**2022 Mini Mu – Geometry**

1. Aaron and Linsey are looking through a telescope and see a beautiful arrangement of stars, a constellation! Given that the 4 stars in this constellation form a isosceles trapezoid with a longer base of 4 light years, shorter base of 3 light years, and height of 2 light years, help the duo find the area of the trapezoid, in light years2.
2. 14 (B) 7 (C) 6 (D) 8 (E) NOT
3. A
4. While travelling across the universe, Yimo comes across Galaxy , which is shaped like a dimensional circle. Segment is tangent to circle is the center of the circle and is on the line . If Yimo knows that and , what is the diameter of the galaxy?

(A) (B) (C) (D) (E) NOTA

1. Yimo, located at point , finds another circle galaxy. and are tangent to the circle. He spots an astronaut travelling from point to via , the point on the galaxy that is tangent to. The perimeter of triangle is 12. What is the length of PA?

(A) 3 (B) 4 (C) 5 (D) 6 (E) NOTA

C

1. Yimo is travelling in a special spaceship. A cross section of the spaceship is shown in the diagram below.

A

B

C

D

N

F

E

M

is a quadrilateral, , is the midpoint of , is the midpoint of If is meters, is centimeters, and is meters, find the perimeter of .

(A) m (B) m (C) m (D) m (E) NOTA

1. In space, astronauts are playing with some simple and -sided shapes, with and being squares, to create a -sided one. They measured mmm. Find the total area enclosed in heptagon in m2.

A

B

C

D

E

G

F

1. (B) 33 (C) (D) (E) NOTA

1. Aliens and are located at the corners of the square . Point represents a café inside square , and . What is the side length of the square?

A

B

C

D

P

1. (B) (C) (D) (E) NOTA
2. In the space, three stars compose a triangle and two stars and are located on the line of AB and AC respectively. In the triangle ABC, it is observed that , , What is the value of

A

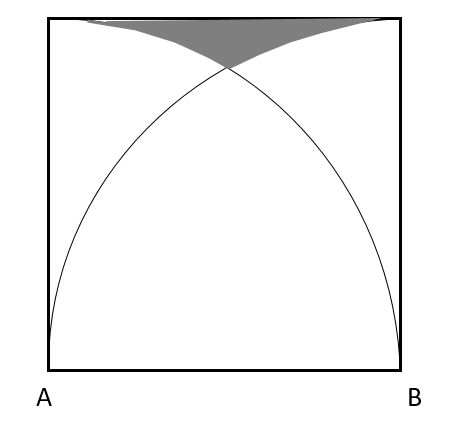
B

C

D

E

1. (B) 3 (C) (D) (E) NOTA
2. Inside a square galaxy , Lindsay and Khawla were in point and respectively. They wanted to race to point and via the curved paths which are arcs of circles centered at vertices and of a square of side length . Find the area of the shaded section.



D

C

1. (B) (C) (E) NOTA
2. If and are similar and have area of and , respectively, then find the ration of the perimeter of to ?
3. 49:64 (B) 8:7 (C) 8:7 (D) 64:49 (E)NOTA

10. If Wesley and Cyrus both start at the origin, (0,0), and Wesley flies straight towards the planet Lee, located at (0,21), at 1.5 units per second and Cyrus flies straight towards the planet White, located at (28,0), at 2 units per second. After 4 seconds, find the sum of the distances between Wesley and Lee, Cyrus and White, and Wesley and Cyrus, in units.

1. 10 (B)45 (C)49 (D)44 (E) NOTA

11. Joanna is on a perfectly spherical planet with a perfectly spherical moon. If the planet Joanna is on has a volume of and the moon of the planet has a volume of , then what is the ratio of the surface area of the moon to the planet?

1. 2/5 (B) 8/125 (C) 25/4 (D) 4/25 (E) NOTA

12. 4 planets, A,B,C,D are aligned in a plane such that they create the following picture, x is a variable.

A

D

C

B

5x-46

2x+5

If AC bisects angle , find the measure of angle .

1. (B) (C) ) (D) ) (E) NOTA

13. Wesley and Cyrus are both on a spaceship with paths that are parallel to each other as shown:

43 degrees

Y

B

W

C

What is the measure of the supplementary angle of ?

1. (B) (C) ) 47 (D) 137 (E) NOTA

14. There exists a galaxy ABCDEF in the shape of a regular octahedron with edge length 1. As shown in the figure.

E

B

C

A

D

F

The midpoints of the edges AB, AC, AD, and AE are M, N, O, and P respectively. The midpoints of edges BF, CF, DF, and EF and Q, R, S, and T, respectively. What is the volume of the shape MNOPQRST?

1. (B)1/4 (C) (D) (E) NOTA

15. A frustum is formed by cutting a circular pyramid with a plane parallel to its base. Suppose there is a giant circular cone made of boba floating in the middle of space. Bruce loves boba and eats a small cone from the top of it forming a frustum. If the resulting frustum is pictured as shown, what was the original surface area of boba cone?

8

9

3

1. (B) (C) (D) (E) NOTA

16. What is the surface area of the frustum of boba in the previous question?

1. (B) (C) (D) (E) NOTA

17. Jose absolutely loves when meteors collide. One day, while stargazing with his pupil Arib, he spies two meteors colliding. He quickly hops in his spaceship to see the stones. When he reached the collided meteors, he separates them and realizes that the smaller one, which is perfectly spherical and has a surface area of , has made a hole that is a quarter of its volume on the larger meteor. Given that the larger meteor has a diameter of meters, how much volume does it still have after the impact?

