2022 KCATM
High School Math Contest

Name: _____

Grade: _____

High School: _____

e-mail address: _____

phone number: _____

INSTRUCTIONS

The following test consists of 20 questions. Use whatever resources you like to solve these problems. Each question is worth 5 points. Partial credit will be given for making progress. However, you must show your work to get any credit. **PLEASE PRINT THIS DOCUMENT OFF IN LANDSCAPE MODE!**

THE CONTEST and REGISTRATION

- There is no cost for this contest.
- There are two grade categories: 9th and 10th graders will be graded in one category, while 11th and 12th graders will be graded in a second category.
- All students will be informed of their score approximately one week after the date below, and the top-3 in each category will be officially recognized.

SUBMIT YOUR TEST AND ANSWERS EITHER …

BY MAIL
Mike Round
13234 Long Street
Overland Park, KS 66213

Entries must be post-marked no later than April 19th.

BY EMAIL
round12345@aol.com

Entries must be received no later than April 19th.

QUESTIONS
High School Test Coordinator: Mike Round
(913) 515-3911   round12345@aol.com

Date	Price
4/1/2020	$2.10
5/1/2020	$1.87
6/1/2020	$2.06
7/1/2020	$2.26
8/1/2020	$2.27
9/1/2020	$2.31
10/1/2020	$2.26
11/1/2020	$2.23
12/1/2020	$2.21
1/1/2021	$2.33
2/1/2021	$2.50
3/1/2021	$2.80
4/1/2021	$2.94
5/1/2021	$2.96
6/1/2021	$3.12
7/1/2021	$3.19
8/1/2021	$3.23
9/1/2021	$3.24
10/1/2021	$3.27
11/1/2021	$3.48
12/1/2021	$3.48
1/1/2022	$3.38
2/1/2022	$3.46
3/1/2022	$3.70
4/1/2022	$4.33

This table shows the average national price for a gallon of gas. How much has the price changed from April 1, 2020 to April 1, 2022?
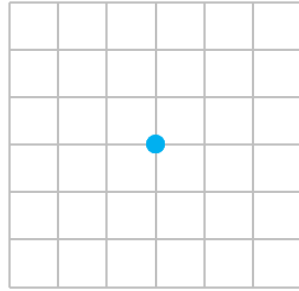
2

Using the answer from question #1, suppose my car gets 25 miles per gallon of gas. I have a 20 mile drive to work (and 20 miles home) and I work Monday through Friday. I also drive 100 miles extra during the week (and weekend). How much more (April 1, 2020 to April 1, 2022) do I now pay each week because of the change in gas prices?

3

I have 32 items to sell in my store Monday morning, selling at $64 each. Half of what I have on hand sells Monday. I decide to reduce the price 50% Tuesday, and again, half of the products I have available sells that day. If this trend continues (cutting the price in half and selling half of what I have), how much money will I have made by Friday at 11:59pm?

4

I'm standing in the middle of the grid, I can only move one unit up, down, left, or right. All movement is random. If I only take two steps, what is the probability I will end up where I started?

5

Built in the 1960s, the SR71 Blackbird could fly at high altitudes (90,000 feet) and at fast speeds (Mach 3.5). If the speed of sound at this altitude is approximately 979 feet / second, how fast could the plane fly in miles / hour?
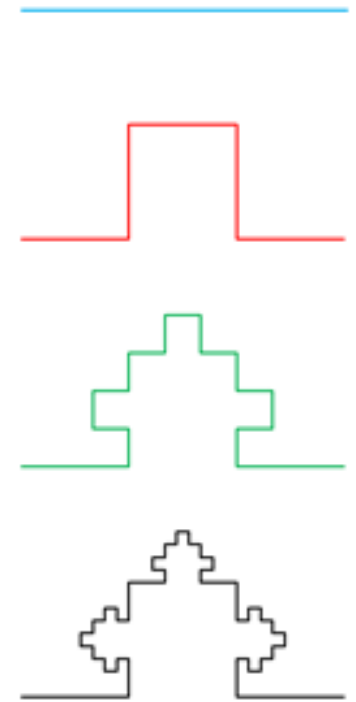
6

At what temperature are Celsius and Fahrenheit equal?

