

Alabama State-Wide Mathematics Contest 2001 Ciphering Problems

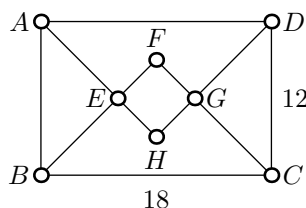
Round 1 Division 1 Geometry Question 1

A right circular cone has height 8 cm and volume 144 cm^3 . What is the area of its base in cm^2 ?

Answer: 54

Round 1 Division 1 Geometry Question 2

Given that the quadrilateral $\square ABCD$ is a rectangle and the quadrilateral $\square EFGH$ is a square, find the area of the quadrilateral $\square EFGH$.



Answer: 18

Round 1 Division 1 Algebra Question 1

Solve for x : $1 - \frac{1}{1 - \frac{1}{x}} = 6$

Answer: $5/6$

Round 1 Division 1 Algebra Question 2

Evaluate the sum: $2001^2 - 2000^2 + 1999^2 - 1998^2 + \dots + 3^2 - 2^2 + 1^2$

Answer: 2003001

Round 1 Division 1 Comprehensive A Question 1

How many three-digit numbers can be made using no zero digits such that in each number no two digits are the same?

Answer: 504

Round 1 Division 1 Comprehensive A Question 2

If $r_1, r_2,$ and r_3 are the roots of $x^3 + 2x^2 - 3x - 1 = 0$ then what is $(r_1 + r_2)(r_2 + r_3)(r_3 + r_1)$?

Answer: 5

Round 1 Division 1 Comprehensive B Question 1

If $\left(x + \frac{1}{x}\right)^7$ is fully expanded and like terms combined, what is the coefficient of x ?

Answer: 35

Round 1 Division 1 Comprehensive B Question 2

Find the radius of the circle inscribed in a triangle whose sides measure 8, 10, and 12.

Answer: $\sqrt{7}$

Round 1	Division 1	Team	Question 1
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How many four digit numbers $abcd$ exist such that a is odd, b is divisible by 3, c is even, and d is prime?

Answer: 400

Round 1	Division 1	Team	Question 2
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A trapezoid has parallel bases of lengths 5 and 30 and non-parallel sides of length 10 and 25. Find the height of the trapezoid.

Answer: $4\sqrt{6}$

Round 2	Division 1	Geometry	Question 1
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In $\triangle ABC$, let D be the midpoint of side \overline{AB} and E the midpoint of side \overline{AC} . What is

$$\frac{\text{area}(\square DBCE)}{\text{area}(\triangle ABC)} ?$$

Answer: $3/4$

Round 2	Division 1	Geometry	Question 2
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In the xy -plane, a circle has center $(2, -3)$ and a tangent line with equation $3x - 4y = -7$. Find the radius of the circle.

Answer: 5

Round 2	Division 1	Algebra	Question 1
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If Little Joe were to sell $\frac{1}{3}$ of his farm he would still have 3 acres more than half of his farm left. How many acres are in his farm?

Answer: 18

Round 2	Division 1	Algebra	Question 2
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Find the sum of the digits of $(999,999)^2$

Answer: 54

Round 2	Division 1	Comprehensive A	Question 1
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If 4% of a uniform seed mixture is replaced by clover seed, the result is a mixture that is 10% clover seed. The original mixture was $p\%$ clover seed where $p = ?$

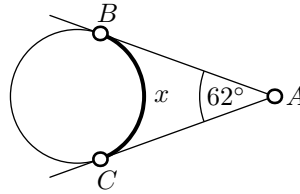
Answer: $25/4$

Round 2	Division 1	Comprehensive A	Question 2
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Find the area of a regular octagon inscribed in a circle of area 8π .

Answer: $16\sqrt{2}$

Lines \overleftrightarrow{AB} and \overleftrightarrow{AC} are tangent to the circle at points B and C . What is the degree measure of arc x (bounded by B and C)?



Answer: 118°

The sum of 28 consecutive odd integers is 2744. Find the smallest of these integers.

