
Round 1

Division 1

Algebra Question 1

How many distinct positive integer factors does 540 have (including 1)?

Answer: 24

Round 1

Division 1

Algebra Question 2

The sequence $\{a_n\}_{n=0}^{\infty}$ defined by

$$a_0 = 0$$

$$a_1 = \sqrt{12}$$

$$a_2 = \sqrt{12 + \sqrt{12}}$$

$$a_3 = \sqrt{12 + \sqrt{12 + \sqrt{12}}}$$

⋮

⋮

⋮

converges to ?

Answer: 4

Round 2

Division 1

Algebra Question 1

Find the sum of the positive solutions of

$$x\sqrt[3]{x} = \frac{x^x}{x}$$

Answer: 10/3

Round 2

Division 1

Algebra Question 2

Find the largest integer which when divided into 364, 414, and 541, in this order, yields remainders which are consecutive integers.

Answer: 7

Round 3

Division 1

Algebra Question 1

The following system is written in base 4. If (x, y) is the solution, express $x + y$ in base 4.

$$2x + 22y = 220$$

$$12x + 20y = 312$$

Answer: 20

Round 3

Division 1

Algebra Question 2

The sum of a geometric series is $\frac{3}{8}$ and the second term is $\frac{1}{12}$. Find the greatest possible common ratio.

Answer: $\frac{2}{3}$

Round 4

Division 1

Algebra Question 1

Solve for the integer n in this decimal expansion:

$$.1n1n1n1n1n\dots = \frac{n}{33}$$

Answer: 5

Round 4

Division 1

Algebra Question 2

Consider the polynomial

$$P(x) = x^3 + bx^2 + cx + d$$

whose roots are equal to the roots of

$$12x^3 - 4x^2 - 3x + 6$$

multiplied by k . If k is the smallest number which will make b , c , and d integers, then $b + c + d = ?$

Answer: 97

Round 5

Division 1

Algebra Question 1

Find the smallest solution of

$$x^{\log_{10} x^2} = 10000\sqrt{10}.$$

Answer: $\sqrt{10}/100$

Round 5

Division 1

Algebra Question 2

If the system

$$ax - y = p$$

$$x + (a - 3)y = q$$

is solved by more than one pair (x, y) and $\frac{p}{q}$ is defined, then $\frac{p}{q}$ has one of two values. The greater of these minus the lesser is?

Answer: $\sqrt{5}$

Round 1

Division 2

Algebra Question 1

The difference between two consecutive perfect squares is 101. What is the larger of these perfect squares?

Answer: 2601

Round 1

Division 2

Algebra Question 2

How many distinct positive integer factors does 540 have (including 1)?

Answer: 24

Round 2

Division 2

Algebra Question 1

What is the smallest nonzero integer which when multiplied by 420 yields a perfect square?

Answer: 105

Round 2

Division 2

Algebra Question 2

Find the sum of the positive solutions of

$$x\sqrt[3]{x} = \frac{x^x}{x}$$

Answer: 10/3

Round 3

Division 2

Algebra Question 1

Solve for x :

$$\frac{\sqrt{x+1} + \sqrt{x-1}}{\sqrt{x+1} - \sqrt{x-1}} = 3.$$

Answer: 5/3

Round 3

Division 2

Algebra Question 2

The following system is written in base 4. If (x, y) is the solution, express $x + y$ in base 4.

$$\begin{aligned} 2x + 22y &= 220 \\ 12x + 20y &= 312 \end{aligned}$$

Answer: 20

Round 4

Division 2

Algebra Question 1

Let $f(x) = 3x^3 + 2x^2 - x + 1$. If $f(a) = f(-a)$ and $a \neq 0$ then $a^2 = ?$

Answer: 1/3

Round 4

Division 2

Algebra Question 2

Solve for the integer n in this decimal expansion:

$$.1n1n1n1n1n\dots = \frac{n}{33}$$

Answer: 5

Round 5

Division 2

Algebra Question 1

If 3 is a root of $4x^2 - 5x + c = 0$, what is the other root?

