

MathEdge Intermediate Level Contest Problems

1) $(100 \times 100) - (99 \times 99) = ?$

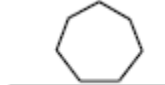
ANS: 199

SOL: $(100 \times 100) - (99 \times 99) = 100 + 99 = 199$

2) Draw the next two pictures:



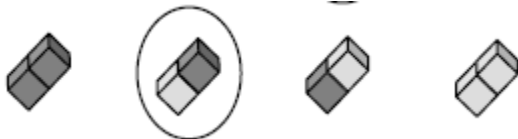
ANS:



3) Circle the shape at the right which fits into the open space of the graph given below:



ANS:



4) Evaluate $50 - 49 + 48 - 47 + 46 - 45 + \dots + 4 - 3 + 2 - 1$.

ANS: 25

SOL: If we group $50 - 49 + 48 - 47 + 46 - 45 + \dots + 4 - 3 + 2 - 1$ as:

$$(50 - 49) + (48 - 47) + (46 - 45) + \dots + (4 - 3) + (2 - 1), \text{ we get}$$

$1 + 1 + 1 + \dots + 1 + 1$. Since there are 25 ones in this sum, the answer is 25.

5) In the repeating decimal $0.234234234\dots$, what is the 50th number after the decimal point?

ANS: 3

SOL: Looking at the fours in the decimal, they appear in positions 3, 6, 9,

Therefore, in every position that is a multiple of three, there is a four. Since 51 is a multiple of three, there is a four in position 51. Therefore, there is a three in position 50.

6) The numbers in the sequence 3, 8, 13, 18, and so on, increase by 5's. The numbers in the sequence 5, 9, 13, 17, and so on, increase by 4's. The number 13 is in both sequences. What is the next number that appears in both sequences?

ANS: 33

SOL: Since one sequence increases by four each time and the other increases by five each time, the two will match up every twenty (four times five). Therefore, if they match up at thirteen, they will again match up at $13 + 20 = 33$.

7) In an experiment, every hour 20% of the total number of bacteria die, and those remaining bacteria double. If there were originally 125 bacteria, how many are there after three hours?

ANS: 512 bacteria

SOL: At the end of the first hour, there are $125 \times 0.8 \times 2 = 200$ bacteria.

At the end of the second hour, there are $200 \times 0.8 \times 2 = 320$ bacteria. At the end of the third hour, there are $320 \times 0.8 \times 2 = 512$ bacteria.

Note, the formula for the number of bacteria after n hours is $(2 \times 4/5)^n \times 125$

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- 8) Together, Juan and Carla made 9 cupcakes to match the colors of the American flag.
- They made 1 fewer blue cupcake than red cupcakes.
 - They made twice as many red cupcakes as white cupcakes.
- How many blue cupcake did they make?

ANS: 3

SOL: Let x be number of white cupcakes. Red = 2x. Blue = 2x - 1.

$$x + (2x) + (2x - 1) = 9 \Rightarrow 5x = 10 \Rightarrow x = 2. \text{ Thus Blue} = 2x - 1 = 2 \times 2 - 1 = 3$$

- 9) The artwork at the Isosceles Museum is unusual because the picture frames are not rectangles. On one wall, the paintings have frames in the shapes of a pentagon, a circle, a hexagon, and an octagon.
- The **forest watercolor** is next to the octagon.
 - The **ocean scene** is not surrounded by a five-sided frame.
 - The **fruit-bowl** painting has a frame shaped like a grapefruit.
 - The painting of **city streets** has a frame in the shape of a stop sign.

Which painting is in the Hexagon frame?

ANS: ocean scene

SOL:

	Pentagon	Circle	Hexagon	Octagon
forest watercolor	√	X	X	X
ocean scene	X	X	√	X
fruit-bowl	X	√	X	X
city streets	X	X	X	√

- 10) Eight teams entered a soccer tournament. Each team played every other team once.
How many total games were played in the tournament?