Answer: 71

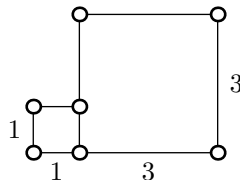
What is the units digit of the integer 8^{2001} ?

Answer: 8

Let the sequence $\{a_n\}_{n=1}^{\infty}$ be defined by $a_1 = 4$
 $a_{n+1} = a_n + 4n$. Find a_{1000} .

Answer: 1998004

What is the distance between the centers of the two squares?



Answer: $\sqrt{5}$

In a regular 9-gon $ABCDEFGHI$, what is the degree measure of angle $\angle ADF$?

Answer: 80°

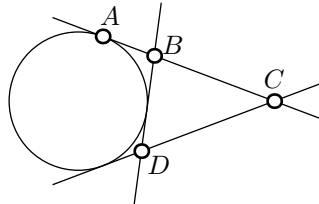
$$(50^{\log_{10} 2} - 5^{\log_{10} 2})^{\log_2 100} = ?$$

Answer: 25

Five boys and five girls are randomly placed in a row. What is the probability that the child standing on each end of the row is a boy?

Answer: $2/9$

All 3 lines are tangent to the circle and $|AC| = 13$. What is the perimeter of triangle $\triangle BCD$?



Answer: 26

If $\frac{1}{(1+x)(1+x^2)(1+x^4)}$ is written as a power series $a_0 + a_1x + a_2x^2 + a_3x^3 + \dots$ the first nonzero term is $a_0 = 1$ and the 12th nonzero term is a_nx^n where $n = ?$

Answer: 41

If the solutions of $x^2 - 2(a+b)x + 4ab = 0$ are $x = 8$ and $x = 10$, then $a^2 + b^2 = ?$

Answer: 41

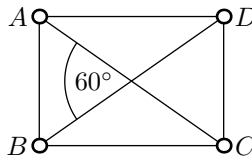
Find the length of one edge of a regular tetrahedron which is inscribed in a sphere of radius 3.

Answer: $2\sqrt{6}$

Given $x^4 - 8x^3 + 21x^2 - 26x + 8 = (x^2 + ax + 4)(x^2 + bx + 2)$. What is the value of ab ?

Answer: 15

The rectangle has area 9. Find $|BC|^2$



Answer: $9\sqrt{3}$

Round 4

Division 1

Geometry

Question 1

The number of square cm in the surface area of a sphere is the same as the number of cubic cm which it encloses. What is the radius of the sphere in cm?

Answer: 3

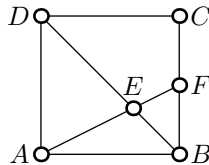
Round 4

Division 1

Geometry

Question 2

In square $\square ABCD$, F is the midpoint of \overline{BC} and the area of quadrilateral $\square CDEF$ is 45. What is the area of triangle $\triangle BEF$?



Answer: 9

Round 4

Division 1

Algebra

Question 1

If $\frac{3}{x} + \frac{2}{y} = 2$ and $\frac{5}{x} - \frac{3}{y} = \frac{1}{6}$, then $x + y = ?$

Answer: 5

Round 4

Division 1

Algebra

Question 2

Find the sum of the real solutions of $3x^{3/4} - 2x^{1/2} - x = 0$.

Answer: 17

Round 4

Division 1

Comprehensive A

Question 1

In the xy -plane, a circle passes through the points $(-2, 3)$ and $(1, 5)$. Its tangent line at $(1, 5)$ has slope -1 . Its center is at (a, b) where $a + b = ?$

Answer: $17/5$

Round 4

Division 1

Comprehensive A

Question 2

How many different sets of 10 towels can be selected from a collection consisting of 10 blue towels which are identical and 10 red towels each of which has different embroidery?

Answer: 1024

Round 4

Division 1

Comprehensive B

Question 1

Find the radius of a circle inscribed in an isosceles triangle whose legs each measure 10 and whose base measures 12.