Answer: $-7/4$

Round 5

Division 2

Algebra Question 2

Find the smallest solution of

$$x^{\log_{10} x^2} = 10000\sqrt{10}.$$

Answer: $\sqrt{10}/100$

Round 1

Division 3

Algebra Question 1

Solve for x :

$$|x| - x = 3.$$

Answer: $-3/2$

Round 1

Division 3

Algebra Question 2

The difference between two consecutive perfect squares is 101. What is the larger of these perfect squares?

Answer: 2601

Round 2

Division 3

Algebra Question 1

If $\log_b 2 = \frac{4}{3}$ then $b^{12} = ?$

Answer: 512

Round 2

Division 3

Algebra Question 2

What is the smallest nonzero integer which when multiplied by 420 yields a perfect square?

Answer: 105

Round 3

Division 3

Algebra Question 1

Find the sum of the solutions of

$$\left(\frac{2^{m(m-4)}}{2^{m-6}}\right)^2 = 1.$$

Answer: 5

Round 3

Division 3

Algebra Question 2

Solve for x :

$$\frac{\sqrt{x+1} + \sqrt{x-1}}{\sqrt{x+1} - \sqrt{x-1}} = 3.$$

Answer: $5/3$

Round 4

Division 3

Algebra Question 1

If $i^2 = -1$ then

$$|i + i^4 - 2i^5 + 5i^7|^2 = ?$$

Answer: 37

Round 4

Division 3

Algebra Question 2

Let $f(x) = 3x^3 + 2x^2 - x + 1$. If $f(a) = f(-a)$ and $a \neq 0$ then $a^2 = ?$

Answer: $1/3$

Round 5

Division 3

Algebra Question 1

For all x and y for which it is defined,

$$\frac{\frac{x}{y} + \frac{y}{x} - 2}{\frac{1}{y} - \frac{1}{x}} = ax^b + cy^d$$

where $a + b + c + d = ?$

Answer: 2

Round 5

Division 3

Algebra Question 2

If 3 is a root of $4x^2 - 5x + c = 0$, what is the other root?

Answer: $-7/4$

Round 1

Division 1

Geometry Question 1

A frustrum of a hexagonal pyramid has top and bottom faces with areas 16 and 100. The perpendicular distance between the two faces is 36. Find the volume of the frustrum.

Answer: 1872

Round 1

Division 1

Geometry Question 2

Each of two circles has area 2π . The distance between the centers of the two circles is 2. What is the area common to both circles?

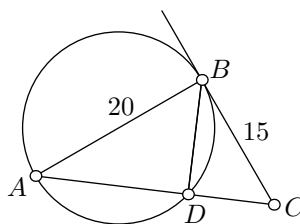
Answer: $\pi - 2$

Round 2

Division 1

Geometry Question 1

In this circle, diameter \overline{AB} measures 20 and tangent \overline{BC} measures 15. What is CD ?



Answer: 9

Round 2

Division 1

Geometry Question 2

A side of a triangle having area 6 contains a point whose distance to each vertex is $\sqrt{10}$. How long is the triangle's shortest side?

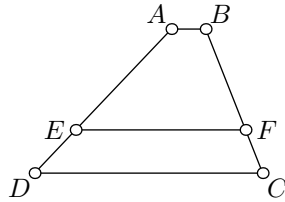
Answer: 2

Round 3

Division 1

Geometry Question 1

Quadrilateral $\square ABCD$ is a trapezoid with $\overline{AB} \parallel \overline{EF} \parallel \overline{CD}$. If $AB = 10$, $DC = 70$, and $\frac{AE}{ED} = 3$, what is EF ?



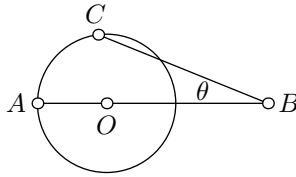
Answer: 55

Round 3

Division 1

Geometry Question 2

The circle has center O and diameter 80; $AB = 120$; $CB = 80$. What is $\cos \theta$?