ANS: 28

SOL: 7 + 6 + 5 + 4 + 3 + 2 + 1 = 28

The first team plays all seven other teams, the second team plays the six teams it has not played, the third team plays the five teams it has not played, and so on.

$$8 \times 7 \div 2 = 28$$

Each team plays seven games but each game is counted twice.

- 11) The first in a set of numbers is 2 and the fifth is 16. If every number is the sum of the previous two numbers (starting with the third number), then what is the sum of the first five numbers?

ANS: 38

SOL: Let the second number in the sequence be a . Then the third term would be a + 2 , the fourth term would be a + (a + 2) = 2a + 2 , and the fifth term would be (a + 2) + (2a + 2) = 3a + 4 . The fifth term is also equal to 16. So:

$$3a + 4 = 16; 3a = 12; a = 4$$

Therefore, the sequence is 2, 4, 6, 10, 16, making the sum of the first five terms 38.

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12) Karen, Jon, Marcus and Tara each ate a different kind of mini-pizza for lunch. After lunch, there was $\frac{1}{4}$ of the plain pizza left, $\frac{1}{3}$ of the pepper pizza left, $\frac{1}{2}$ of the mushroom pizza left, and $\frac{5}{8}$ of the sausage pizza left.

- Karen ate the most.
- Jon ate the least
- Marcus ate more than Tara.

Who ate the Pepper pizza?

ANS: Marcus

SOL:

	plain pizza	pepper pizza	mushroom pizza	sausage pizza
Person	Karen	Marcus	Tara	Jon



13) Kathy drew an interesting design with her pen, shown to the right. The numbers indicate the length of each line in centimeters. Kathy continued this design until her pen ran out of ink. If the total distance of all the lines she drew is 3 meters, then what is the length of the longest line she drew? In what direction was her pen moving when she drew this line?

ANS: 17 cm, must have been drawn down

SOL: First, we want to find the longest line of which we can draw two. Since we cannot exceed 3 meters = 300 centimeters, and since we have two of each line, we are looking for the largest sum of $1 + 2 + 3 + \dots$ that is less than $300 \div 2 = 150$. We have that

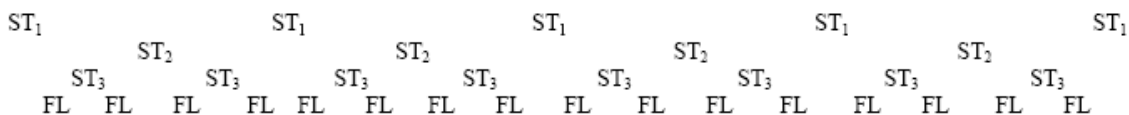
$1 + 2 + 3 + \dots + 15 + 16 = 136$. So after we have drawn two of every line up to 16 cm, we have a total of 272 cm. We still need 28 cm, so a line of 17 cm and a line of 11 cm will be drawn.

Therefore, the longest line drawn is 17 cm. Looking at the diagram, distances that are odd are always drawn down or to the right. Since there is only one 17 cm line, it must have been drawn down.

14) Tim is building a fence. First, he places five stakes in the ground. He then places a stake between each of those five stakes. At this point, he decides the fence is not dense enough, and once again places a stake between each of the stakes already there. Finally, for decoration, he plants a flower between each of the stakes in the finished fence. How many flowers did Tim plant?

ANS: 16 flowers

SOL: (ST_x – A stake placed in the xth step. FL – A flower.)



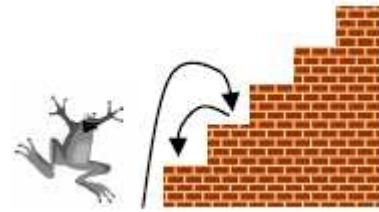
Simply counting the bottom row, Tim planted 16 flowers.

Alternative Solution : After the first step, in which there are five stakes placed, the number of gaps between stakes follows the pattern 4, 8, 16, 32, Since there were

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three steps after the original five stakes were planted, we take the third term in the above pattern, giving 16 flowers.