Answer: 3

Round 4

Division 1

Comprehensive B

Question 2

If two different integers i and j between 1 and 100 inclusive are chosen at random, what is the probability that $|i - j| = 45$?

Answer: $1/90$

Round 4	Division 1	Team	Question 1
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If the parabola $y = ax^2 + bx + c$ has vertex $(6, 8)$ and $(4, 0)$ is on the parabola, then $a + b + c = ?$

Answer: -42

Round 4	Division 1	Team	Question 2
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Find the sum of the solutions of $2x^3 + x^2 + cx - 3 = 0$ if one solution is the negative of another.

Answer: $-1/2$

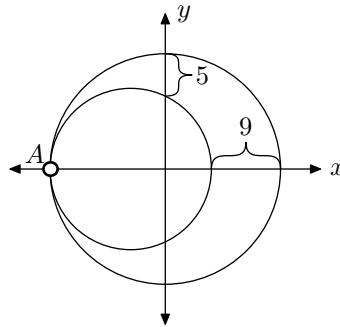
Round 5	Division 1	Geometry	Question 1
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The altitude to the hypotenuse of a “30°-60°-90°” right triangle measures $\sqrt{3}$. What is the area of the triangle?

Answer: $2\sqrt{3}$

Round 5	Division 1	Geometry	Question 2
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The larger circle is centered at the origin. The smaller circle is tangent to the larger circle at point A . What is the diameter of the smaller circle?



Answer: 41

Round 5	Division 1	Algebra	Question 1
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Evaluate: $\log_8 16$

Answer: $4/3$

Round 5	Division 1	Algebra	Question 2
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Let $i = \sqrt{-1}$. If $z + |z| = 4 + 8i$, find $|z|^2$

Answer: 100

Round 5	Division 1	Comprehensive A	Question 1
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If the radius of a disc is decreased by 10%, the area of the disc is decreased by $p\%$ where $p = ?$

Answer: 19

Round 5	Division 1	Comprehensive A	Question 2
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When polynomial $p(x)$ is divided by $x - 2$, the remainder is 5. When $p(x)$ is divided by $x - 3$, the remainder is 11. When $p(x)$ is divided by $(x - 3)(x - 2)$, the remainder $r(x)$ satisfies $r(6) = ?$

Answer: 29

Round 5	Division 1	Comprehensive B	Question 1
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For what value of c is the graph of $y = 6x$ tangent to the graph of $y = x^2 + c$?

Answer: 9

Round 5	Division 1	Comprehensive B	Question 2
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How many ordered pairs of positive integers (a, b) satisfy $a^2 - b^2 = 512$?

Answer: 4

Round 5	Division 1	Team	Question 1
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Find the value of k such that the lines with equations $x - y = -2$, $3x - y = 2$, and $kx - 3y = -4$ all pass through the same point.

Answer: 4

Round 5	Division 1	Team	Question 2
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If $40^a = 2$ and $40^b = 4$, then $10^{(1-a-b)/(2(1-b))} = ?$

Answer: $\sqrt{5}$

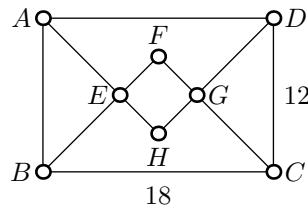
Round 1	Division 2	Geometry	Question 1
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A right circular cone has height 8 cm and volume 144 cm^3 . What is the area of its base in cm^2 ?

Answer: 54

Round 1	Division 2	Geometry	Question 2
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Given that the quadrilateral $\square ABCD$ is a rectangle and the quadrilateral $\square EFGH$ is a square, find the area of the quadrilateral $\square EFGH$.



Answer: 18

Round 1	Division 2	Algebra	Question 1
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Solve for x : $1 - \frac{1}{1 - \frac{1}{x}} = 6$

Answer: $5/6$

Round 1	Division 2	Algebra	Question 2
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A ladder is leaning against a vertical wall so that the top of the ladder is 7 feet above the ground. If the ladder's bottom is moved 1 foot away from the wall, its top will rest against the bottom of the wall. How long is the ladder in feet?

