DKC^3 2020 - Word Problems

(Each word problem is worth 5 points)

1. **Dinner Table**

   Six individuals were having dinner together at a rectangular table. Alice, at the head of the table, had chicken. Continuing clockwise around the table the others had coffee cake, mud pie, fish sticks, spaghetti, and a salad.

   Bob sat across from Alice.
   Charlie had spaghetti.
   Danny sat next to Charlie.
   Eve sat next to Frank.
   Frank was not sitting across from Danny.

   Who ate the coffee cake?

2. **Natural Blackjack**

   Blackjack is a card game where the player tries to get to 21. A natural blackjack is any ace and face card/10. There are four suits in a standard deck of cards: hearts and diamonds (red), and spades and clubs (black).

   What are the odds the first two cards pulled from a standard 52 card deck are both black (spades or clubs), and make a natural blackjack? Round your answer to the nearest hundredth percent.

3. **Fill in the Blanks**

   Four words with the letters CRO, in that order, have all their other letters removed. You must use the letters in the pool to fill in the blanks of the missing letters.

   _ CRO _ _ _
   CRO _ _ _ _
   C _ _ R _ _ O _ _
   C _ R _ _ O _ _ _

   Pool: A, A, A, A, A, B, B, C, C, D, D, E, H, I, N, P, R, R, T, T

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4. Government Hackers

There have been a series of instances where someone has been hacking into government computer systems. Based on evidence gathered from the NSA, CIA and FBI the detectives believe that a pair of hackers, working together, has been performing the crimes. The detectives have been able to identify five suspects, of which they're sure two of them are the pair of hackers. They have allowed the five suspects to make two statements each. One of the guilty hackers makes two true statements. The other guilty hacker makes two false statements. Little is known about the truthfulness of the statements made by the other three suspects. Using the statements below, which two are the hackers?

Suspect A:
I haven't hacked into any government systems.
B is innocent

Suspect B:
I am innocent.
E's first statement is false.

Suspect C:
I have no idea who the guilty ones are.
D's statements are both false.

Suspect D:
C's second statement is not true.
A is not guilty.

Suspect E:
A and B are the hackers you're looking for.
At least one of D's statements is true.

5. Find the Length

The width of a rectangle is 20cm. The diagonal is 8cm more than the length. Find the length (cm) of the rectangle.

6. Paper Towels

What is the maximum number of times a paper towel can be folded in half by hand?

