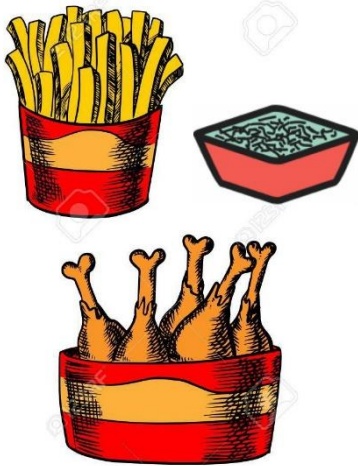


SPECIAL June 2020 – PUZZLES Number 9

Logic & Maths

1. The works picnic lunch is being catered by a chicken takeaway shop.



There are cartons of chips, cartons of chicken pieces, and cartons of coleslaw.

Everyone gets their own carton of chips.

Each carton of chicken pieces is shared between two people.

Each carton of coleslaw is shared between three people.

There is no waste and no leftovers.

A total of one hundred and forty three cartons is supplied.

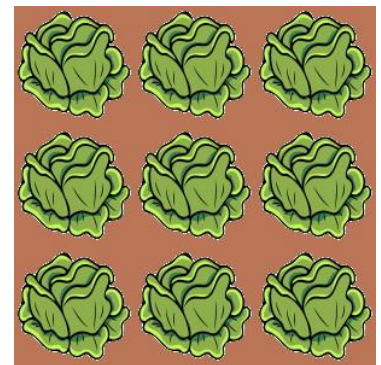
How many picnickers are there?

2. A farmer always grows his cabbages in square plots as shown.

In 2020 he plans to grow 29 more cabbages than he did in 2019.

(a) How many cabbages did he grow in 2019?

(b) How many cabbages will he expect to grow in 2020?



3. Another farmer has four sacks of produce which he wishes to weigh. However, as his scales are more accurate for heavier weights, he decides to weigh every possible combination of two of the four sacks; the results of this are: 7 kg, 10 kg, 11 kg, 12 kg, 13 kg and 16 kg

Given that each sack had a different weight to the other sacks and each sack had a weight which was a whole number of kilograms, what was the weight of each sack?

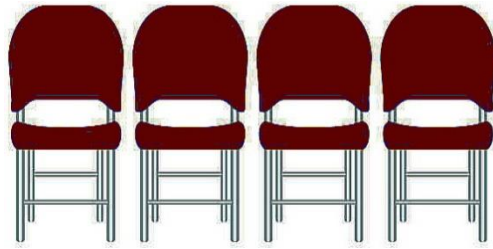
4. At the end of 2016 Walter was half as old as his grandmother. The sum of the years in which they were born is 3927. How old was Walter at the end of 2019?

5. Bob drove to work at an average 60 km/h for 20 minutes until a traffic snarl half way to work caused him to stop for 15 minutes, after which he completed his trip at an average 80 km/h.

(a) How long in minutes did his journey take?

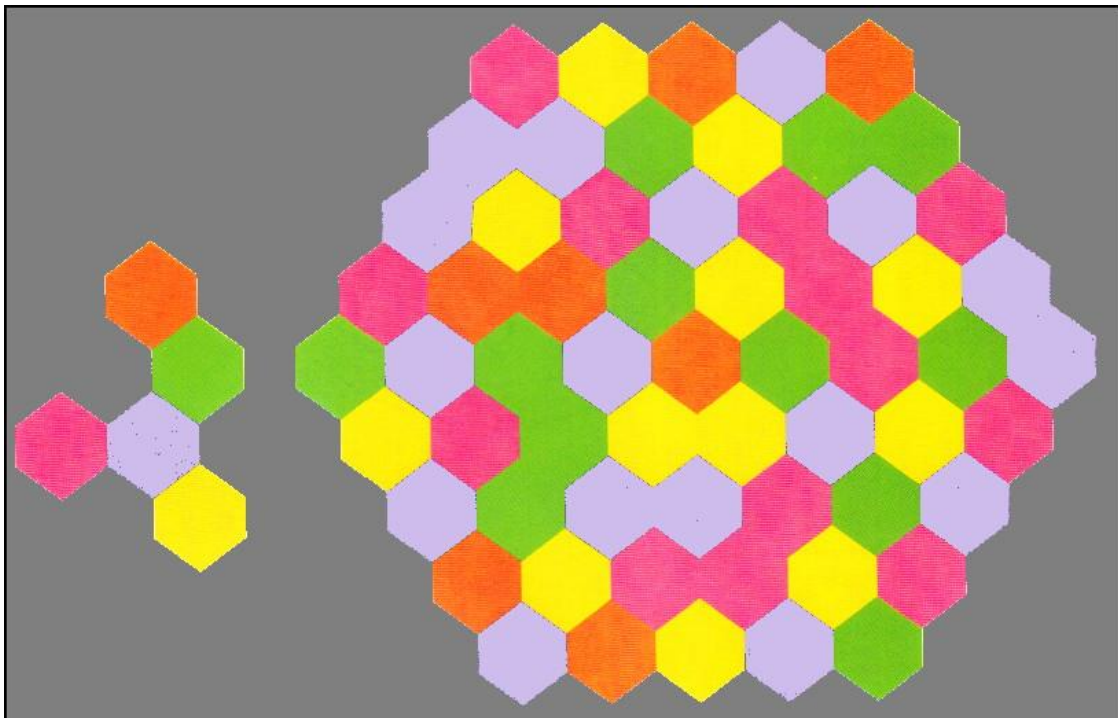
(b) What was his average speed for the whole trip?

