"Calculation-Free" Science Problems: Test problems for GPT4 + Wolfram Alpha and GPT4 + Code Interpreter

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Eclipse problems

1. An astronaut is standing in the Sea of Tranquility during what on earth is called a total lunar eclipse. They are looking in the direction of the earth. What they see is:

   A. The surface of the moon, illuminated by earth light.
   B. The night side of the earth, occluding the sun.
   C. The surface of the moon, illuminated only by starlight.
   D. The surface of the moon, illuminated by the sun.
   E. The sun.
   F. The day side of the earth, with a small circular shadow moving quickly over it.
   G. The night side of the earth. The sun is somewhere else entirely.
   H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

2. An astronaut is standing in the Sea of Tranquility during what on earth is called a total lunar eclipse. They are looking in the direction of the sun. What they see is:

   A. The surface of the moon, illuminated by earth light.
   B. The night side of the earth, occluding the sun.
   C. The surface of the moon, illuminated only by starlight.
   D. The surface of the moon, illuminated by the sun.
   E. The sun.
   F. The day side of the earth, with a small circular shadow moving quickly over it.
   G. The night side of the earth. The sun is somewhere else entirely.
   H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

3. An astronaut is standing in the Sea of Tranquility during what on earth is called a total solar eclipse. They are looking in the direction of the earth. What they see is:

   A. The surface of the moon, illuminated by earth light.

B. The night side of the earth, occluding the sun.

C. The surface of the moon, illuminated only by starlight.

D. The surface of the moon, illuminated by the sun.

E. The sun.

F. The day side of the earth, with a small circular shadow moving quickly over it.

G. The night side of the earth. The sun is somewhere else entirely.

H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

4. An astronaut is standing in the Sea of Tranquility during what on earth is called a total solar eclipse. They are looking in the direction of the sun. What they see is:

   A. The surface of the moon, illuminated by earth light.

   B. The night side of the earth, occluding the sun.

   C. The surface of the moon, illuminated only by starlight.

   D. The surface of the moon, illuminated by the sun.

   E. The sun.

   F. The day side of the earth, with a small circular shadow moving quickly over it.

   G. The night side of the earth. The sun is somewhere else entirely.

   H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

5. An astronaut is standing on the so-called "dark side of the moon", during what on earth is called a total lunar eclipse. They are looking in the direction of the earth. What they see is:

   A. The surface of the moon, illuminated by earth light.

   B. The night side of the earth, occluding the sun.

   C. The surface of the moon, illuminated only by starlight.

   D. The surface of the moon, illuminated by the sun.

   E. The sun.

   F. The day side of the earth, with a small circular shadow moving quickly over it.

   G. The night side of the earth. The sun is somewhere else entirely.

   H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

6. An astronaut is standing on the so-called "dark side of the moon", during what on earth is called a total lunar eclipse. They are looking in the direction of the sun. What they see is:

   A. The surface of the moon, illuminated by earth light.

   B. The night side of the earth, occluding the sun.

   C. The surface of the moon, illuminated only by starlight.

   D. The surface of the moon, illuminated by the sun.

   E. The sun.

   F. The day side of the earth, with a small circular shadow moving quickly over it.

   G. The night side of the earth. The sun is somewhere else entirely.

   H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

7. An astronaut is standing on the so-called "dark side of the moon", during what on earth is called a total solar eclipse. They are looking in the direction of the earth. What they see is:

A. The surface of the moon, illuminated by earth light.

B. The night side of the earth, occluding the sun.

C. The surface of the moon, illuminated only by starlight.

D. The surface of the moon, illuminated by the sun.

E. The sun.

F. The day side of the earth, with a small circular shadow moving quickly over it.

G. The night side of the earth. The sun is somewhere else entirely.

H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

8. An astronaut is standing on the so-called "dark side of the moon" during what on earth is called a total solar eclipse. They are looking in the direction of the sun. What they see is:

   A. The surface of the moon, illuminated by earth light.

   B. The night side of the earth, occluding the sun.

   C. The surface of the moon, illuminated only by starlight.

   D. The surface of the moon, illuminated by the sun.

   E. The sun.

   F. The day side of the earth, with a small circular shadow moving quickly over it.

   G. The night side of the earth. The sun is somewhere else entirely.

   H. A starry sky. Neither the sun, the earth, or the surface of the moon is in the field of view.

Distance combination problems

9. Joe says that he lives 10 miles from the Atlantic, that Beth lives 10 miles from the Atlantic, and that he and Beth live 3000 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