Answer: 25

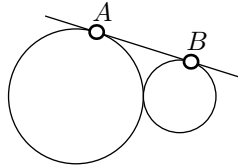
Round 1	Division 2	Comprehensive A	Question 1
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How many three-digit numbers can be made using no zero digits such that in each number no two digits are the same?

Answer: 504

Round 1	Division 2	Comprehensive A	Question 2
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Two tangent circles have radii 9 and 25 and the line is tangent to each circle at A and B . What is $|AB|$?



Answer: 30

Round 1	Division 2	Comprehensive B	Question 1
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If $\left(x + \frac{1}{x}\right)^7$ is fully expanded and like terms combined, what is the coefficient of x ?

Answer: 35

Round 1	Division 2	Comprehensive B	Question 2
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Find a 3 digit number which is 11 times the sum of its digits.

Answer: 198

Round 1	Division 2	Team	Question 1
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How many four digit numbers $abcd$ exist such that a is odd, b is divisible by 3, c is even, and d is prime?

Answer: 400

Round 1	Division 2	Team	Question 2
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A trapezoid has parallel bases of lengths 5 and 30 and non-parallel sides of length 10 and 25. Find the height of the trapezoid.

Answer: $4\sqrt{6}$

Round 2	Division 2	Geometry	Question 1
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In $\triangle ABC$, let D be the midpoint of side \overline{AB} and E the midpoint of side \overline{AC} . What is

$$\frac{\text{area}(\square DBCE)}{\text{area}(\triangle ABC)} ?$$

Answer: $3/4$

Round 2	Division 2	Geometry	Question 2
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In the xy -plane, a circle has center $(2, -3)$ and a tangent line with equation $3x - 4y = -7$. Find the radius of the circle.

Answer: 5

Round 2

Division 2

Algebra

Question 1

If Little Joe were to sell $\frac{1}{3}$ of his farm he would still have 3 acres more than half of his farm left. How many acres are in his farm?

Answer: 18

Round 2

Division 2

Algebra

Question 2

Find a real number x such that $9^x - 9^{x-1} = 24$.

Answer: $3/2$

Round 2

Division 2

Comprehensive A

Question 1

If 4% of a uniform seed mixture is replaced by clover seed, the result is a mixture that is 10% clover seed. The original mixture was $p\%$ clover seed where $p = ?$

Answer: $25/4$

Round 2

Division 2

Comprehensive A

Question 2

Find the largest integer n so that 8^n divides 44^{44} .

Answer: 29

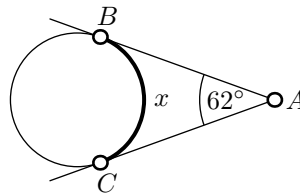
Round 2

Division 2

Comprehensive B

Question 1

Lines \overleftrightarrow{AB} and \overleftrightarrow{AC} are tangent to the circle at points B and C . What is the degree measure of arc x (bounded by B and C)?



Answer: 118°

Round 2

Division 2

Comprehensive B

Question 2

The sum of 28 consecutive odd integers is 2744. Find the smallest of these integers.

Answer: 71

Round 2

Division 2

Team

Question 1

What is the units digit of the integer 8^{2001} ?

Answer: 8

Round 2

Division 2

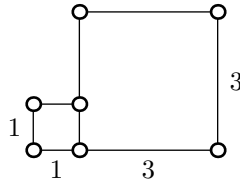
Team

Question 2

Find the area of a regular octagon inscribed in a circle of area 8π .

Answer: $16\sqrt{2}$

What is the distance between the centers of the two squares?



Answer: $\sqrt{5}$

In an isosceles triangle $\triangle ABC$, $|AB| = |AC| = 20$ and $m(\angle CAB) \geq 60^\circ$. If $|BC|$ is an integer, what is the greatest possible perimeter of the triangle?