DKC^3 2020 - Word Problems

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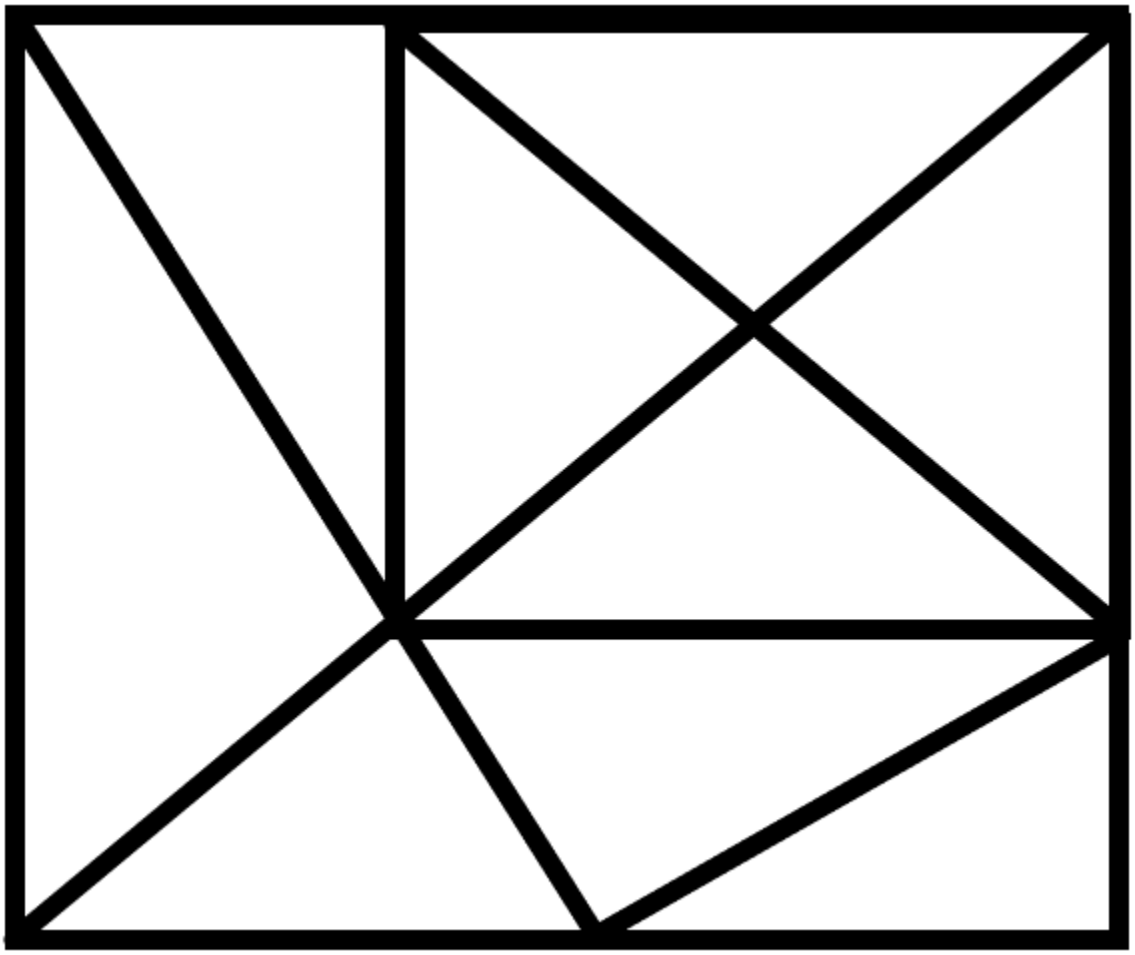
7. Triangles

How many triangles are there?



8. The Birds and the Trees

There are 2 trees in a garden – an Oak and a Maple. On both trees are some birds.

The birds perched on the Oak say to the birds perched on the Maple that if two of you come to our tree, then our population will be 4 times that of yours.

Then the birds in the Maple tree say to the birds in the Oak tree that if one of you comes over here, then our population will be two-thirds that of yours.

How many birds are in each tree?

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9. Softball Scores

A softball team played ten games, scoring 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 runs. They lost by one run in exactly five games. In each of the other games, they scored twice as many runs as their opponent. How many total runs did their opponents score?

10. Air Travel

There are two planes. One is flying from New York to Tokyo at a speed of 800 MPH. The other is flying from Tokyo to New York at a speed of 700 MPH. When the planes meet, which one will be closer to Tokyo?

11. Five-Letter Word

I am a five-letter word.
Remove one letter, and my meaning remains.
Remove another and I remain the same.
What word am I?

12. Chalk Math

Your teacher has a total of 16 full-sized pieces of chalk. When a piece of chalk is reduced to 1/4 of its original size, it gets too small for her to hold for writing, and so she sets that piece aside. But your teacher hates wasting things, so when she realizes that she has enough of these small pieces to join together and make another full-sized piece of chalk, she joins them and uses the new piece of chalk. If she uses one piece of chalk each day, how many days would the 16 pieces of chalk last?

13. Perfect Square

Find the largest perfect square that divides 14!

