QUESTION 1

Let:

$$\begin{aligned} A &= \text{At what radius does a circle have the same numerical circumference and area?} \\ B &= \text{At what radius does a sphere have the same numerical surface area and volume?} \\ C &= \text{Find the area of the annulus between two concurrent circles with radii } A \text{ and } B. \\ D &= \text{Find the volume of a rectangular pyramid with base length } A\text{, base width } B\text{, and height } \frac{C}{\pi}. \end{aligned}$$

Find D

QUESTION 2

Given a three-dimensional rectangular prism known to have 6 faces with side lengths of 3, 4, and 5.
Let:

$$A = \text{The volume of the solid}$$
$$B = \text{The height of the largest cone that can fit in the solid}$$
$$C = \text{The largest diagonal in the solid.}$$
$$D = \text{The amount of spheres with radius 2 that can fit inside the solid without overlap}$$

Find $\dfrac{AC}{BD}$

QUESTION 3

Let:

A = The sum of the exterior angles of a 90-gon

B = The sum of the interior angles of a 90-gon

C = The number of diagonals of a 90-gon

D = The length of the inradius to the nearest tenth of a 90-gon that has a side length of 8 given that $\tan 28^\circ$ is approximately 28.63

Find $A + B + C + D$

QUESTION 4

Assign a value of 5 to each true statement and a value of -3 to each false statement.

- Brahmagupta's formula works for all quadrilaterals.
- The angle bisectors of a triangle meet at the circumcenter.
- All rectangles are cyclic.
- A triangle with sides of length 12, 60, and 61 is obtuse.
- Al quadrilaterals are cyclic.
- Three non-colinear points form a plane.
- The area of a triangle can be found by multiplying the lengths of two consecutive sides, the cosine of the angle between them, and $\frac{1}{2}$.

Find the total value of all the statements.

QUESTION 5

Let:

$$A = \text{Find the area of } \frac{(x-3)^2}{25} + \frac{(y+5)^2}{16} = 1$$

$$B = \text{How many lines of symmetry does a square have?}$$

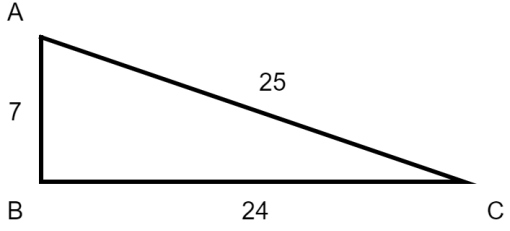
$$C = \text{Find the sum of the exterior angles of a polygon that has an area of } \frac{2\sqrt{3} + \pi^2 - 3\sqrt{10}}{9\pi^2 + \sin(34^\circ)}$$

$$D = \text{Find the ordinate of the intersection point of functions } f(x) = (\log_e(\sin(45^\circ)))\, x^3 \text{ and } g(x) = (\sqrt{\pi})\, x^2 \text{ closest to the origin}$$

Find $ABCD$

QUESTION 6

Natani for some reason, always wants his food in a certain shape, the triangle. Given the following triangle, solve the following. Let:



Find $(A * D)/(B * C)$

$$\begin{aligned} A &= \text{Find the cosine of } \angle A \\ B &= \text{Find the tangent of } \angle C \\ C &= \text{Find the sine of } \angle B \\ D &= \text{The area of the incircle of triangle } ABC \end{aligned}$$

QUESTION 7

Let:

A = The sum of the y-intercept and slope of the linear function going through $(2, -5)$ and $(6, 11)$.
B = The area of the circle going through $(7, 9)$, $(12, 4)$, and $(24, 16)$.
C = If the vertex of the quadratic function going through $(-1, 10)$, $(2, -1)$, and $(3, -6)$ is written in the form (a, b), find a.
D = If the cubic function going through $(-1, 10)$, $(1, 0)$, $(2, 4)$, and $(-3, -36)$ is written in the form $ax^3 + bx^2 + cx + d$, find $a + b + c + d$.

Find $A + C + \dfrac{D}{B}$

QUESTION 8

Consider a trapezoid $ABCD$ with bases AB and CD having side lengths of 8 and 24, respectively. (Also, consider each part separate from each other).
Let:

A = The length of the midsegment of trapezoid $ABCD$

B = Let diagonals AC and BD intersect at point E. If the distance from E to AB is 5, find the area of trapezoid $ABCD$.