Answer: 79

$$(50^{\log_{10} 2} - 5^{\log_{10} 2})^{\log_2 100} = ?$$

Answer: 25

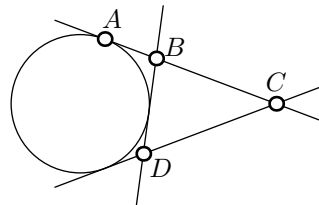
Five boys and five girls are randomly placed in a row. What is the probability that the child standing on each end of the row is a boy?

Answer: $2/9$

$$\log_2 \left(\frac{4}{3} \right) + \log_2 (24) = ?$$

Answer: 5

All 3 lines are tangent to the circle and $|AC| = 13$. What is the perimeter of triangle $\triangle BCD$?



Answer: 26

If the solutions of $x^2 - 2(a+b)x + 4ab = 0$ are $x = 8$ and $x = 10$, then $a^2 + b^2 = ?$

Answer: 41

Round 3

Division 2

Comprehensive B

Question 2

In a triangle with sides measuring 5, 5, and 6, what is the measure of the longest altitude?

Answer: $24/5$

Round 3

Division 2

Team

Question 1

Given $x^4 - 8x^3 + 21x^2 - 26x + 8 = (x^2 + ax + 4)(x^2 + bx + 2)$. What is the value of ab ?

Answer: 15

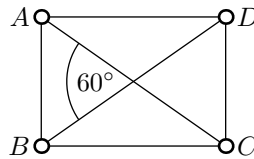
Round 3

Division 2

Team

Question 2

The rectangle has area 9. Find $|BC|^2$



Answer: $9\sqrt{3}$

Round 4

Division 2

Geometry

Question 1

The number of square cm in the surface area of a sphere is the same as the number of cubic cm which it encloses. What is the radius of the sphere in cm?

Answer: 3

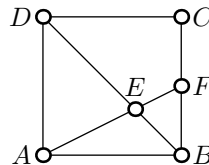
Round 4

Division 2

Geometry

Question 2

In square $\square ABCD$, F is the midpoint of \overline{BC} and the area of quadrilateral $\square CDEF$ is 45. What is the area of triangle $\triangle BEF$?



Answer: 9

Round 4

Division 2

Algebra

Question 1

If $\frac{3}{x} + \frac{2}{y} = 2$ and $\frac{5}{x} - \frac{3}{y} = \frac{1}{6}$, then $x + y = ?$

Answer: 5

Round 4

Division 2

Algebra

Question 2

Find the sum of the real solutions of $3x^{3/4} - 2x^{1/2} - x = 0$.

Answer: 17

Round 4

Division 2

Comprehensive A

Question 1

Let θ be the largest angle in a triangle whose sides measure 4, 5, and 6. Then $\cos \theta = ?$

Answer: $1/8$

Round 4

Division 2

Comprehensive A

Question 2

In the xy -plane, a circle passes through the points $(-2, 3)$ and $(1, 5)$. Its tangent line at $(1, 5)$ has slope -1 . Its center is at (a, b) where $a + b = ?$

Answer: $17/5$

Round 4

Division 2

Comprehensive B

Question 1

Find the radius of a circle inscribed in an isosceles triangle whose legs each measure 10 and whose base measures 12.

Answer: 3

Round 4

Division 2

Comprehensive B

Question 2

If two different integers i and j between 1 and 100 inclusive are chosen at random, what is the probability that $|i - j| = 45$?

Answer: $1/90$

Round 4

Division 2

Team

Question 1

If the parabola $y = ax^2 + bx + c$ has vertex $(6, 8)$ and $(4, 0)$ is on the parabola, then $a + b + c = ?$

Answer: -42

Round 4

Division 2

Team

Question 2

Find the sum of the solutions of $2x^3 + x^2 + cx - 3 = 0$ if one solution is the negative of another.

Answer: $-1/2$

Round 5

Division 2

Geometry

Question 1

The altitude to the hypotenuse of a "30°-60°-90°" right triangle measures $\sqrt{3}$. What is the area of the triangle?