6. Chas and Dave insist on sitting next to each other; Alf and Bill don't mind where they sit, except that Bill prefers to sit to Dave's immediate right.



Taking all these preferences into account, how many different ways can you sit Alf, Bill, Chas and Dave in four seats in a line from left to right?

7.



How many times can you find the sequence on the left in the large pattern on the right?

It can be rotated, but not reflected (flipped or mirror-image)

8.



You have three bags, each containing two marbles. Bag A contains two white marbles, Bag B contains two black marbles, and Bag C contains one white marble and one black marble.

You pick a random bag and take out one marble. It is a white marble.

What is the probability that the remaining marble from the same bag is also white?

9. The proprietor of a travelling medicine show sells six products, each in a different size bottle.

The six bottles contain respectively 30 fluid ounces, 32 fluid ounces, 36 fluid ounces, 38 fluid ounces, 40 fluid ounces and 62 fluid ounces of liquid.

Of those six different size bottles, five contain medicine for internal consumption; one contains paint remover.

The first customer purchases two bottles of medicine. The second customer purchases exactly twice the volume of medicine as the first customer. Which bottle contains the paint remover?



10. In Molly's home aquarium she has a total of 560 fish, but only four kinds.

If she had ten goldfish less, she would have twice as many goldfish as she has tetras. If she had ten tetras less she would have three tetras for every barb, and she has two-and-one-half barbs to every daino.

- a. How many barbs does she have?
- b. How many dainos does she have?
- c. If she swapped 75% of her tetras for seven goldfish per tetra, how many fish would she then have in total?

(Answers and solutions commence on the next page)

ANSWERS:

1. 78

This could be done by trial-and-error, made simpler by the fact that the number of picnickers must be a multiple of both two and three, AND that the number of cartons is directly proportional to the number of picnickers.

Try 30 picnickers: that would require 30 cartons of chips, 15 cartons of chicken pieces and 10 cartons of coleslaw = 55 cartons in all. That's too low: but can provide the correct answer by multiplying 30 by 143 and dividing by 55.

Another arithmetical approach is to let the number of picnickers be p .

The total number of cartons is therefore $p + \frac{1}{3}p + \frac{1}{2}p = \frac{11p}{6}$

$$\frac{11p}{6} = 143$$

$$p = \frac{6 \times 143}{11} = 78$$

2. (a) 196 [14 X 14] (b) 225 [15 X 15]

Trial-and-error is a reasonable approach given that the number of cabbages in the plot will always be a square number and that the difference between 2019's and 2020's answers is modest enough for the number of cabbages on a side to be fairly small. (It's also a fact that if the difference between squares is an odd number then the two squares must be an odd number squared and an even number squared.)

Try number of 2019 cabbages =	Then the number of 2020 cabbages =	Is the number of 2020 cabbages a square number?
25	54	no
36	65	no
49	78	no
64	93	no
81	110	no
100	129	no
121	150	no
144	173	no
169	198	no
196	225	Yes (15 X 15)

If the number of 2019 cabbages was 225, the number of 2020 cabbages would have to be at least 256 which is 31 higher (exceeds limit of 29). Therefore there are no possible answers bigger than 196 and 225

3. 3 kg, 4 kg, 7 kg and 9 kg

In order from lightest to heaviest, call the sacks A, B, C and D

The two lightest sacks had a total weight of 7 kg

$$A + B = 7$$

Possible weights are: $A=1, B = 6$; or $A = 2, B = 5$; or $A = 3, B=4$

The most A can weigh is 3 kg; the least B can weigh is 4 kg.

The two heaviest sacks (C & D) had a total weight of 16 kg.

C must weigh at least 1 more kg than B, so the least C can weigh is 5 kg; the most D can weigh is 11 kg.

