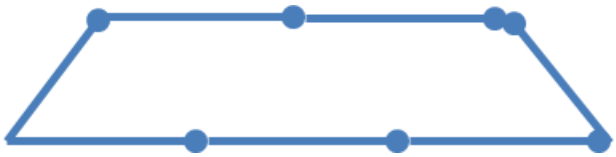
Problem No. 1
N is a natural number between 1 and 20, such that the sum of the numbers from 1 to N equals the sum of the numbers from N+1 to 20. What is the value of N?

Problem No. 2
A list of 5 positive integers has mean 5, mode 5, median 5 and range 5. How many different ordered lists may be formed?

Problem No. 3



Seven matchsticks of equal length are placed end-to-end, as illustrated, to form a rhombus.
By relocating 3 matchsticks exactly 2 equilateral triangles may be formed (all 7 matchsticks are used).
In how many ways may this be done?

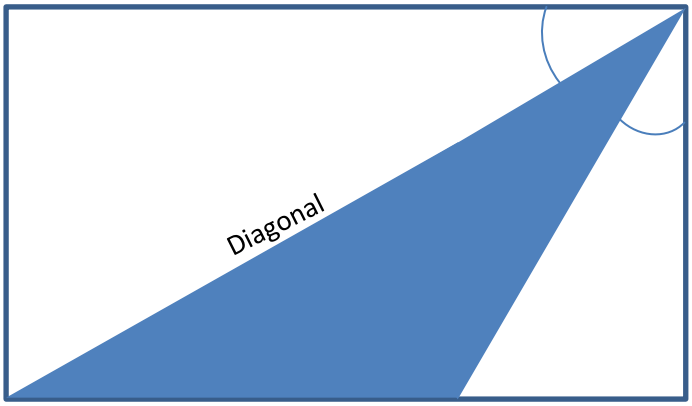
Problem No. 4
If you were to write down all of the numbers that could be produced by changing one digit in the number 300, how many of the numbers formed are prime?

Problem No. 5
$2025 = a^b.c^d$. What is the minimum value of a+b+c+d? (where a, b, c, d are natural numbers)

Problem No. 6
A school TY class decides to design and sell school hoodies at Christmas as their business venture. They can buy hoodies at €30 each which they can purchase in bundles which are multiples of 20. Their research tells them that they will sell 100 hoodies only if they are priced at €75 each. They also find that each time they increase the price by €5 twenty fewer hoodies will be sold and that each time they reduce the price by €5 twenty more hoodies will be sold.
How many hoodies should be bought in order to maximise profit if only one order is made?

Problem No. 7
What is the maximum number of times that "Friday, the 13th of a month" can occur in a non-leap year?

Problem No. 8
A 90^{o} angle is trisected and a rectangle formed so that one of the trisectors is a diagonal (as shown). Find the ratio of the area of the shaded triangle to the area of the rectangle in its simplest form.

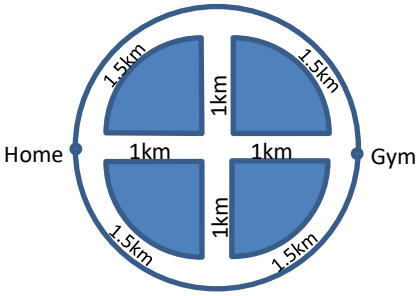


Problem No. 9
The numbers on many phones which are not smart-phones (sometimes known as button phones) use a keypad with the **ITU E.161 standard**. This may allow text messages to be sent on these phones. A student presses two different such keys (of those which produce letters) at random giving only 3 presses in total.
What is the probability that the combination of letters produced starts with a vowel?
Give your answer fully in decimal form.

Problem No. 10
Hugo and Naoise are members of their local youth club. Both take part in a chess competition where they win a number of league points for a win, a lesser number for a draw and no points for a loss. After 10 games, Hugo has scored 44 points for winning 7 and drawing 3 of his games. Meanwhile, Naoise has won 5, drawn 3 and lost 2 of her games.
How many points has Naoise scored?

Problem No. 11
In a football (soccer) game the home team won by 5 goals to 4. The home team scored first and were never behind in the game. In how many ways could the goals have been scored?