10. Joe says that he lives 10 miles from New York City, that Beth lives 10 miles from New York City, and that he and Beth live 3000 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

11. Joe says that he lives 10 miles from Lake Michigan, that Beth lives 10 miles from Lake Michigan, and that he and Beth live 100 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

12. Joe says that he lives 10 miles from Walden Pond, that Beth lives 10 miles from Walden Pond, and that he and Beth live 100 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

13. Joe says that he lives 100 miles from Walden Pond, that Beth lives 100 miles from Lake Michigan, and that he and Beth live 10 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

14. Joe says that he lives 1000 miles from Walden Pond, that Beth lives 1000 miles from Lake Michigan, and that he and Beth live 10 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

15. Joe says that he lives 10 miles from Lake Huron, that Beth lives 10 miles from Lake Michigan, and that he and Beth live 10 miles apart. Is it possible that Joe is telling the truth? Answer "Yes" or "No".

16. Is there a point in the Nile River that is exactly 827 miles from the Al-Azhar Mosque in Cairo? Answer "Yes" or "No".

17. Is there a point in the Nile River that is exactly 8562 miles from the Al-Azhar Mosque in Cairo? Answer "Yes" or "No".

18. Is there a point x in the Danube River and a point y in the Rhine River that are exactly 12 miles apart? Answer "Yes" or "No".

19. Is there a point x in the Danube River and a point y in the Rhine River that are exactly 429 miles apart? Answer "Yes" or "No".

20. Is there a point x in the Danube River and a point y in the Rhine River that are exactly 8738 miles apart? Answer "Yes" or "No".

Clockwise vs. counterclockwise

If you have a map that shows Chicago, New York City, and Atlanta, and you draw a circle through the three of them, then the sequence ⟨Chicago; New York; Atlanta⟩ is in clockwise order. The sequence ⟨New York; Chicago; Atlanta⟩ on the other hand, is in counterclockwise order.

For each of the following, state whether it is in clockwise or counterclockwise order:

21. Caracas, Venezuela; Amarillo, Texas; Quebec, Quebec.

22. New Orleans, Louisiana; Springfield, Illinois; Jacksonville, Florida.

23. Kingston, Jamaica; Fresno, California; Albany, New York.

24. Indianapolis, Indiana; Wichita, Kansas; Montgomery, Alabama.

25. Denver, Colorado; Houston, Texas; Indianapolis, Indiana.

26. Seattle, Washington; New York, New York; Mazatlan, Mexico.

27. Spokane, Washington; Mexico City, Mexico; Virginia Beach, Virginia.

28. Sitka, Alaska; Oakland, California; Albany, New York.

29. Pierre, South Dakota; Eastport, Maine; Columbia, South Carolina.

30. Toronto, Ontario; El Paso, Texas; Key West, Florida.

31. Sitka, Alaska; Omaha, Nebraska; Long Beach, California.

32. Edmonton, Alberta; New Orleans, Louisiana; Washington DC.

Sorting problems

Sorting problems should be scored in terms of the number of pairs in order divided by the total number of pairs. The order of answers has been randomized.