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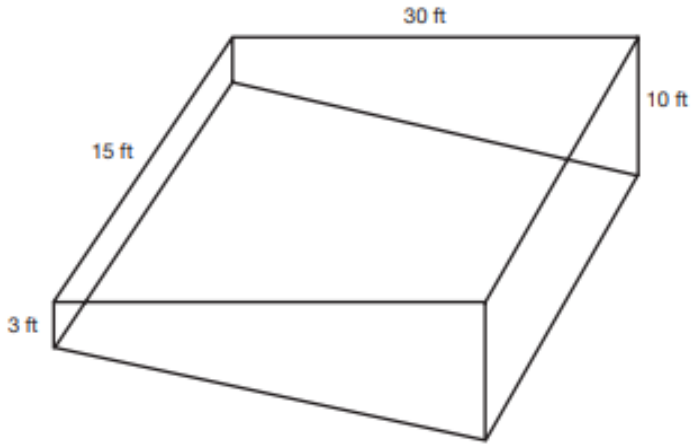
14. In-ground Pool

An inground pool is filling with water. The shallow end is 3ft deep and gradually slopes to the deepest end, which is 10ft deep. The width of the pool is 15ft and the length is 30ft. What is the volume (ft^3) of the pool?

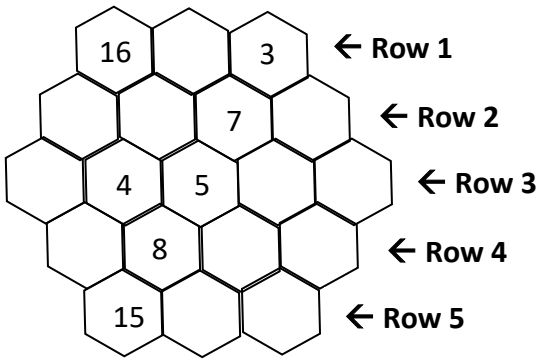


15. Unique Number

What is unique about 8549176320?

16. Hexagon Sudoku

Fill in the missing numbers so that every column or diagonal has the same sum. You can only use the numbers from 1 to 19 inclusive and can use no number more than once.



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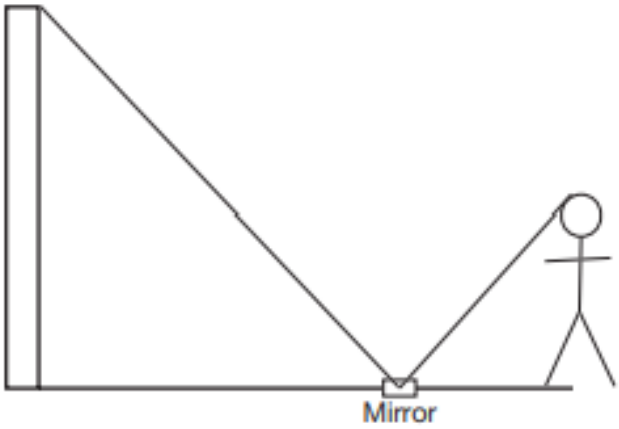
17. In the Mirror

One method of finding the height of an object is to place a mirror on the ground and then position yourself so that the top of the object can be seen in the mirror. How high is a structure in meters if a person who is 160cm tall observes the top of a structure when the mirror is 100m from the structure and the person is 8m from the mirror?



18. Smallest Number

Find the smallest number with the following properties. What is the number?

When I divide it by 2, the remainder is 1.
When I divide it by 3, the remainder is 2.
When I divide it by 4, the remainder is 3.
When I divide it by 5, the remainder is 4.
When I divide it by 6, the remainder is 5.
When I divide it by 7, the remainder is 6.
When I divide it by 8, the remainder is 7.
When I divide it by 9, the remainder is 8.
When I divide it by 10, the remainder is 9.

19. Solve the Equalities

Using the digits 1-9 exactly once each, fill in the blanks below so that both equalities are true.

