Jeopardy

Recursive Sequences	Math Logic	Radians	Gauss Prep	Induction	Modular Arithmetic	Complex Numbers
100	100	100	100	100	100	100
200	200	200	200	200	200	200
300	300	300	300	300	300	300
400	400	400	400	400	400	400
500	500	500	500	500	500	500

Recursive Sequences - 100

Find an infinite sequence which is both an arithmetic sequence and a geometric sequence.

Recursive Sequences - 200

Find the next 2 numbers in the following pattern:
1, 21, 312, 4213, ...

Recursive Sequences - 300

The sequence $t_1, t_2, t_3, \ldots$ is geometric.
If $t_1 = 3$ and $t_4 = -24$, find t_{10}.

Answer

Recursive Sequences - 400

Let $a_1, a_2, a_3, \ldots$ be an arithmetic sequence with first term 7 and common difference 13. Find n such that $a_n = 2022$.

Recursive Sequences - 500

Let a_n be the number of ways one can climb an n-step staircase by going up either one or two steps at a time. Fill out the following table.

n	1	2	3	4	5	6	7	8
a_n	1	2						

Recursive Sequences - 100 Answer

The sequence of 0's: 0, 0, 0, 0, ...

Recursive Sequences - 200 Answer

$$1, 21, 312, 4213, \textcolor{red}{53124, 642135}, \dots$$

Recursive Sequences - 300 Answer

$$t_{10} = -1536$$

Recursive Sequences - 400 Answer

$$n = 156$$

Recursive Sequences - 500 Answer

n	1	2	3	4	5	6	7	8
a_n	1	2	3	5	8	13	21	34

Math Logic - 100

- I will eat either pizza or spaghetti for dinner.

- I will not eat spaghetti for dinner.

What would I have for dinner?

Answer

Math Logic - 200

What is the mathematical symbols for "or", "and", "not", in that order?

Math Logic - 300

Make a truth table for $P \vee Q$.

Math Logic - 400

Find the simplest equivalent logical expression of $\neg(\neg\neg P \lor \neg Q) \land Q$.

Answer

Math Logic - 500

Four boys, Joshua, Daniel, Nicholas, and Ryan, are at home to watch some movies. Who does like Action movies?

1. Joshua is at one of the ends.
2. The boy wearing the Black shirt is somewhere to the left of the youngest boy (11-year-old).
3. Joshua likes Horror movies.
4. The 14-year-old boy is at the third position.
5. The boy wearing the Red shirt is somewhere between the 13-year-old boy and the one who likes Action movies, in that order.
6. Daniel likes Thriller movies.
7. The boy who is going to eat Cookies is at one of the ends.
8. The boy wearing the Black shirt is exactly to the left of the one who likes Thriller movies.
9. The boy who is going to eat Crackers is exactly to the right of the boy who likes Comedy movies.
10. The boy wearing the Red shirt is somewhere between the boy who is going to eat Popcorn and Nicholas, in that order.
11. At one of the ends is the boy who likes Thriller movies.
12. Nicholas is somewhere between Joshua and Daniel, in that order.
13. At the first position is the boy wearing the Green shirt.

Answer

(Taken from https://www.brainzilla.com/)

Math Logic - 100 Answer

Pizza!

Math Logic - 200 Answer

$$\lor, \land, \lnot$$

Math Logic - 300 Answer

P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

Math Logic - 400
Answer

$$\neg P \wedge Q$$

Math Logic - 500 Answer

Nicholas

Radians - 100

Let r be the radius, let d be the diameter, let C be the circumference, and let A be the area.

a) What is the formula for the circumference of a circle?

b) What is the formula for the area of a circle?

Answer

Radians - 200

Why was 360° chosen to be the number of degrees in a full circle? List at least two theories.

Radians - 300

Convert 20° to radians.

Answer

Radians - 400

Calculate the arc length of the sector with radius 28 cm and a central angle of $\frac{27\pi}{14}$ radians.

Answer

Radians - 500

Calculate the sector area of the sector with radius 11 mm and a central angle of $\frac{4\pi}{3}$ radians.

Radians - 100 Answer

a) $C = 2\pi r$ or $C = \pi d$

b) $A = \pi r^2$

Radians - 200
Answer

- Highly composite

- Solar and lunar years

- Sexagesimal (base 60) number system and equilateral triangles

Radians - 300
Answer

$$20° = \frac{\pi}{9} \text{ radians}$$

Radians - 400
Answer

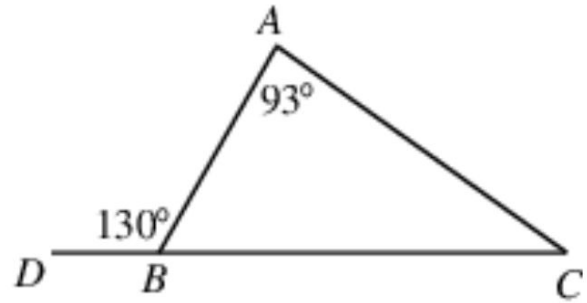$$\text{arc length} = 54\pi \text{ cm}$$

Radians - 500
Answer

$$\text{sector area} = \frac{242\pi}{3} \text{ mm}^2$$

Gauss Prep - 100

In the diagram, the size of $\angle ACB$ is
(A) $57°$ (B) $37°$ (C) $47°$
(D) $60°$ (E) $17°$