33. Sort the items below in increasing order of mass:

    A. Pablo Picasso, when five years old.

    B. The Great Sphinx

C. An atom of uranium.

D. The planet Mercury.

E. A Toyota Corolla

F. The polio virus.

G. A hamster.

H. Emily Dickinson, when twenty-three years old.

34. Sort the events below by duration:

A. The lifetime of Marie Antoinette.

B. The Precambrian period.

C. The first performance of Beethoven's seventh symphony.

D. Lincoln speaking the Gettysburg address.

E. The Hundred Years' War.

F. The reign of Queen Victoria.

G. The existence of the species of passenger pigeons (ending with the death of "Martha").

H. The battle of Gettysburg.

I. The existence of legal slavery in what is now the United States.

J. The reign of Marie Antoinette.

K. The lifetime of Joan of Arc.

35. Sort the events below by starting date:

A. The lifetime of Marie Antoinette.

B. The Precambrian period.

C. The first performance of Beethoven's seventh symphony.

D. Lincoln speaking the Gettysburg address.

E. The Hundred Years' War.

F. The reign of Queen Victoria.

G. The existence of the species of passenger pigeons (ending with the death of "Martha").

H. The battle of Gettysburg.

I. The existence of legal slavery in what is now the United States.

J. The reign of Marie Antoinette.

K. The lifetime of Joan of Arc.

36. Sort the events below by ending date:

A. The lifetime of Marie Antoinette.

B. The Precambrian period.

C. The first performance of Beethoven's seventh symphony.

D. Lincoln speaking the Gettysburg address.

E. The Hundred Years' War.

F. The reign of Queen Victoria.

G. The existence of the species of passenger pigeons (ending with the death of "Martha").

H. The battle of Gettysburg.

I. The existence of legal slavery in what is now the United States.

J. The reign of Marie Antoinette.

K. The lifetime of Joan of Arc.

37. Sort these entities in increasing order of distance from the painting "The Mona Lisa".

A. Omaha Beach

B. Phobos, the moon of Mars.

C. The Dome of the Rock

D. The Washington Monument

E. The Sistine Chapel

F. Leonardo da Vinci's painting, "St. John the Baptist".

G. The Tomb of Napoleon.

H. The Rosetta Stone

I. The Parthenon

J. Mount Fujiyama

K. The Great Barrier Reef.

38. Sort these people by increasing order of the distance of their birthplace from the birthplace of Frederic Chopin.

A. Gandhi

B. Mao

C. Cleopatra

D. Kafka

E. Mohammed

F. Cate Blanchett

G. Napoleon

H. Marie Curie

39. Sort these people by increasing order of the distance of their birthplace from the birthplace of Abraham Lincoln.

A. Ruth Bader Ginsburg

B. The Duke of Wellington

C. Ulysses Grant

D. Vladimir Lenin

E. Jacindra Ardren.

F. Ho Chi Minh

G. Kamala Harris

H. Barack Obama

I. George Washington

Satellites

All the problems in this section were solved default GPT-4; GPT never called either plug-in.

40. Is it possible to have a satellite such that the point on the earth underneath the satellite always has longitude 40 degrees? Assume that the satellite is moving in a closed orbit around the Earth and that the only influence on the satellite's motion is the Earth's gravity. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

41. Is it possible to have a satellite such that the earth point underneath the satellite always has latitude forty degrees south? Assume that the satellite is moving in a closed orbit around the Earth and that the only influence on the satellite's motion is the Earth's gravity. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

42. Is it possible to have a satellite such that the northernmost earth point underneath the satellite has latitude 40 degrees N and the southernmost has latitude 30 degrees S? Assume that the satellite is moving in a closed orbit around the Earth and that the only influence on the satellite's motion is the Earth's gravity. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

43. Assume that a satellite passes in its orbit over the North Pole. Which of the following is true:

    A. It must pass over the South Pole.

    B. It cannot pass over the South Pole.

    C. It might or might not pass over the South Pole.

    Assume that the satellite is moving in a closed orbit around the Earth and that the only influence on the satellite's motion is the Earth's gravity. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

44. Suppose that the orbit of a satellite, which is non-circular, takes it over the North Pole, and moreover, it is furthest from the earth when it is over the North Pole. When will it be nearest to the earth?

    A. When it is over the equator.

    B. When it is over the South Pole.

    C. At some point after it has crossed the equator but before it has passed over the South Pole.

    D. None of the above are necessarily true.

    Assume that the satellite is moving in a closed orbit around the Earth and that the only influence on the satellite's motion is the Earth's gravity. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

45. Can two earth satellites have their orbits in planes that are not equal but are parallel? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

46. Can two earth satellites have their orbits in planes that are orthogonal? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

47. Let C be the center of the earth. Can there be two earth satellites X and Y such that X, C, and Y always lie in a straight line, with C between X and Y? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

48. Let C be the center of the earth. Can there be two earth satellites X and Y such that C, X, and Y always lie in a straight line, with X between C and Y? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

49. Let C be the center of the earth. Can there be two earth satellites X and Y such that the angle XCY is always a right angle? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

50. Let C be the center of the earth. Can there be two earth satellites X and Y such that the angle CXY is always a right angle? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

51. Let C be the center of the earth. Can there be two earth satellites X and Y such that the angle CXY is always 60 degrees? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

52. Let C be the center of the earth. Can there be three earth satellites X, Y, and Z such that C, X, Y, and Z are always coplanar? Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.

53. Let C be the center of the earth. Can there be three earth satellites X, Y, and Z such that the lines CX, CY, and CZ are always all pairwise orthogonal?
Assume that the satellites are each moving in a closed orbit around the Earth and that the only influence on the satellites' motion is the Earth's gravity. Assume that it is not possible for them to occupy the same point in space simultaneously. Assume that the Earth is a perfect

sphere. Ignore the revolution of the Earth around the sun, but do not ignore the rotation of the Earth around its axis.