Answer: $7/8$

Round 4

Division 1

Geometry Question 1

A sector of a circle of radius 4 inches has perimeter 14 inches. Find the area of the sector in square inches.

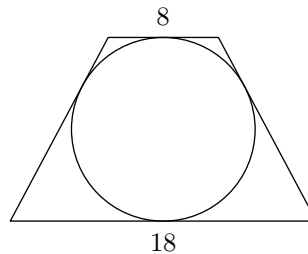
Answer: 12

Round 4

Division 1

Geometry Question 2

Find the radius of the circle inscribed in the isosceles trapezoid which has bases measuring 8 and 18.



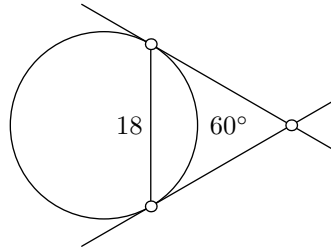
Answer: 6

Round 5

Division 1

Geometry Question 1

Two tangent lines to a circle meet at an angle of 60° . The distance between the points of tangency is 18. What is the area of the circle?



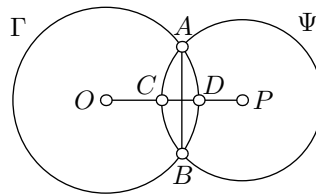
Answer: 108π

Round 5

Division 1

Geometry Question 2

The circle Γ centered at O has radius 52; $AB = 40$; $CD = 12$. Find the radius of the circle Ψ centered at P .



Answer: 29

Round 1

Division 2

Geometry Question 1

The shorter diagonal of a rhombus has the same length as a side and the other diagonal is 6. What is the area of the rhombus?

Answer: $6\sqrt{3}$

Round 1

Division 2

Geometry Question 2

A frustum of a hexagonal pyramid has top and bottom faces with areas 16 and 100. The perpendicular distance between the two faces is 36. Find the volume of the frustum.

Answer: 1872

Round 2

Division 2

Geometry Question 1

In a right triangle, the altitude to the hypotenuse divides the hypotenuse into segments having lengths 4 and 21. What is the shorter leg of the triangle?

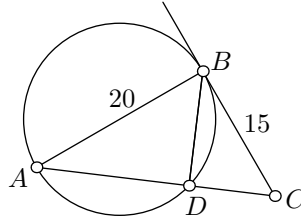
Answer: 10

Round 2

Division 2

Geometry Question 2

In this circle, diameter \overline{AB} measures 20 and tangent \overline{BC} measures 15. What is CD ?



Answer: 9

Round 3

Division 2

Geometry Question 1

Find the area of the region in the xy -plane bounded by the lines $x + y = 12$, $y = x$, and $y = 5x$.

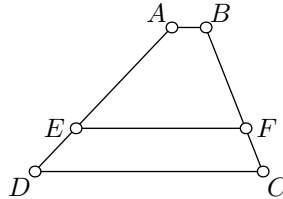
Answer: 24

Round 3

Division 2

Geometry Question 2

Quadrilateral $\square ABCD$ is a trapezoid with $\overline{AB} \parallel \overline{EF} \parallel \overline{CD}$. If $AB = 10$, $DC = 70$, and $\frac{AE}{ED} = 3$, what is EF ?



Answer: 55

Round 4

Division 2

Geometry Question 1

Find the area of a circle circumscribed around an equilateral triangle each of whose sides is 6.

Answer: 12π

Round 4

Division 2

Geometry Question 2

A sector of a circle of radius 4 inches has perimeter 14 inches. Find the area of the sector in square inches.

Answer: 12

Round 5

Division 2

Geometry Question 1

For how many integer values of n is there a triangle whose sides have lengths 5, 6, and $4 + n$?