Answer: $2\sqrt{3}$

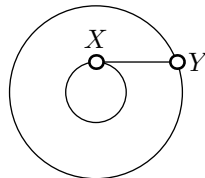
Round 5

Division 2

Geometry

Question 2

Line segment \overline{XY} is tangent to the smaller of the concentric circles at X and measures 1 cm. What is the area of the annulus in square cm?



Answer: π

Round 5

Division 2

Algebra

Question 1

If $f(x) = 3x - 7$, solve $f(2x) = 4f(x)$.

Answer: $7/2$

Round 5	Division 2	Algebra	Question 2
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Solve: $\log_2(\log_3(\log_2 x)) = 1$

Answer: 512

Round 5	Division 2	Comprehensive A	Question 1
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If the radius of a disc is decreased by 10%, the area of the disc is decreased by $p\%$ where $p = ?$

Answer: 19

Round 5	Division 2	Comprehensive A	Question 2
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If $\sum_{n=2}^{\infty} r^n = 1$, then $2r + 1 = ?$

Answer: $\sqrt{5}$

Round 5	Division 2	Comprehensive B	Question 1
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For what value of c is the graph of $y = 6x$ tangent to the graph of $y = x^2 + c$?

Answer: 9

Round 5	Division 2	Comprehensive B	Question 2
---------	------------	-----------------	------------

Find a positive solution of the equation: $\sqrt[4]{3^{x^2}} \sqrt{3^{x-1}} = \sqrt[8]{9^{x+1}}$

Answer: $3/2$

Round 5	Division 2	Team	Question 1
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Find the value of k such that the lines with equations $x - y = -2$, $3x - y = 2$, and $kx - 3y = -4$ all pass through the same point.

Answer: 4

Round 5	Division 1	Team	Question 2
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If $40^a = 2$ and $40^b = 4$, then $10^{(1-a-b)/(2(1-b))} = ?$

Answer: $\sqrt{5}$

Round 1	Division 3	Geometry	Question 1
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A square has the same perimeter as an equilateral triangle whose sides each measure 2. What is the area of the square?

Answer: $9/4$

Round 1	Division 3	Geometry	Question 2
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A right circular cone has height 8 cm and volume 144 cm^3 . What is the area of its base in cm^2 ?

Answer: 54

Round 1

Division 3

Algebra

Question 1

$$\left(-\frac{1}{32}\right)^{2/5} = ?$$

Answer: $1/4$

Round 1

Division 3

Algebra

Question 2

Solve for x : $1 - \frac{1}{1 - \frac{1}{x}} = 6$

Answer: $5/6$

Round 1

Division 3

Comprehensive A

Question 1

If θ is the smallest angle in a 3-4-5 right triangle, what is $\sec \theta + \tan \theta$?

Answer: 2

Round 1

Division 3

Comprehensive A

Question 2

How many three-digit numbers can be made using no zero digits such that in each number no two digits are the same?

Answer: 504

Round 1

Division 3

Comprehensive B

Question 1

In the xy -plane, the distance between the points $(-1, 2)$ and $(a, 5)$ is 5. If $a > 0$ then $a = ?$

Answer: 3

Round 1

Division 3

Comprehensive B

Question 2

If $\left(x + \frac{1}{x}\right)^7$ is fully expanded and like terms combined, what is the coefficient of x ?

Answer: 35

Round 1

Division 3

Team

Question 1

How many four digit numbers $abcd$ exist such that a is odd, b is divisible by 3, c is even, and d is prime?

Answer: 400

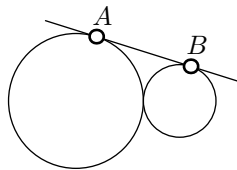
Round 1

Division 3

Team

Question 2

Two tangent circles have radii 9 and 25 and the line is tangent to each circle at A and B . What is $|AB|$?



Answer: 30

Round 2	Division 3	Geometry	Question 1
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Each interior angle of a regular polygon measures 165° . How many sides does the polygon have?