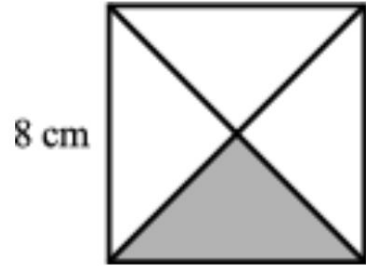*(Source: 2005 Gauss (Grade 7), #8)*

<u>Answer</u>

Gauss Prep - 200

The diagonals have been drawn in the square shown. The area of the shaded region of the square is

(A) 4 cm^2 (B) 8 cm^2 (C) 16 cm^2

(D) 56 cm^2 (E) 64 cm^2

8 cm

(Source: 2014 Gauss (Grade 7), #12)

Answer

Gauss Prep - 300

How many positive whole numbers, including 1, divide exactly into both 40 and 72?

(A) 9   (B) 12   (C) 4   (D) 2   (E) 5

(Source: 2007 Gauss (Grade 7), #15)

Answer

Gauss Prep - 400

There are several groups of six integers whose product is 1. Which of the following cannot be the sum of such a group of six integers?

(A) -6 (B) -2 (C) 0   (D) 2   (E) 6

(Source: 2018 Gauss (Grade 7), #18)

Answer

Gauss Prep - 500

In the addition shown, P and Q each represent single digits, and the sum is $1PP7$. What is $P + Q$?

$$\begin{array}{r} 7\ 7\ P \\ 6\ Q\ P \\ +\ \ \ \ Q\ Q\ P \\ \hline 1\ P\ P\ 7 \end{array}$$

(A) 9   (B) 12   (C) 14   (D) 15   (E) 13

(Source: 2013 Gauss (Grade 7), #21)

Answer

Gauss Prep - 100 Answer

(B)

Gauss Prep - 200 Answer

(C)

Gauss Prep - 300 Answer

(C)

Gauss Prep - 400 Answer

(C)

Gauss Prep - 500
Answer

<div style="text-align: center; font-size: 2em;">(C)</div>

Induction - 100

Let $t_1, t_2, \ldots$ be a sequence such that $t_{n+1} = t_n + 1$ for all natural numbers n. Find $t_8 - t_1$.

Induction - 200

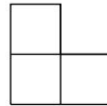Find all $n \in \mathbb{N}$ such that $2^n \leq n^2$.

Induction - 300

Compute the sum of the first 50 odd positive integers:

$1 + 3 + 5 + \ldots + 97 + 99$

Induction - 400

Find all natural numbers n such that a $3 \times n$ grid of squares can be tiled using triominoes.
Recall: a triomino is an L-shaped tile (see below).

Induction - 500

Let $a_1, a_2, a_3, \ldots$ be a sequence of positive real numbers defined by $a_1 = 1$ and $a_{n+1} = \sqrt{a_n + 2}$ for $n \geq 1$. True or False:

a) $a_2 \leq 2$

b) For all positive real numbers $x \leq 2$, $\sqrt{x + 2} \leq 2$.

c) $a_n \leq 2$ for all $n \in \mathbb{N}$.

Answer

Induction - 100 Answer

$$t_8 - t_1 = 7$$

Induction - 200
Answer

$$n = 2, 3, 4$$

Induction - 300
Answer

$$50^2 = 2500$$

Induction - 400
Answer

All even natural numbers n.

Induction - 500 Answer

a) True.

b) True.

c) True.

Modular Arithmetic - 100

What is the remainder of $-347 \div 5$?

Answer

Modular Arithmetic - 200

Is 11 congruent to 87 modulo 3?

Modular Arithmetic - 300

What is the last digit of $3829^2 \times (2891^{92} - 47728 + 2692213^3)$?

Modular Arithmetic - 400

What is the remainder when $(189^5 + 3417^{283}) \times 164^2$ is divided by 17?

Modular Arithmetic - 500

a) If today is Tuesday, what day is it in 589 days?

b) If today is Friday, what day was it 264 days ago?

Answer

Modular Arithmetic - 100 Answer

$$3$$

Modular Arithmetic - 200 Answer

No

Modular Arithmetic - 300 Answer

0

Modular Arithmetic - 400 Answer

$$13$$

Modular Arithmetic - 500 Answer

    a) Wednesday

    b) Sunday

Complex Numbers - 100

What is the imaginary part of the number 0?

Complex Numbers - 200

Calculate/simplify i^{77}.

Complex Numbers - 300

Calculate $(-5 + 7i) \times (2 - 3i)$

Complex Numbers - 400

Calculate $\dfrac{(-5 + 7i)}{(2 - 3i)}$

Complex Numbers - 500

Find solutions of the quadratic equation $2x^2 + 4x + 7 = 0$.

Complex Numbers - 100 Answer

0

Complex Numbers - 200 Answer

$$i$$

Complex Numbers - 300 Answer

$$11 + 29i$$

Complex Numbers - 400 Answer

$$\frac{-31 - i}{13}$$

Complex Numbers - 500 Answer

$$-1 \pm \frac{\sqrt{10}}{2}i$$