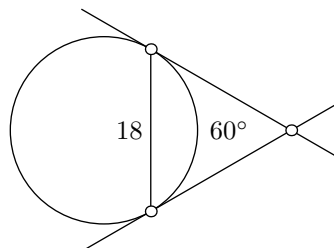
Answer: 9

Round 5

Division 2

Geometry Question 2

Two tangent lines to a circle meet at an angle of 60° . The distance between the points of tangency is 18. What is the area of the circle?



Answer: 108π

Round 1

Division 3

Geometry Question 1

Find the largest number of rectangular solids with edges measuring 2 cm, 5 cm, and 8 cm which can be placed inside a rectangular solid with edges measuring 20 cm, 40 cm, and 60 cm.

Answer: 600

Round 1

Division 3

Geometry Question 2

The shorter diagonal of a rhombus has the same length as a side and the other diagonal is 6. What is the area of the rhombus?

Answer: $6\sqrt{3}$

Round 2

Division 3

Geometry Question 1

Find the volume of the region bounded by two concentric spheres of radii 1 and 3.

Answer: $104\pi/3$

Round 2

Division 3

Geometry Question 2

In a right triangle, the altitude to the hypotenuse divides the hypotenuse into segments having lengths 4 and 21. What is the shorter leg of the triangle?

Answer: 10

Round 3

Division 3

Geometry Question 1

In a circle, a sector having an arc of 10 degrees has an area of 25π . What is the radius of the circle?

Answer: 30

Round 3

Division 3

Geometry Question 2

Find the area of the region in the xy -plane bounded by the lines $x + y = 12$, $y = x$, and $y = 5x$.

Answer: 24

Round 4

Division 3

Geometry Question 1

In the xy -plane, the point $(6, -10)$ is the midpoint of a line segment connecting the point $(-3, 5)$ with the point B . What is the sum of the coordinates of B ?

Answer: -10

Round 4

Division 3

Geometry Question 2

Find the area of a circle circumscribed around an equilateral triangle each of whose sides is 6.

Answer: 12π

Round 5

Division 3

Geometry Question 1

A rectangular solid has a surface area of 82. Two of its edges are 2 and 3. What is an edge perpendicular to these two edges?

Answer: 7

Round 5

Division 3

Geometry Question 2

For how many integer values of n is there a triangle whose sides have lengths 5, 6, and $4 + n$?

Answer: 9

Round 1

Division 1

Comprehensive A

Question 1

Evaluate $\cos(2 \arctan 4)$.

Answer: $-15/17$

Round 1

Division 1

Comprehensive A

Question 2

Find the product of the solutions of

$$x^2 - 2x + c = 0$$

given that the sum of the squares of the solutions is 9.

Answer: $-5/2$

Round 1

Division 1

Comprehensive B

Question 1

If $\cos x = 3 \sin x$, what is $\sin x \cos x$?

Answer: $3/10$

Round 1

Division 1

Comprehensive B

Question 2

Given that i is an imaginary solution of

$$x^3 - 2ix^2 + (i - 2)x + i + 1 = 0$$

express the other non-real solution in the form $a + bi$.

Answer: $-1 + i$

Round 2

Division 1

Comprehensive A

Question 1

After a 1 inch thick slice is cut from one side of a cube, the volume of the remaining figure is 100 cubic inches. Find the edge length of the cube in inches.

Answer: 5

Round 4

Division 1

Comprehensive A

Question 1

How many integers are there between 100 and 1000 in which no digit is repeated?

Answer: 648

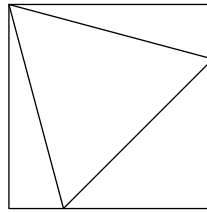
Round 4

Division 1

Comprehensive A

Question 2

Equilateral triangle ABC is inscribed in a square of side length 1. The sum of a side of the triangle and a diagonal of the square is ?



