 240-265 meters
- 35b) [1] Food, merchandise, or equivalent. If you can buy it at an airport shop, it's right.
- 36) [1] Norfolk and Western
- 37) [15]: [7.5] for general shape. -0.25 for every missing / incorrect line intersection (31 intersections total). Minimum 0 points. Answers charted as straight lines when they should be wavy should not receive points.  
[0.5] for elevation labels of 800 ft and 850 ft. -0.25 for each missing. No penalty for extra labels. Units are not needed.  
[0.5] for a starting elevation of 800ft, positive slope  
[0.5] for an ending elevation below 800ft, negative slope  
[6] for all roads, railroads, or streams labeled correctly. [0.5] each, 12 total.



Student-Created Map Criteria:

[5] given for correct PLSS labeling; -0.25 for each incorrect section label/placement. -0.5 for each township/range label/placement. -2 for no borders. -1 for incorrect dimensions. -3 for shifting section 4 to a position other than indicated. Minimum 0 points.

[6] given for all contours; -0.5 for every incorrect contour. Minimum 0 points.

[9]: [2] for all ski lifts in correct position, direction, and length; [3] for ski lift (3d); [1.5 - 0.5x] for each ski lift with x of the following errors: a direction off by  $> 5^\circ$ , a length off by  $> \frac{1}{8}$  inches, or an endpoint offset by  $> \frac{3}{8}$  inches.

[2] for the trail from the ski lift to the road turn. No deductions for this criterion should result if the ski lift is positioned incorrectly

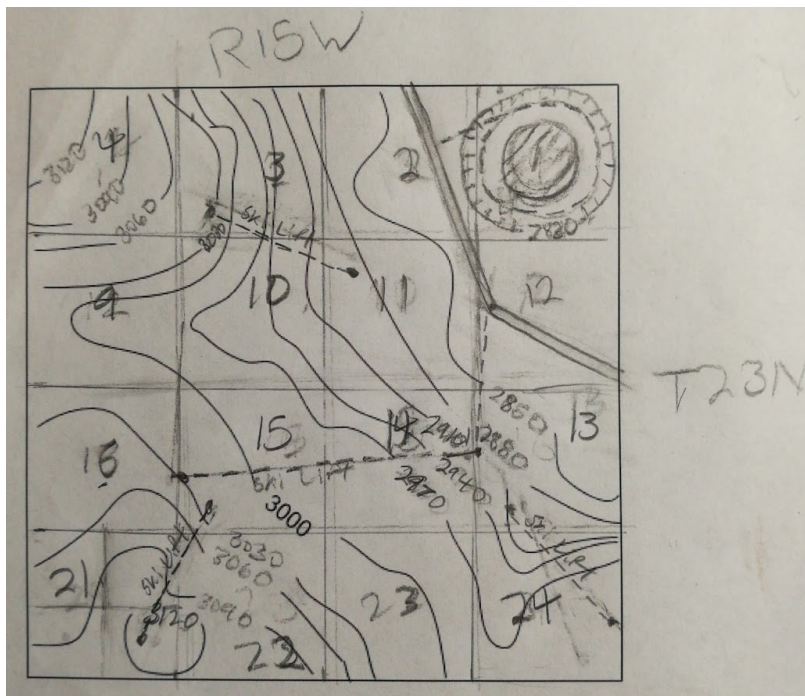
[4]: [2] for each of the two road segments for type, angle, and relative position. [1.5 - 0.5x] points awarded for x aspects incorrect.

[2] for lake size, placement, and type. [1.5 - 0.5x] points awarded for x aspects incorrect.

[2] for trail around lake, awarded for distance from lake and placement.

[1] for trail between road and circular lake trail (relative location and placement)

[2] for correct depression contour placement and labelling



\*Clarifications:

- Depression contour value is 2820 ft.
- Sorry for all the eraser markings!

Total test score:

/173