
Set 1

1. (4) A line of symmetry passes through the center of a shape, dividing the shape so that one side is the mirror image of the other. How many lines of symmetry does a square have?

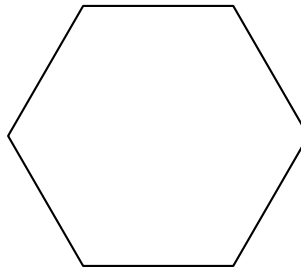
2. (4) It is raining 10 meatballs per hour. A meatball monster eats 3 meatballs per hour. After how many hours will there be 42 fallen meatballs not eaten by the meatball monster?

3. (4) Find the sum of positive factors of 97.

Set 2

1. (5) I really, really, really like to eat cheese. Because of my lack of funds to buy cheese, I asked my friends to give me money to buy cheese. Jack, Jonathon, Jasmine, and Jessica gave me a total of 46 dollars. Jack gave 3 dollars more than Jonathon, who gave 4 dollars more than Jasmine, who gave 5 dollars more than Jessica. How many dollars did Jonathon give me?

2. (5) An equilateral triangle is drawn on top of the regular hexagon below. What is the greatest possible number of intersection points between the triangle and hexagon?



3. (5) When I drive home from school, I have to stop at 4 traffic lights. I have to stop at each one for anywhere from 30 to 90 seconds. Assume everything other than the traffic lights takes the same amount of time. Let m be the minimum time for me to get home, and M to be the maximum time for me to get home. Compute $M - m$, in minutes.

Set 3

1. **(6)** A family of two adults and two children sit down for a group photo. The children sit in the middle and the adults sit on the edge. In how many ways can the family members be arranged?

2. **(6)** Heneni recently moved into a house that has a lawn in the shape of a right triangle. Unfortunately, Heneni does not have a measuring tape, but she knows that the area of the triangle is 30 and the lengths of the two shortest sides are 7 apart. What is the length of the shortest side?

3. **(6)** Albert, an experienced K-Pop artist, takes 5 days to write a new piece of music. His apprentice, Bobette, takes an entire 20 days to write a new piece (Don't blame her, she's an apprentice). How many days would it take for them to write one piece together? Assume that K-Pop artists work at a constant rate.

Set 4

1. (7) Mrs. Manoogian is disappointed in Arthur's recent test scores, so she steals his noise-cancelling headphones and locks it in a safe that can be opened with a five-digit code. She gives Arthur three hints as to what the code is:

- (a) This number is divisible by 6.
- (b) The first three digits of this number are 1, 5, and 8, but not necessarily in that order.
- (c) The sum of the digits in this number are 15.

Let a be the tens digit of the 5-digit code, and b be the ones digit of the code. What is $10a + b$?

2. (7) The math team has been called upon to help plan out a field trip to a local theme park. 470 students are to go on the field trip to the theme park. They can either ride in buses or vans. Each bus holds 50 students, and each van holds 15 students. If the school uses 15 vehicles to bring all of the students and each vehicle has all of its seats filled, how many vans does the school use?

3. (7) It is 9:45 PM. Lucas plans to go to sleep when the hour hand and the minute hand are pointing in the same direction, and before 10 PM. To the nearest integer, how many minutes will Lucas wait before going to sleep?

Note: For you Zoomers who haven't seen an analog clock before, the minute hand makes a full rotation every hour and the hour hand makes a full rotation every 12 hours. Both hands point in the same direction at 12 AM and 12 PM.

Set 5

1. (8) For given integers a and b , let $a \star b = a^3 - b^4$ and $a * b = b - \frac{1}{a}$. The value of $(2 \star 0) * (2 * 2)$ can be expressed as a simplified fraction $\frac{m}{n}$. Find $m + n$.
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2. (8) In the land of Teapolia, there are 2 types of creatures: lizards and frogs. Lizards always lie and frogs always tell the truth. One day, Artemis visits Teapolia and sees three entrances, A, B , and C (there is only one correct entrance). Jerry, Jack, Jason, and Jonathon of Teapolia approach Artemis and say:

Jerry: A or C is the right way to go.