C = If there existed a point E on CD such that ABE formed an equilateral triangle, what would be the area of trapezoid $ABCD$?

D = Let the height of trapezoid $ABCD$ be 5 and the length of AD to be 13. If $ABCD$ was rotated 360° about the midpoint of its midsegment such that it created the frustum of a cone, what would be the area of this cone?

Find $A - B + C\sqrt{3} + \dfrac{D}{7\pi}$

QUESTION 9

Vibav, Anish, and Tanmay are known at Rickards High School to be the RHS Circus managers. The RHS Circus is in the shape of a cone with radius 12 feet and height 4 feet on top of a cylinder with the same radius and height 8 feet such that the cylinder and cone share a base.
Let:

A = The volume of the RHS Circus.

B = The clowns that are scheduled to perform today at the RHS Circus are Suhas, Sukeerth, Shravan, Shunmuka, and Haldiya. If two groups of two clowns are to be performing at the same time in the opening act, how many possible combinations are there?

C = What is the area of the largest sphere that can fit in the RHS Circus assuming that there is no divide between the cylinder and cone that comprise the RHS Circus?

D = Consider points B and C to be 4π feet away from each other across the circumference of the unshared base of the cylinder and point A to be on the shared base such that it forms an isosceles triangle with points B and C. If lines AB, BC, and AC are directly created through the cylinder, what is the area of this triangle?

Find

QUESTION 10

Consider three functions, $\left(x+\frac{\sqrt{3}}{2}\right)^2+\left(y-\frac{1}{2}\right)^2=3$, $\left(x-\frac{\sqrt{3}}{2}\right)^2+\left(y-\frac{1}{2}\right)^2=3$, and $x^2+(y+1)^2=3$.

Let:

A = The area of the first function

B = The sum of all the abscissas of the intersection points between the functions

C = The area of the intersection between all three functions

D = The area of the shape formed by drawing lines between all of the intersection points between the functions

Find $A-B+4C+2D$

QUESTION 11

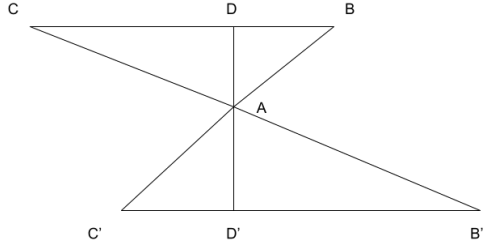
Anish is known worldwide to be the Grand Master in the field of unicirclology, the study of the unit circle. Answer the following questions to earn the rank of Unit Circle Knight in the field of unicirclology!
Let:

$$\begin{aligned} A &= \sin(120^\circ) \\ B &= \cos(240^\circ) \\ C &= \tan(315^\circ) \\ D &= \text{How many radians are there in } 360^\circ? \end{aligned}$$

Find $A + B - \dfrac{C}{2} + D$

QUESTION 12

Let segment BC = 6 and segment B'C' = 8

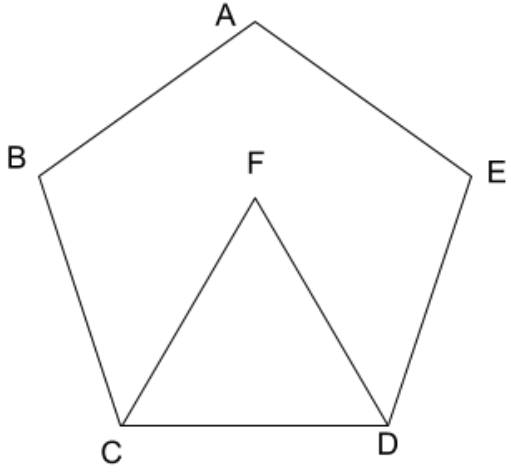


A = If the length of CB' is 21, what is the length of CA?
B = What is the area of $\triangle BCA$ given that DD' has the length of 14
C = What is the area of $\triangle CDA$
D = Find the length of DB'.

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

QUESTION 13

Let ABCDE be a regular polygon with equilateral triangle CDF with side length 4.



A = Find the length of FC

B = Find the angle measure of $\angle AFC$

C = Find the angle measure of $\angle AFE$

D = Find the distance of AF given that the distance from A to CD is approximately 8.

Find $A + B + C + D$

QUESTION 14

Who is the famous mathematician is known as the "father of geometry" or the "founder of geometry"