Answer: $\sqrt{6}$

Round 4

Division 1

Comprehensive B

Question 1

Find the largest value k for which this system of equations is consistent:

$$x + 2y - k = 0$$

$$y - 3x - 2 = 0$$

$$x - ky + 12 = 0$$

Answer: 5

Round 4

Division 1

Comprehensive B

Question 2

In a right triangle, the medians from the acute angles to the legs measure $2\sqrt{2}$ and $\sqrt{17}$. What is the square of the hypotenuse?

Answer: 20

Round 5

Division 1

Comprehensive A

Question 1

What radius yields the maximum area for a sector of a circle with perimeter 12?

Answer: 3

Round 5

Division 1

Comprehensive A

Question 2

If r_1 , r_2 , and r_3 are the roots of

$$x^3 - 2x^2 - 6x + 5 = 0$$

then

$$\frac{1}{r_1 r_2} + \frac{1}{r_2 r_3} + \frac{1}{r_3 r_1} = ?$$

Answer: $-2/5$

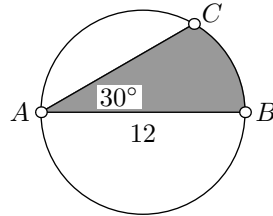
Round 5

Division 1

Comprehensive B

Question 1

The diameter AB of the circle is 12, and the measure of angle $\angle CAB$ is 30° . Find the shaded area.



Answer: $6\pi + 9\sqrt{3}$ or $3(2\pi + 3\sqrt{3})$

Round 5

Division 1

Comprehensive B

Question 2

Jar A contains 11 pennies and 1 nickel. Jar B contains 12 pennies. At random: 8 coins are moved from Jar A to Jar B, then 8 coins are moved from Jar B to Jar A. The probability that the nickel is now in Jar A is $p\%$ where $p = ?$

Answer: 60

Round 1

Division 2

Comprehensive A

Question 1

If the x^3 term in the binomial expansion of $(1 + ax)^5$ is $-80x^3$, what is the number a ?

Answer: -2

Round 1

Division 2

Comprehensive A

Question 2

Evaluate $\cos(2 \arctan 4)$.

Answer: $-15/17$

Round 1

Division 2

Comprehensive B

Question 1

A cube has a diagonal of 6. What is its volume?

Answer: $24\sqrt{3}$

Round 1

Division 2

Comprehensive B

Question 2

If $\cos x = 3 \sin x$, what is $\sin x \cos x$?

Answer: $3/10$

Round 2

Division 2

Comprehensive A

Question 1

The probability that a man will be alive 25 years from now is $3/7$ and the probability that his wife will be alive 25 years from now is $4/5$. What is the probability that both will die during the next 25 years?

Answer: $4/35$

Round 2

Division 2

Comprehensive A

Question 2

After a 1 inch thick slice is cut from one side of a cube, the volume of the remaining figure is 100 cubic inches. Find the edge length of the cube in inches.

Answer: 5

Round 4

Division 2

Comprehensive A

Question 2

How many integers are there between 100 and 1000 in which no digit is repeated?

Answer: 648

Round 4

Division 2

Comprehensive B

Question 1

Given a triangle T with an altitude of 10. Find the largest value of x such that a line parallel to and x units above the corresponding base divides the triangle into two regions, the ratio of whose areas is 1:3.

Answer: 5

Round 4

Division 2

Comprehensive B

Question 2

Find the largest value k for which this system of equations is consistent:

$$x + 2y - k = 0$$

$$y - 3x - 2 = 0$$

$$x - ky + 12 = 0$$

Answer: 5

Round 5

Division 2

Comprehensive A

Question 1

Evaluate:

$$27^{1/6} \cdot \sqrt{12}$$

Answer: 6

Round 5

Division 2

Comprehensive A

Question 2

What radius yields the maximum area for a sector of a circle with perimeter 12?