- 15) MathFROG is sitting at the bottom of the stairs and would like to leap to the top. MathFROG leaps up two steps and then down one. Then MathFROG leaps up another two steps and down one. (Note that down one is considered another leap). If this pattern continues, how many leaps will be necessary for MathFROG to touch the 5th step the first time?



ANS: 7

SOL: To get up each step requires 2 leaps. It takes 6 leaps to get to the third step. Another leap from third will get to 5th step as it leaps two steps first (then down one). Thus answer = 6 + 1 = 7 leaps.

- 16) Green and blue marbles are placed in the following way: one green, one blue, two green, two blue, three green, three blue, and so on. What is the colour of the 100th marble placed?



ANS: a) green

SOL: a) First, we want to find the largest number of marbles we can place so that there are an equal number of each colour. Since the most we can have of either colour (if the two have equal amounts) is 50, we are looking for the largest sum of $1 + 2 + 3 + \dots$ that is less than 50. We can see that $1 + 2 + 3 + \dots + 8 + 9 = 45$. That means that after placing nine green and nine blue marbles, we have $45 + 45 = 90$ marbles placed. We then place 10 green marbles, and that takes us up to 100 marbles. Therefore, the 100th marble placed is green.

- 17) Troy plants a magical plant in his garden. The plant doubles in height every day, until it reaches its maximum height. If it takes 10 days to reach its maximum height, how many days does it take to get to half of that height?

ANS: 9 days

SOL: It will take nine days for the plant to reach half of its maximum height. If it doubles in height each day, and if it was at half its maximum height on day nine, it would double ($2 \times \frac{1}{2} = 1$) to its full maximum height in one day, on day ten.

- 18) Rosa, Glen, Cathy, and Errol each bought snacks from several vending machines. Each person got back 6 coins, but they were different combinations of coins. Each person received less than \$1 in change. The machines returned only nickels, dimes, and quarters. Each person had at least one of each coin.

- Rosa had the fewest dimes but the same number of quarters as Errol.
- Glen had an equal number of nickels, dimes, and quarters.
- Cathy had the same number of quarters as Glen.
- Errol had more dimes than Cathy.
- Cathy had more dimes than quarters.
- Rosa had fewer quarters than Cathy.

How much money did Cathy get back from the machines?

ANS: 85cents

Coins	Rosa	Glen	Cathy	Errol
Nickels	4 nickels = 20 cents	2 nickels = 10 cents	1 nickel = 5 cents	1 nickel = 5 cents
Dimes	1 dime = 10 cents	2 dimes = 20 cents	3 dimes = 30 cents	4 dimes = 40 cents
Quarters	1 quarter = 25 cents	2 quarters = 50 cents	2 quarters = 50 cents	1 quarter = 25 cents
Total	55 cents	80 cents	85 cents	70 cents

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19) Mrs. Richards is having one big birthday party for all seven grandchildren because each celebrates a birthday in the same month. She arranged candles in combinations that show each grandchild's age (see graph). Each candle figure represents a certain number of years.

- The youngest grandchild will be 2 on this birthday.
- Louis and Paul are twins. They will be 9.
- Marley and Keith are a year apart..

How much older is Carla than Julianne?

ANS: 4 (15 - 11 = 4)

Child	Louis	Paul	Alicia	Keith	Marley	Carla	Julianne
Age in years	9	9	2	8	7	15	11

SOL:

Step 1

- You know that Louis will be 9 on this birthday.
- Since he has 3 candles, divide 9 by 3 to find the number of years each candle represents.
- $9 \div 3 = 3$, so each candle represents 3 years. Place a 3 next to each pyramid-shaped candle in the drawing.

Step 2

- You know that Paul is 9 years old.
- The pattern for Paul's candles is different from that of his twin, Louis. What does each of his candles represent?
- Guess and check: What number doubled + 1 = 9? $4 + 4 + 1 = 9$
- So, a cube-shaped candle represents 4. A sphere-shaped candle represents 1.

Step 3

- Give each figure the numbers shown above.
- See which combination works. Use the clues to check.
- Assign values to the figures, as shown below.

