

QUESTION 1

Find the sum of the value in parentheses of all of the true statements:

- (-2) A square is a rectangle.
- (-1) A pentagon can tessellate.
- (3) The inverse of the statement “If I have my music, then I am satisfied.” is “If I do not have my music, then I am not satisfied.”
- (4) Skew lines can be in the same plane.
- (7) The icosahedron is a platonic solid.
- (-5) The diagonals of a kite are always perpendicular.

QUESTION 2

Let

A = The number of vertices on a polyhedron with 40 faces and 50 edges

B = The number of edges on a polyhedron with 30 faces and 40 vertices

C = The number of faces on a polyhedron with 25 vertices and 35 edges

D = The volume of a hexahedron with one side of length 6

Find $A + B + C + D$

QUESTION 3

Let

$$A = \text{the center of } (x - 3)^2 + (y + 5)^2 = 10$$

$$B = \text{the center of } x^2 + 2x + y^2 + 6y = -3$$

$$C = \text{the center of } x^2 + 10x + y^2 - 6y - 34 = 4$$

Consider the polygon formed by A , B , and C . Find the center of mass of this polygon.

QUESTION 4

Consider a cube with a side length of 12. Let

A = the volume of the cube

B = the surface area of the largest sphere that can fit inside the cube

C = the volume of the smallest sphere the cube can fit in

D = the surface area of the largest cylinder that can fit inside the cube

Find $A + B + C + D$.

QUESTION 5

Let

A = the sum of the interior angles of a convex non-regular icosagon

B = the area of a hexagon that can be inscribed in a circle with an area of 18π

C = the volume of the figure formed when the polygon defined by the coordinates $(1, 2)$, $(1, 6)$, $(5, 6)$, and $(5, 2)$ is rotated about the x -axis

D = the volume of the figure formed when the polygon defined by the coordinates $(1, 2)$, $(1, 6)$, $(5, 6)$, and $(5, 2)$ is rotated about the y -axis

Find the value of $3A + 2B - C - D$.

QUESTION 6

A dartboard has 5 rings alternating concentric black and white with a red bullseye. The bullseye has a radius of 1, and each consecutive outer ring has a radius that is 1 unit larger than the one before it. The bullseye is centered in a black ring, followed by a white one, alternating for all 5 rings on the board. Assume that a dart thrown will always land on the board. Let

A = the probability of hitting a bullseye

B = the total area occupied by white

C = the expected point value of a given throw, if the black rings are worth 3 points, the white rings are 2 points, and the bullseye is worth 5 points

Find $A + B + C$.

QUESTION 7

There are two poles of height 8 feet and of 10 feet. They are a distance of 50 feet apart. Given that two wires are strung from the top of one pole to the base of another. Let

A = The distance, in feet, from the top of the 10 foot pole to the bottom of the 8 foot pole

B = The distance, in feet, from the top of the 8 foot pole to the bottom of the 10 foot pole

C = The distance, in feet, from the top of the 10 foot pole to the top of the 8 foot pole

D = The height above the ground where the two wires cross, in feet

Find $A^2 + B^2 + C^2 + 9D$.

QUESTION 8

Consider a circle O and point A that is outside of O . Let B be on O such that AB intersects O again at C , such that B is closer to A than C , and let D be on O such that AD is tangent to O . If $AD = 9$ and $AC = 24$, let A be the length of AB .

Consider a square with side 6, and a circle such that the two vertices of one of the sides lies on a circle O , which is also tangent to the opposite side. Let B be the radius of this circle.

Consider a circle such that there are two perpendicular chords AB and CD , which intersect at E . If $AE = 3$, $BE = 4$, $CE = 1$, $DE = 12$, let C be the diameter of this circle.

Consider a pentagon $ABCDE$ such that $EA = AD = DB = BC$, $\angle EAD = \angle ADB = 40^\circ$, and $\angle BCD = 20^\circ$. Let D be the measure of $\angle DAB$ in degrees.

Find $A + B + C + D$.

QUESTION 9

Given a frustrum of a cone with upper radius 2, lower radius of 4, and height of 8. Let

A = The area of the upper base

B = The area of the lower base

C = The volume of the frustrum

D = The lateral surface area of the frustrum

Find the value of $A + B + C + D$.

QUESTION 10

Given a tetrahedron of side length 3, let

A = The total surface area of the tetrahedron

B = The length of the altitude of the tetrahedron

C = The volume of the tetrahedron

Find $\frac{12ABC}{27}$.

QUESTION 11

Given an irregular, convex hexagon $ABCDEF$ with $A(-1, 1)$, $B(4, 3)$, $C(6, 1)$, $D(3, -2)$, $E(0, -3)$, $F(-1, -1)$, let

A = The area of triangle ACE

B = The distance between points A and D

C = The area of the hexagon

Find $A + B + C$

QUESTION 12

In triangle ABC , let D be a point on AC such that BD is the angle bisector of $\angle B$. Given that $AB = 4$, $AC = 8$, $BC = 6$, let

A = the length of AD

B = the length of CD

C = the length of BD

D = the area of $\triangle ABC$

Find $10A + 5B + 15C + D\sqrt{60}$.

QUESTION 13

There is a medieval book written that has sheets made of 1-inch thick stone blocks. The length of each sheet is 8 inches and the width of each sheet is 11 inches. There is no cover on the book and the sheet 1 is the top sheet. The books ends at sheet 10. Let

A = the length of the space diagonal of the book when closed

B = the height of the book when closed

C = the volume of the book

D = the space diagonal from the bottom of sheet 10 to the top of sheet 3

Find $A + B + C + D$.

QUESTION 14

Let

$$A = \sin 30^\circ$$

$$B = \sin 60^\circ$$

$$C = \cos 30^\circ$$

$$D = \cos 60^\circ$$

Find $A + B + C + D$.