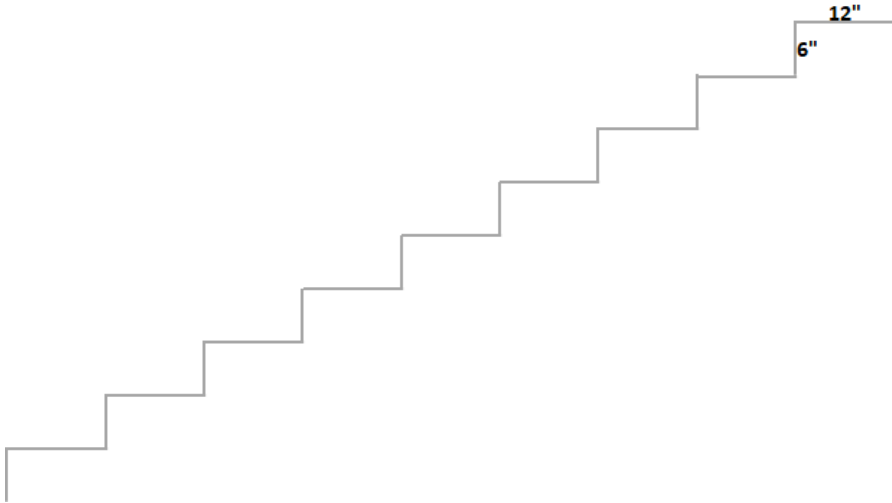| Scale	Freezing Point	Boiling Point
Celsius	0°	100°
Fahrenheit	32°	212°

7

The length of the top image is 27 units. With each iteration, a change takes place in the middle third of the shown segments. What is the total length of the fourth image?

8

The staircase below needs carpeting. If each step is 6" high and 12" deep, and if the stairwell is 36" wide, how many square yards of carpet do I need to completely carpet all stairs?
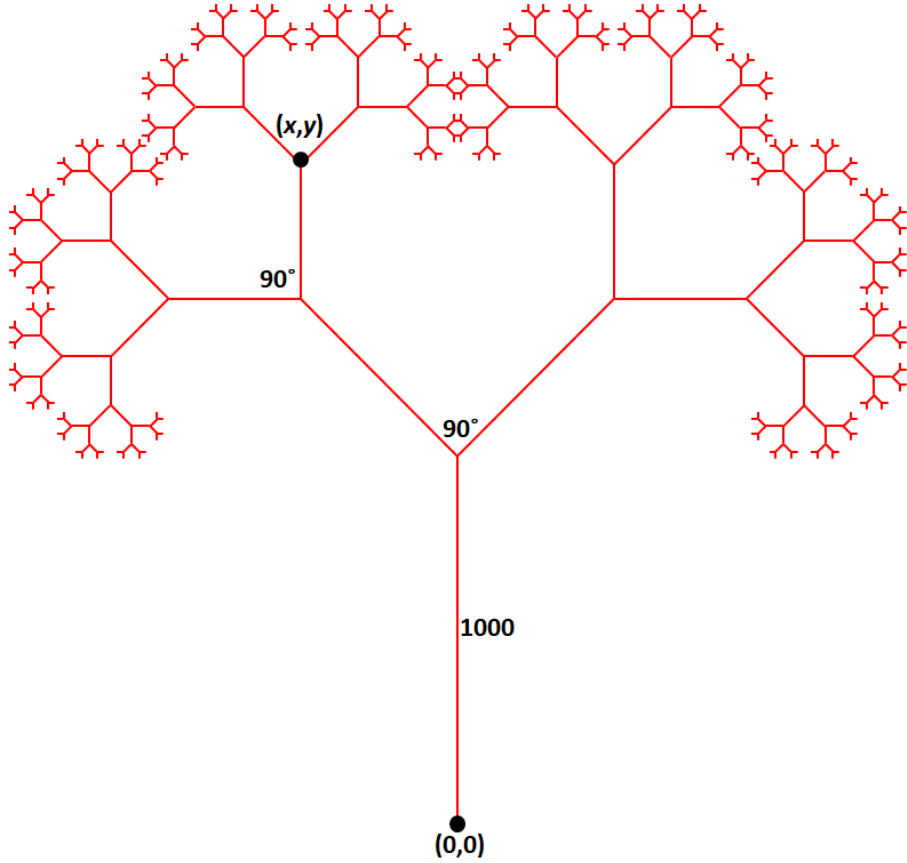

12"

6"

9

Suppose the probability of me catching a disease is 30%. If I've tested positive for the disease, the probability of me being hospitalized is 5%. If I've been hospitalized because of the disease, the probability of me dying from the disease is 10%.

If I'm an average person, what is the probability I will die from the disease?

10

Starting at coordinates $(0,0)$, a line 1,000 units long is drawn as indicated. This line then branches into two separate lines (which form a 90° angle, as shown). Each of these lines is 60% the length of the previous segment. The process continues. Find the (x, y) coordinates of the indicated point.

(x,y)

90°

90°

1000

(0,0)

11

What is my GPA if I have 3 As, 2 Bs, and 1 C (use the accompanying table for the value of each grade)?