Answer: 3

Round 5

Division 2

Comprehensive B

Question 1

If

$$2^x 4^y = 1$$

$$4^x 2^y = \frac{1}{2}$$

then

$$x + y = ?$$

Answer: $-1/3$

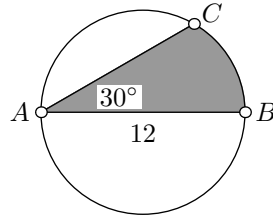
Round 5

Division 2

Comprehensive B

Question 2

The diameter AB of the circle is 12, and the measure of angle $\angle CAB$ is 30° . Find the shaded area.



Answer: $6\pi + 9\sqrt{3}$ or $3(2\pi + 3\sqrt{3})$

Round 1

Division 3

Comprehensive A

Question 1

A square has a perimeter of 20. What is one of its diagonals?

Answer: $5\sqrt{2}$

Round 1

Division 3

Comprehensive A

Question 2

If the x^3 term in the binomial expansion of $(1 + ax)^5$ is $-80x^3$, what is the number a ?

Answer: -2

Round 1

Division 3

Comprehensive B

Question 1

Evaluate the following integer:

$$\frac{1.8 \times 10^{-74}}{(3 \times 10^{-40})^2}$$

Answer: 200000

Round 1

Division 3

Comprehensive B

Question 2

A cube has a diagonal of 6. What is its volume?

Answer: $24\sqrt{3}$

Round 2

Division 3

Comprehensive A

Question 1

Evaluate

$$\log_8 4 - \log_8 6 + \log_8 3$$

Answer: $1/3$

Round 2

Division 3

Comprehensive A

Question 2

The probability that a man will be alive 25 years from now is $3/7$ and the probability that his wife will be alive 25 years from now is $4/5$. What is the probability that both will die during the next 25 years?

Answer: $4/35$

Round 2

Division 3

Comprehensive B

Question 1

In how many ways can a committee of 3 be chosen from a group of 10 people?

Answer: 120

Round 2

Division 3

Comprehensive B

Question 2

If x and y are positive number such that

$$\begin{aligned}\log_{10}(xy) &= 3 \\ \log_{10}\left(\frac{x}{y}\right) &= 1\end{aligned}$$

then $x + y = ?$

Answer: 110

Round 3

Division 3

Comprehensive A

Question 1

An angle of 105° measures how many radians?

Answer: $7\pi/12$

Round 3

Division 3

Comprehensive A

Question 2

I can carry all but 2 of my books in my briefcase. There are 10 ways in which I can choose which books I carry. How many books do I have?

Answer: 5

Round 3

Division 3

Comprehensive B

Question 1

For what value of c does the equation

$$4x^2 - 12x + c = 0$$

have only one solution?

Answer: 9

Round 3

Division 3

Comprehensive B

Question 2

In a regular hexagon with sides measuring 1, the shortest diagonals each measure ?

Answer: $\sqrt{3}$

Round 4

Division 3

Comprehensive A

Question 1

If $a/b = 2$, what is

$$\frac{4ab}{16a^2 + b^2}?$$

Answer: $8/65$

Round 4

Division 3

Comprehensive A

Question 2

If a right triangle has a hypotenuse of 41 and an area of 180, what is its shortest leg?

Answer: 9

Round 4

Division 3

Comprehensive B

Question 1

The number of students who take both math and chemistry is 30. This represents 10% of the math enrollment and 12% of the chemistry enrollment. How many students take at least one of these two courses?

Answer: 520

Round 4

Division 3

Comprehensive B

Question 2

Given a triangle T with an altitude of 10. Find the largest value of x such that a line parallel to and x units above the corresponding base divides the triangle into two regions, the ratio of whose areas is 1:3.

Answer: 5

Round 5

Division 3

Comprehensive A

Question 1

A man travels 5 miles north, 2 miles east, 1 mile north, and 10 miles west. How many miles is he from his starting position?