Answer: 24

Round 2	Division 3	Geometry	Question 2
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In $\triangle ABC$, let D be the midpoint of side \overline{AB} and E the midpoint of side \overline{AC} . What is

$$\frac{\text{area}(\square DBCE)}{\text{area}(\triangle ABC)} ?$$

Answer: $3/4$

Round 2	Division 3	Algebra	Question 1
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Determine the value of k such that -4 is a root of $5x^2 - 2x - k = 0$.

Answer: 88

Round 2	Division 3	Algebra	Question 2
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If Little Joe were to sell $\frac{1}{3}$ of his farm he would still have 3 acres more than half of his farm left. How many acres are in his farm?

Answer: 18

Round 2	Division 3	Comprehensive A	Question 1
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The region in the xy -plane enclosed by the x -axis, the y -axis, and the graph of $y + 3x = 4$ has what area?

Answer: $8/3$

Round 2	Division 3	Comprehensive A	Question 2
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If 4% of a uniform seed mixture is replaced by clover seed, the result is a mixture that is 10% clover seed. The original mixture was $p\%$ clover seed where $p = ?$

Answer: $25/4$

Round 2	Division 3	Comprehensive B	Question 1
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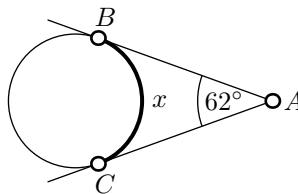
For which value of k does the following system of equations fail to have a solution?

$$\begin{aligned} 2x + y &= 7 \\ kx - 4y &= 6 \end{aligned}$$

Answer: -8

Round 2	Division 3	Comprehensive B	Question 2
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Lines \overleftrightarrow{AB} and \overleftrightarrow{AC} are tangent to the circle at points B and C . What is the degree measure of arc x (bounded by B and C)?



Answer: 118°

Round 2

Division 3

Team

Question 1

In the xy -plane, a circle has center $(2, -3)$ and a tangent line with equation $3x - 4y = -7$. Find the radius of the circle.

Answer: 5

Round 2

Division 3

Team

Question 2

What is the units digit of the integer 8^{2001} ?

Answer: 8

Round 3

Division 3

Geometry

Question 1

Find the radius of a circle whose area is equal to the sum of the areas of two circles of radii 2 and 3, respectively.

Answer: $\sqrt{13}$

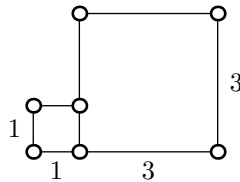
Round 3

Division 3

Geometry

Question 2

What is the distance between the centers of the two squares?



Answer: $\sqrt{5}$

Round 3

Division 3

Algebra

Question 1

Find the sum of the solutions of $|2x - 1| = 3$.

Answer: 1

Round 3

Division 3

Algebra

Question 2

$$(50^{\log_{10} 2} - 5^{\log_{10} 2})^{\log_2 100} = ?$$

Answer: 25

Round 3

Division 3

Comprehensive A

Question 1

If the circumference of a circle is 10π , what is the area of the circle?

Answer: 25π

Round 3

Division 3

Comprehensive A

Question 2

$$\log_2 \left(\frac{4}{3} \right) + \log_2(24) = ?$$

Answer: 5

Round 3	Division 3	Comprehensive B	Question 1
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A circle inscribed in a square of area 49 has what radius?

Answer: $7/2$

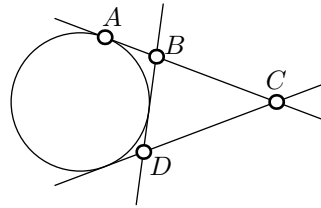
Round 3	Division 3	Comprehensive B	Question 2
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If the solutions of $x^2 - 2(a + b)x + 4ab = 0$ are $x = 8$ and $x = 10$, then $a^2 + b^2 = ?$

Answer: 41

Round 3	Division 3	Team	Question 1
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All 3 lines are tangent to the circle and $|AC| = 13$. What is the perimeter of triangle $\triangle BCD$?