□□ * □ = □□

□ * □ = □□

DKC^3 2020 - Word Problems

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20. Farmer Bob

Farmer Bob is trying to figure out how much Anhydrous Ammonia (NH3) he wants to side dress (apply) next to his corn. NH3, like most fertilizers, has an N-P-K specification. This represents the proportion of the fertilizer (by weight) that adds Nitrogen, Phosphorus, and Potassium to the soil. The N-P-K specification of common fertilizers used on Bob's field are:

Urea	46-0-0
Map	11-52-0
Potash	0-0-60
10-34-0	10-34-0
Riser	7-17-13
NH3	82-0-0

Urea, Map, Potash, and NH3 are sold and applied by weight. For example, if you apply 100 pounds per acre of Map, you will add 11 pounds of Nitrogen and 52 pounds of Phosphorus per acre to the field. 10-34-0 and Riser, on the other hand, are liquids that are typically sprayed in the seed furrow as the corn is planted. 10-34-0 weighs 11.7 pounds per gallon and Riser weighs 11 pounds per gallon.

Bob spread 105 pounds of Urea per acre, 105 pounds of Map per acre, and 100 pounds of Potash per acre before he planted his corn. He also sprayed 4 gallons per acre of 10-34-0 and 1 gallon per acre of Riser as he was planting his corn. How many pounds per acre of NH3 must Bob side dress next to his corn to achieve his goal of 135 pounds per acre of total Nitrogen added to his field?

21. Alphabet Groups

The first 22 letters of the alphabet are divided into 4 groups. Where would you place W, X, Y, and Z?

1. ACEMNORSUV
2. BDFHKLT
3. GPQ
4. IJ

22. Impossible Dollar

You are given n > 0 of each of the standard denomination US coins: 1¢, 5¢, 10¢, 25¢, 50¢, $1. What is the smallest n such that it is impossible to select n coins that make exactly a dollar?

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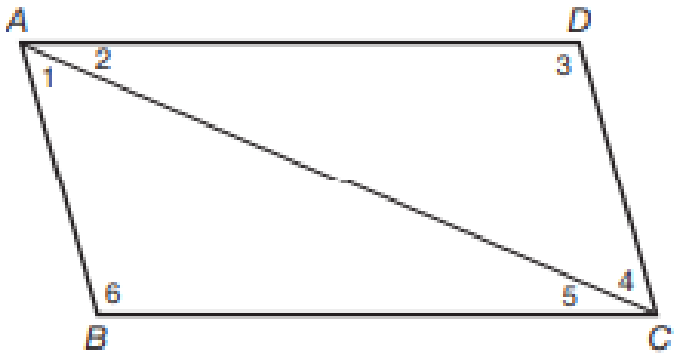
23. Find the Angle

Suppose ABCD is a parallelogram; ∠B = 120 and ∠2 = 40. Find m∠4.



24. Dog Food

You're watching someone's dog, but sadly they forgot to give you the dog food. There's a store nearby that offers four different size bags of dog food. 5lbs at $1.40/lb, 7.5lbs at $1.60/lb, 10lbs at $1.10/lb, and 12lbs at $0.94/lb. The dog is staying with you for 7 days and eats three 1/4 lb meals per day. You don't have a dog so assuming all leftover dog food is wasted, what size bag should you buy to feed the dog while spending the least amount of money?

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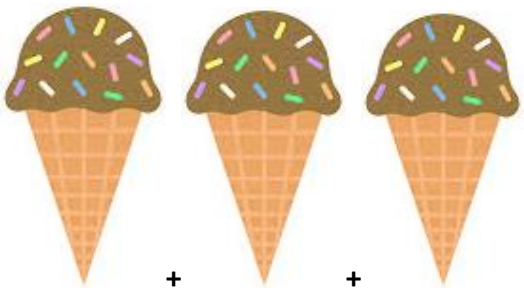
25. Ice Cream Algebra

Given the following equations, what does the cherry equal?



+ + = 69

/ = 23

+ + = 13

+ = 7

= 25