(A). (B). (C). (D). (E). NOTA

18. The Schwarzschild radius is the radius of the event horizon of a Schwarzschild black hole. The formula to calculate the Schwarzschild radius is . is the Schwarzschild radius, M is the mass of the object in kilograms, G is the universal gravitational constant, and c is the speed of light. Assuming that the event horizon can be represented by a perfect sphere, solve for the Schwarzschild radius of the event horizon of a Schwarzschild black hole of mass 900 kg. (Use constants G=6.67⋅10^-11 and c=3⋅10^8.)

(A)

(B)

(C)

(D)

(E) NOTA

19. Three AGNs (Active Galactic Nucleus): a quasar, a blazar, and a radio galaxy are arranged in such a way that their astrophysical jets form a right triangle ΔABC with right angle at ∠B. The three AGNs themselves bisect each side of the triangle. Find the area of the triangle formed by the AGNs if AB has a length of 20 and AC has a length of 52.

(A) (B) (C) (D) (E) NOTA

20. Nelson wants to see if time dilation can help him submit his assignments on time. He travels near light speed in space and brings an analog clock with him. 6.5 hours pass for Nelson and 11 hours pass back on Earth. If the clock has an hour hand of length 8, calculate the difference between the area of the clock covered by the traversal of the hour hand for Nelson’s clock and for an identical clock’s hour hand on Earth.

(A)26π  (B) 18π  (C) 28π (D) 16π  (E) NOTA

21. When Nelson travelled to space, he borrowed a rocket ship from his good friend James. The rocket is made up of a cylinder with height 200m and radius 30m, a frustum (a truncated cone) with radii of 30m and 15m and a height of 100m on top of the cylinder, and a hemisphere of radius 15m on top of the frustrum. If 70% of the rocket is full of fuel, calculate the volume of the fuel within the rocket, in m3.

(A) 141855 π (B) 180005 π (C) 191575 π (D) 164325 π (E) NOTA

22. Yimo wants to find a rare and mysterious space mole. He knows that the space mole is contained within a section of space which can be represented by rotating the area bound by the lines x=0, x=9, y=x/2+9, and y=3x/2

about the y axis after graphing them on the cartesian plane. Find the volume of this space.

(A) 832/3 π  (B) 52 π (C) 192 π  (D) 243 π (E) NOTA

23. Aw Snap! While Yimo was out looking for the space mole, the evil LordVadercraft appeared from a wormhole and threatened to capture all the space moles in existence. Luckily for Yimo, LordVadercraft fears trigonometry! Help Yimo scare him off by solving for sin∠L in right triangle ΔLVC with a right angle at ∠V, where VC=285 and LC=293.

(A) 285/293  (B) 72/285 (C) 285/72 (D) 293/285 (E) NOTA

24. Grand leader Shiju is planning to go on a space expedition but is wondering what would be the most efficient way to make a plate to put food on. Given that they will make a plate in the shape of a regular polygon with 3 or more sides with perimeter 21 meters, find the minimum area that the plate can be.

(A) (B) (C) (D)  (E) NOTA

25. The Hercules-Corona Borealis Great Wall is the largest known structure in the observable universe. Arib claims to own the largest known structure in the observable universe. Which property states that Arib claims to own the Hercules-Corona Borealis Great Wall?

(A) Commutative Property

(B) Inverse Property

(C) Associative Property

(D) Identity Property

(E) NOTA

26. Elijah really likes Uranus, and he also really likes Boötes Void. He wants to move Uranus so that its new location is within Boötes Void. If Boötes Void can be represented as a space on a grid like the Cartesian plane and Uranus must be located on a lattice point, find the number of locations Uranus can be located if Boötes Void has an area of 330 and is bound by 62 lattice points.

(A) 300  (B) 299 (C) 362 (D) 361  (E) NOTA

27. Everyone knows Einstein’s formula e=mc^2, so let us use it right now! If a pyramid with the base of a regular hexagon has a slant height of 13 and the apothem of the base has length ( 5sqrt3)/2, solve for the energy that can be obtained from this pyramid assuming that the pyramid has a mass equal to its volume. (Use c=3⋅108)

(A) (B) (C) (D) (E) NOTA

28. 69 galaxies are arranged such that they form a convex hexacontakaienneagon and 420 other galaxies are arranged to form a convex tetrahectaicosagon. Find the remainder r when t, the number of diagonals in the tetrahectaicosagon is divided by h, the number of diagonals in the hexacontakaienneagon.

(A) 38  (B) 38.46 (C) 9730/253 (D) 1044 (E) NOTA

29. OH NO! Nelson is at it again! He has decided that in order to attract more women that he should create a gravitational field around himself! If the gravitational field can be represented by a hemisphere of radius twice Nelson’s height of 5 foot 10 and is centered at Nelson’s feet, find the volume of this “space of attraction” in cubic inches. (Assume that Nelson is standing in a perfectly flat plane large enough to hold the entire volume of the gravitational field).

(A) 1372000 π/3 (B) 1152000 π (C) 686000 π/3 (D) 144000 π (E) NOTA

30. Jose and Arib again spot another two meteors crash into each other. One meteor, the shape of a right cone with radius 4 and height 12 crashes into another cone of radius 6 and height 12. They form a resulting shape as shown below such that the vertex of one coincides with the center of the base of the other. Find the volume of the resulting intersection between the two cones. The bases of the two cones are parallel.

a. . b. . c. d.. e. NOTA

31. Upon flying through space, following the equation 3x+4y=10, Arib sees Wesley’s mouth, a black hole represented by the equation . If he doesn’t want to enter the event horizon of Wesley’s mouth, what is the closest he will ever be to the event horizon(the event horizon is the surface of the sphere).

1. 0 (B)1 (C)2 (D) (E) NOTA

(TB) A pulsar spins fast enough such that its shape becomes deformed and is represented by an ellipse. If said ellipse has the equation , find the eccentricity of this ellipse. Give your answer as a fraction in simplest form.