Answer: 26

Round 3	Division 3	Team	Question 2
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Five boys and five girls are randomly placed in a row. What is the probability that the child standing on each end of the row is a boy?

Answer: $2/9$

Round 4	Division 3	Geometry	Question 1
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The midpoint of the line segment connecting the points $(-1, 2)$ and $(5, 7)$ in the xy -plane is (a, b) where $b - a = ?$

Answer: $5/2$

Round 4	Division 3	Geometry	Question 2
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The number of square cm in the surface area of a sphere is the same as the number of cubic cm which it encloses. What is the radius of the sphere in cm?

Answer: 3

Round 4	Division 3	Algebra	Question 1
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$$\frac{3! 6!}{4!} = ?$$

Answer: 180

Round 4	Division 3	Algebra	Question 2
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If $\frac{3}{x} + \frac{2}{y} = 2$ and $\frac{5}{x} - \frac{3}{y} = \frac{1}{6}$, then $x + y = ?$

Answer: 5

Round 4	Division 3	Comprehensive A	Question 1
$\left(\frac{a^5}{b^2c}\right)^3 = a^x b^y c^z$ where $x + y + z = ?$ Answer: 6			
Round 4	Division 3	Comprehensive A	Question 2
Let θ be the largest angle in a triangle whose sides measure 4, 5, and 6. Then $\cos \theta = ?$ Answer: $1/8$			
Round 4	Division 3	Comprehensive B	Question 1
Solve for x : $5^{1-2x} = 25$ Answer: $-1/2$			
Round 4	Division 3	Comprehensive B	Question 2
Find the radius of a circle inscribed in an isosceles triangle whose legs each measure 10 and whose base measures 12. Answer: 3			
Round 4	Division 3	Team	Question 1
If the parabola $y = ax^2 + bx + c$ has vertex $(6, 8)$ and $(4, 0)$ is on the parabola, then $a + b + c = ?$ Answer: -42			
Round 4	Division 3	Team	Question 2
Find the sum of the real solutions of $3x^{3/4} - 2x^{1/2} - x = 0$. Answer: 17			
Round 5	Division 3	Geometry	Question 1
A (convex) polygon is such that when all possible diagonals containing the vertex A are drawn, 10 triangles are formed. How many sides does the polygon have? Answer: 12			
Round 5	Division 3	Geometry	Question 2
The altitude to the hypotenuse of a "30°-60°-90°" right triangle measures $\sqrt{3}$. What is the area of the triangle? Answer: $2\sqrt{3}$			
Round 5	Division 3	Algebra	Question 1
If $f(x) = 3x - 7$, solve $f(2x) = 4f(x)$. Answer: $7/2$			
Round 5	Division 3	Algebra	Question 2
Solve: $\log_2(\log_3(\log_2 x)) = 1$ Answer: 512			

Round 5	Division 3	Comprehensive A	Question 1
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If $\log_b \left(\frac{1}{1000} \right) = -3$, then $b = ?$

Answer: 10

Round 5	Division 3	Comprehensive A	Question 2
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If the radius of a disc is decreased by 10%, the area of the disc is decreased by $p\%$ where $p = ?$

Answer: 19

Round 5	Division 3	Comprehensive B	Question 1
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The measures of the three angles of a triangle are in the ratio of 3 : 4 : 5. What is the degree measure of the largest angle?

Answer: 75°

Round 5	Division 3	Comprehensive B	Question 2
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For what value of c is the graph of $y = 6x$ tangent to the graph of $y = x^2 + c$?

Answer: 9

Round 5	Division 3	Team	Question 1
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Find the value of k such that the lines with equations $x - y = -2$, $3x - y = 2$, and $kx - 3y = -4$ all pass through the same point.

Answer: 4

Round 5	Division 3	Team	Question 2
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Find a positive solution of the equation: $\sqrt[4]{3^{x^2}} \sqrt{3^{x-1}} = \sqrt[8]{9^{x+1}}$

Answer: $3/2$