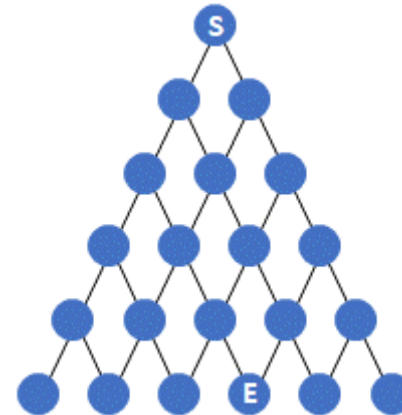| Grade	Value
A	4.00
B	3.00
C	2.00
D	1.00
F	0.00

12

I have more information about my class schedule, including the number of credits for each class. With this new information, what is my GPA?

Class	Credits	Grade
Math	4	C
English	3	A
History	3	A
Phy Ed	1	A
Art	2	B
Science	3	B

13

Starting at the "S", you move downward along a line to the next circle, eventually reaching the bottom. How many different paths would lead you to the "E"?

14

Cake batter is made in a circular prism, with diameter 8" and height 4", and filled to the top. If this batter is then poured into a rectangular-based prism with length 12" and width 9", how high will the batter reach?

15

Easter falls on the first Sunday following the first full moon following the spring equinox. For the sake of simplicity, assume the Spring Equinox falls on the 80th day of the year, full moons occur every 30 days, and these three events cannot fall on the same day. With these assumptions, what is the range of days Easter can fall on?16.
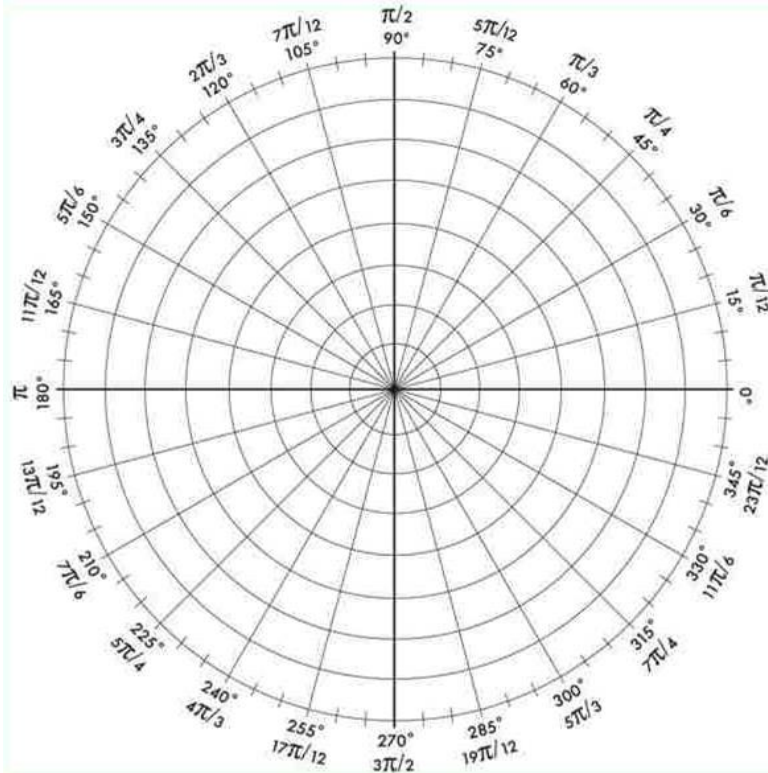
16

Expand $y = (x+y)^2(x-y)^2$.

17

A business gift-wraps purchases during the Christmas season, and on Christmas Eve, the demand is huge. The three-stage process is described below. Each station cannot work on a present until the previous station has completed their function, and once a station is finished with one package, they immediately start on the next package (if it's available). The times each station actually worked on a gift are recorded below, with each station averaging 2 minutes / package. How many minutes did it take to have all three gifts wrapped?

Gift #	STATION A Worker sets up box and present	STATION B Robot fills box with stuffing	STATION C Worker seals and wraps box
1	1 *min*	2 *min*	1 *min*
2	4 *min*	2 *min*	2 *min*
3	1 *min*	2 *min*	3 *min*

18

Graph the function $r = 1 + 2cos(2\theta)$ using polar coordinates below.

19

The point $(3,3)$ is closest to which point (x, y) on the function $y = x^2$?

20

In an election, Candidate 1 received two-thirds of the votes during the first one-third of the voting. Candidate 2 received three-fourths of the votes during the next one-fourth of the voting. What % of the remaining vote does Candidate 3 need to be declared the *only* winner?

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