Jack: B is the right way to go.

Jason: The correct entrances is not A or C .

Jonathon: Jerry is telling the truth.

How many of the four are frogs?

3. (8) Alfredo's Pizza Cafe has created Geogebra, a software made to stop bad pizza. In retaliation, Pizza by Alfredo creates Desmos, and the two entities compete for an online graphing calculator supremacy. Geogebra started off with 73.5 million users around the world, and it is gaining 400 thousand more each day. Desmos started off with 62.9 million users, and it is gaining 1 million more each day. If x is the amount of days it will take Desmos to have twice the amount of users as Geogebra, what is $\lfloor x \rfloor$?

Note: $\lfloor x \rfloor$ is the nearest integer less than or equal to x .

Set 6

1. **(9)** Attracted by the smell of coffee, two ants on a table climbs up a cylindrical handle-less mug. Both start at the bottom of the mug and climb at the same speed. One ant takes the shortest distance to the top of the mug, which takes it 6 seconds. Another ant with a broken leg can only climb up the mug at an angle 30° to the table, so it spirals around the mug. How many seconds will it take the second ant to reach the top?

2. **(9)** Between 50 and 140 inclusive, how many integers have exactly 4 factors?

3. **(9)** Each color can be represented by its red (R), green (G), and blue (B) components. The values of R , G , and B are real numbers (not necessarily integers) between 0 and 250. If the sum $R + G + B$ is less than 150, we call the color "dark." If $R + G + B$ is greater than 600, we call the color "light." What is the ratio of the number of "dark" to "light" colors?

Set 7

1. **(10)** I roll a fair 3-sided die 9 times. There are $3^9 = 19683$ possible outcomes of this. How many of these outcomes result in each side coming up 3 times?

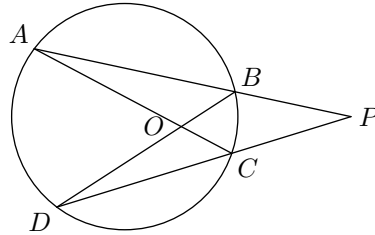
2. **(10)** Every year, students like to buy yearbooks. The more yearbooks are sold, the less each yearbook costs. Every yearbook is sold at the same price. The cost of each yearbook is represented by the expression $100 - \frac{x}{5}$ where x is the number of yearbooks sold. How many yearbooks should the yearbook company sell to maximize its profit?

3. **(10)** On a table there are 30 slips, each labeled with the positive integers 1 to 30. Eric, Jasmine, and Arthur each take one slip, then they look at it and show it to Mr. Lucas. After seeing all the slips, Mr. Lucas says, "Wow, these three slips form an arithmetic sequence, and two of you guys chose prime numbers!" After analyzing more, he adds, "And, if you subtract 1 from the two larger numbers, you get a geometric sequence!" What is the sum of the three numbers on the slips?

(Note: a, b, c is an arithmetic sequence if $a + c = 2b$. a, b, c is a geometric sequence if $ac = b^2$.)

Set 8

1. **(11)** In the figure below, points A , B , C , and D are on a circle with diameter 90. Segments AB and DC are extended along B and C , respectively, to meet at point P . AC and BD intersect at O . If $\angle P = 34^\circ$ and $\angle AOD = 66^\circ$, the length of minor arc AD can be expressed as $k\pi$, where k is a positive integer. Find k .



2. **(11)** You will play three rounds of rock, paper, scissors with the Terrifying WinMaC Creature. If the creature loses, in the next round they will play the hand that would've won the last round 80% of the time. If the creature wins, they will repeat the same hand from last time 60% of the time. There is a winner every round. If you win the first round and make the best choices, what is the probability that you win the third round? Express your answer as a percentage.

3. **(11)** How many permutations of the name "guwifugidf" are there that have at exactly 2 pairs of letters that are next to each other? To clarify, "gguwiffuid" would be an example because the "gg" and the "ff" are the two pairs, but "gguwiffid" would not because there are 3 pairs, not 2.