Possible weights are: $C = 5, D = 11$; or $C = 6, D = 10$; or $C = 7, D = 9$;

If $A = 1$ and $B = 6$, then $C = 7, D = 9$

$A + C = 8$ (not possible)

So A is greater than 1

If $A = 2$ and $B = 5$, C could be 6 and $D = 10$ OR C could be 7 and D could be 9

$A + C = 8$ (not possible)

$A + C = 9$ (not possible)

So A is greater than 2

A must be 3 and B must be 4; C can't be 5 because $A + C$ would be 8, which is not possible. C can't be 6 because $A + C$ would be 9 which is not possible.

C could be 7 in which case D would be 9. But C can't be more than 7 because $C + D = 16$ and D is larger than C

So A must be 3, B must be 4, C must be 7 and D must be 9

4. 38

Algebraic Solution: (Trial & Error might be easier!)

Let Walter's birth year = b

Walter is therefore $(2016 - b)$ years old in 2016

His grandmother is $2 \times (2016 - b) = (4032 - 2b)$ years old in 2016.

Her birth year is therefore $2016 - 4032 + 2b = -2016 + 2b$

The sum of their birth years is 3927

$b - 2016 + 2b = 3927$

$3b = 5943$

$b = 1981$

Walter was born in 1981 and was 35 years old in 2016

He will be 38 at the end of 2019

5. (a) 50 min (b) 48 km/h

If Bob drove the first 20 minutes at 60 km/h, he travelled 20 km.

If this is half-way, the full distance to work is therefore 40 km.

The last half of his trip (20 km) was done at 80 km/h and was therefore covered in 15 minutes

(a) His trip took $(20 + 15 + 15) = 50$ minutes.

(b) average speed for the whole trip in km/h is given by (distance in km) divided by (time in hours)

= 40 divided by five sixths

= 40 multiplied by six fifths

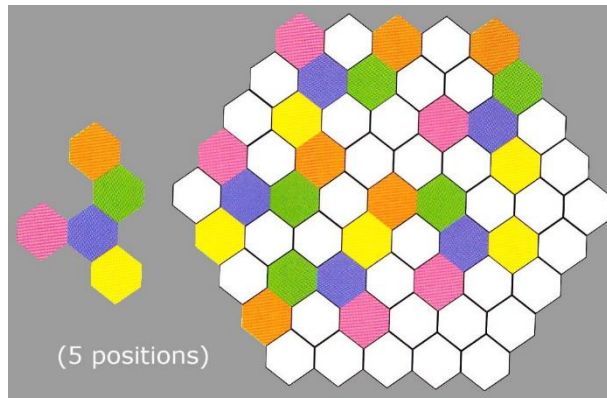
= 48 km/h

6. 2 ways

It's easiest to have BILL always sitting on DAVE's immediate right, then considering all the remaining possibilities for ALF and CHAS

LEFT	DAVE	BILL	ALF	CHAS	X	RIGHT
	DAVE	BILL	CHAS	ALF	X	
	ALF	DAVE	BILL	CHAS	X	
	CHAS	DAVE	BILL	ALF	✓	
	ALF	CHAS	DAVE	BILL	✓	
	CHAS	ALF	DAVE	BILL	X	

7. 5 positions



8. Two thirds.

The answer is $\frac{2}{3}$ (not $\frac{1}{2}$, which is the most common wrong answer)

You know that you did not get the first marble from Bag B (two black marbles) so there are three possibilities remaining

- [1] You chose Bag A, first white marble; the other marble will be white.
- [2] You chose Bag A, second white marble. The other marble will be white
- [3] You chose Bag C, the white marble. The other marble will be black

So 2 out of 3 remaining possibilities are white.

Why not $\frac{1}{2}$? You are selecting marbles, not bags.

Note: This puzzle crops up a lot on the internet; there are various useful explanations to illustrate why the correct answer is $\frac{2}{3}$ and not $\frac{1}{2}$. Just search "You have three bags, each containing two marbles."

9. The paint remover is in the 40 fluid ounce bottle

This can be answered by trial-and-error but there is a simple mathematical shortcut.

If the second customer buys exactly twice the volume as the first customer, their total purchase must be a whole number divisible by 3

The total volume of all six bottles is $30 + 32 + 36 + 38 + 40 + 62 = 238$

Paint remover	Other 5 bottles	Divisible by 3?	Possible?
30	208	no	no
32	206	no	no
36	202	no	no
38	200	no	no
40	198	yes	yes
62	176	no	no

(1st customer purchased 30 + 36 fl oz bottles; 2nd purchased 32, 38 & 62 fl oz)

10. a. 50 barbs b. 20 dainos c. 1280 fish

(Trial & Error solution)

The number of barbs, tetras and goldfish are set mathematically by a smaller number of dainos

What number of dainos are required to produce a total of 560 fish?

Dainos	Barbs	Tetras - 10	Tetras	Goldfish - 10	Goldfish	Total = 560
Try 2	5	15	25	50	60	92 (way too few)
Try 6	15	45	55	110	120	196 (too few)
Try 20	50	150	160	320	330	560 ✓