Answer: 10

Round 5

Division 3

Comprehensive A

Question 2

Evaluate:

$$27^{1/6} \cdot \sqrt{12}$$

Answer: 6

Round 5

Division 3

Comprehensive B

Question 1

A school offers 5 different language classes, 4 different science classes, and 3 different math classes. How many ways are there to choose 2 classes, not both in the same subject?

Answer: 47

Round 5

Division 3

Comprehensive B

Question 2

If

$$2^x 4^y = 1$$

$$4^x 2^y = \frac{1}{2}$$

then

$$x + y = ?$$

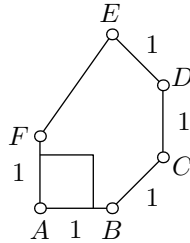
Answer: $-1/3$

Round 1

Division 1

Team Question 1

In this polygon, angle A is a right angle, and angles B , C , and D each measure 135° . Find EF .



Answer: $\sqrt{3}$

Round 1

Division 1

Team Question 2

Find the smallest positive integer having 10 distinct positive integer factors (including 1).

Answer: 48

Round 2

Division 1

Team Question 1

If

$$\begin{aligned}x^2 + y^2 + x + y &= 36 \\xy + x + y &= -13\end{aligned}$$

what is the greatest possible value of xy ?

Answer: -8

Round 2

Division 1

Team Question 2

If $\log_a N = 1/8$ and $\log_b N = 5/3$, what is $\log_{ab} N$?

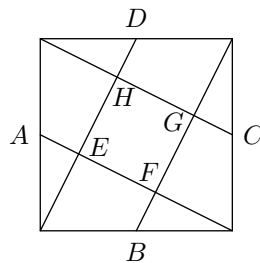
Answer: $5/43$

Round 3

Division 1

Team Question 1

If the square has area 100 and A , B , C , and D are the midpoints of the sides, what is the area of quadrilateral $EFGH$?



Answer: 20

Round 3

Division 1

Team Question 2

If $i = \sqrt{-1}$, how many solutions of

$$\bar{z} = -i z^9$$

have positive real and imaginary parts?

Answer: 3

Round 4

Division 1

Team Question 1

A, B, and C race a distance d yards at uniform speeds. A beats B by 10 yards, B beats C by 12 yards, and A beats C by 18 yards. What is d ?

Answer: 30

Round 4

Division 1

Team Question 2

Let S be the set of all points in the xy -plane whose distance d_1 to $(0,0)$ and distance d_2 to $(1,0)$ satisfy

$$\frac{d_1}{d_2} = 4.$$

What is the maximum possible distance between two points in S ?

Answer: $8/15$

Round 5

Division 1

Team Question 1

In the x - y plane, the graph of the relation

$$x^2 - 2y^2 - xy - x - y = 0$$

has the shape of an "X"; the two lines meet at (a,b) where $a^2 + b^2 = ?$

Answer: $2/9$

Round 5

Division 1

Team Question 2

What is the maximum number of regions into which the plane can be divided by 20 lines?

Answer: 211

Round 1

Division 2

Team Question 1

Find the product of the solutions of

$$x^2 - 2x + c = 0$$

given that the sum of the squares of the solutions is 9.

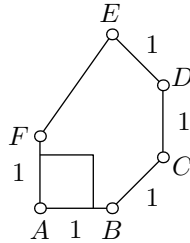
Answer: $-5/2$

Round 1

Division 2

Team Question 2

In this polygon, angle A is a right angle, and angles B , C , and D each measure 135° . Find EF .



Answer: $\sqrt{3}$

Round 2

Division 2

Team Question 1

A side of a triangle having area 6 contains a point whose distance to each vertex is $\sqrt{10}$. How long is the triangle's shortest side?

Answer: 2

Round 2

Division 2

Team Question 2

If

$$\begin{aligned}x^2 + y^2 + x + y &= 36 \\xy + x + y &= -13\end{aligned}$$

what is the greatest possible value of xy ?

Answer: -8

Round 3

Division 2

Team Question 1

Given that $3 + 2\sqrt{5}$ solves

$$7x^3 - 43x^2 - 71x + 11 = 0$$

find a rational solution of this equation.