Problem No. 12



Every day a jogger runs from Home to the Gym (see Diagram). There are 4 straight roads, each 1km in length, and 4 curved roads, each 1.5km in length.
His coach requires him to run **more** than 3km each day.
He decides to run a different path each day but never travelling twice on the same stretch of road on a given day. Any intersection point may be passed more than once except that when he reaches the Gym he must stop and enter.
On how many days can he run using a different route each day?

Problem No. 13
There are 20 sweets on a table. In a game two players take turns to choose some sweets, but must choose at least one but never more than half of what remains. The loser is the one who has no valid move. How many sweets should the first player choose on the first move to ensure that they may always win the game?
Give your explanation on a separate sheet.

Problem No. 14
At a fast-food outlet chicken nuggets are sold in boxes of either 6, 9 or 20 nuggets. What is the largest number of nuggets that cannot be purchased using these boxes?

Problem No. 15
Use each of the numbers 2, 3, 5, 7, 7, 9 once only and any mathematical symbols to make a total of 185.

Problem No. 16
A regular 11- sided polygon is inscribed in a circle, centre C. Triangles are drawn using 3 of the polygon's vertices to be vertices of each of the triangles. How many of the triangles formed will have the centre, C, within the triangle?

Problem No. 17
Place the numbers $\frac{1}{6}, \frac{1}{3,}, \frac{1}{2}, \frac{2}{3}, 1, \frac{3}{2}, 2, 3, 6$ in a 3 by 3 grid such that the products of the three numbers in the rows, columns and both diagonals multiply to give 1 in each case.

Problem No. 18
A train travelling at constant speed takes 12 seconds to pass completely through a tunnel 110 meters long and 15 seconds to pass completely through a tunnel 215 meters long. What is the speed of the train in kilometres per hour?

Problem No. 19
At the 2024 Paris Olympics Arshad Nadeem from Pakistan won a gold medal for his javelin throw. He also set a new Olympic Record for the distance thrown which was 92.97m.
See video
RTÉ Sport on X:
Assuming
1) that the acute angle at which the javelin landed was the same as the angle at release (the Release Angle is shown on the video at timestamp 0:25 – 00:29)
2) that the Release Height was the same as Nadeem's height and
3) that the javelin travels in a straight line for the short final part of its flight

how much of the distance thrown may be attributed to Nadeem's height?
Give the answer in metres correct to one decimal place.

Problem No. 20
A, B and C are three positive whole numbers such that

$$A.B.C = 240$$
$$A.C + B = 46$$
$$A + C.B = 64$$

Write down the value of A + B + C

Problem No. 21
Four ingredients – Honey, Olive oil, Vinegar and Lemon juice - are used to make a salad dressing with the following instructions:

18 parts must not contain honey
16 parts must not contain olive oil
14 parts must not contain vinegar
15 parts must not contain lemon juice

In what ratio of parts are the ingredients used? Give the ratio numbers in the form
Honey : Olive oil : Vinegar : Lemon juice.

Problem No. 22
A signpost on a motorway indicates that there are two towns at different distances further ahead. Both of the distances are square numbers. Having travelled a number of kilometres, the next signpost shows the distances to both towns are, again, square numbers. Later again, having travelled 120 km from the first signpost a third signpost shows the distances ahead to the two towns to be square numbers. What distances are displayed on the first signpost?
Give your explanation on a separate sheet.

Problem No. 23
The letters x, y, z stand for non-zero digits. The positive integer xyz is a multiple of 3;
the positive integer zyxyz is a multiple of 15 and the positive integer xyzyx is a multiple of 8.
What is the integer xyz?

Problem No. 24
I need to paint each face of a cube in a different colour from a selection of 6 colours.
How many different outcomes may I have?

Problem No. 25
I have four digits but no zero will you find.
One score is their total when in that frame of mind.
My fourth, for example, though greater than the third
Is still small by half when to my second compared.
Minimal difference between first and second persists
Though no repetition of digits in my number exists.

What number am I?

Problem No. 26
On the Engineers Ireland website what is Justine Butler's essential skill that can inhibit or boost a career?