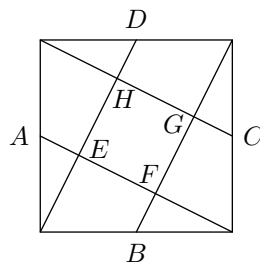
Answer: $1/7$

Round 3

Division 2

Team Question 2

If the square has area 100 and A , B , C , and D are the midpoints of the sides, what is the area of quadrilateral $EFGH$?



Answer: 20

Round 4

Division 2

Team Question 1

In a right triangle, the medians from the acute angles to the legs measure $2\sqrt{2}$ and $\sqrt{17}$. What is the square of the hypotenuse?

Answer: 20

Round 4

Division 2

Team Question 2

A, B, and C race a distance d yards at uniform speeds. A beats B by 10 yards, B beats C by 12 yards, and A beats C by 18 yards. What is d ?

Answer: 30

Round 5

Division 2

Team Question 1

Jar A contains 11 pennies and 1 nickel. Jar B contains 12 pennies. At random: 8 coins are moved from Jar A to Jar B, then 8 coins are moved from Jar B to Jar A. The probability that the nickel is now in Jar A is $p\%$ where $p = ?$

Answer: 60

Round 5

Division 2

Team Question 2

In the x - y plane, the graph of the relation

$$x^2 - 2y^2 - xy - x - y = 0$$

has the shape of an "X"; the two lines meet at (a, b) where $a^2 + b^2 = ?$

Answer: $2/9$

Round 1

Division 3

Team Question 1

Evaluate $\cos(2 \arctan 4)$.

Answer: $-15/17$

Round 1

Division 3

Team Question 2

Find the product of the solutions of

$$x^2 - 2x + c = 0$$

given that the sum of the squares of the solutions is 9.

Answer: $-5/2$

Round 2

Division 3

Team Question 1

Find the sum of the positive solutions of

$$x\sqrt[3]{x} = \frac{x^x}{x}$$

Answer: $10/3$

Round 2

Division 3

Team Question 2

A side of a triangle having area 6 contains a point whose distance to each vertex is $\sqrt{10}$. How long is the triangle's shortest side?

Answer: 2

Round 3

Division 3

Team Question 1

A ball rests in a round hole of radius 10 cm in a flat table and protrudes upward from the table a vertical distance of 50 cm. Find the radius of the ball in cm.

Answer: 26

Round 3

Division 3

Team Question 2

Given that $3 + 2\sqrt{5}$ solves

$$7x^3 - 43x^2 - 71x + 11 = 0$$

find a rational solution of this equation.

Answer: $1/7$

Round 4

Division 3

Team Question 1

Find the largest value k for which this system of equations is consistent:

$$x + 2y - k = 0$$

$$y - 3x - 2 = 0$$

$$x - ky + 12 = 0$$

Answer: 5

Round 4

Division 3

Team Question 2

In a right triangle, the medians from the acute angles to the legs measure $2\sqrt{2}$ and $\sqrt{17}$. What is the square of the hypotenuse?

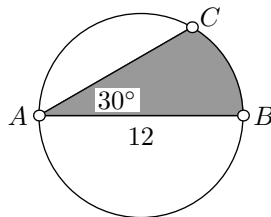
Answer: 20

Round 5

Division 3

Team Question 1

The diameter AB of the circle is 12, and the measure of angle $\angle CAB$ is 30° . Find the shaded area.



Answer: $6\pi + 9\sqrt{3}$ or $3(2\pi + 3\sqrt{3})$

Round 5

Division 3

Team Question 2

Jar A contains 11 pennies and 1 nickel. Jar B contains 12 pennies. At random: 8 coins are moved from Jar A to Jar B, then 8 coins are moved from Jar B to Jar A. The probability that the nickel is now in Jar A is $p\%$ where $p = ?$

Answer: 60