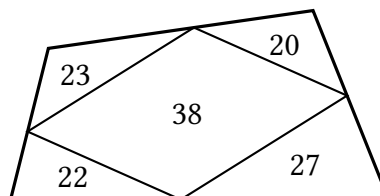




Problem 1

A quadrilateral is divided into four triangles and a smaller quadrilateral as shown in the figure. The numbers in the figure indicate the circumference of each smaller part. What is the circumference of the large quadrilateral?



- A 54 B 56 C 73 D 80 E 92

Problem 2

Which expression equals $\frac{a\sqrt{ab^4}}{(\sqrt{ab})^3}$ (assuming $a > 0$ and $b > 0$)?

- A 1 B \sqrt{a} C \sqrt{b} D $\sqrt{a^3b}$ E $\frac{b}{a}$

Problem 3

What is the value of $\sqrt[3]{100}$ rounded to the nearest integer?

- A 3 B 4 C 5 D 6 E 7

Problem 4

How many numbers n with $1 < n < 1000$ are both the square of an integer and the third power of an integer?

- A 0 B 1 C 2 D 3 E More than 3

Problem 5

In Pål's sock drawer there are twelve socks. Three of them are blue, four are red, and five are yellow. In the morning he pulls out two of them at random and puts them on. What is the probability that he finds a pair of equal coloured socks?

- A $\frac{17}{60}$ B $\frac{2}{5}$ C $\frac{11}{41}$ D $\frac{1}{2}$ E $\frac{19}{66}$



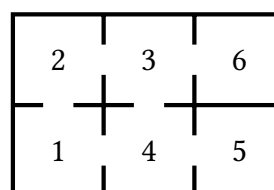
Problem 6

How many integers a have the property that the equations $x^2 + y^2 = 1$ and $x + y = a$ have at least one common solution with real numbers x and y ?

- A 0 B 1 C 2 D 3 E Infinitely many

Problem 7

A lab rat lives in a box with six rooms. There are openings between some of the rooms, as shown in the figure. One day the rat wakes up in room number 1, and moves 2022 times from one room to a neighbouring room. Where can it possibly have ended up at the end of the day?



- A Any of the six rooms B Room 1, 3, or 5 C Room 2, 4, or 5
D Room 2, 4, or 6 E Room 1, 3, or 6

Problem 8

What does the expression $\frac{\frac{\sqrt{6}}{\sqrt{3}-\sqrt{2}} - \frac{\sqrt{3}}{2-\sqrt{3}}}{\sqrt{2}-1}$ equal?

- A 2 B 3 C $\sqrt{6}$ D $2\sqrt{3}$ E $3\sqrt{2}$

Problem 9

Two real numbers a and b satisfy $3^a = 4^b = 6$.
What is the value of $(a-1)(2b-1)$?

- A 1 B $\sqrt{6}$ C $2\sqrt{3}$ D 6 E Neither of these

Problem 10

Herman is playing with building blocks. He has two red, two blue, and two yellow blocks, and wants to build a tower by stacking all the blocks atop each other. In how many ways can he do so?

- A 30 B 36 C 45 D 70 E 90



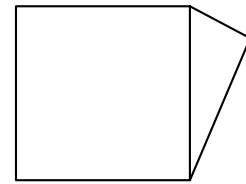
Problem 11

Three positive integers a , b , and c satisfy $a^2 + b^3 + c^3 = 100$. What is $ab + bc + ca$?

- A 24 B 33 C 40 D 47 E 56

Problem 12

The figure shows a square and a right triangle, together forming an irregular pentagon. The square has area 529, while the triangle has area 108. What is the circumference of the pentagon?



- A 92 B 96 C 98 D 100 E 102

Problem 13

Nils writes the numbers 1, 4, 7, 10, ..., 397, 400 on a blackboard. Then he wipes out all those that are divisible by 5. How many numbers remain on the blackboard?

- A 53 B 54 C 94 D 103 E 107

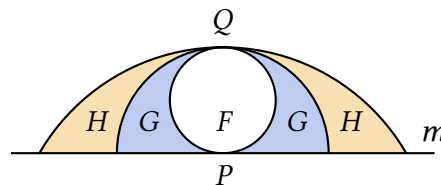
Problem 14

The number 2022 is written using exactly two digits. How many of the numbers 1000, 1001, 1002, ..., 9999 have this property?

- A 315 B 567 C 630 D 648 E 1260

Problem 15

A circle of radius 1 is tangent to a line m in a point P . Two circular arcs, of radius 2 and 4 respectively, have end points on m , and are tangent to the circle in the point Q diametrically opposite P on the circle.



The circle has area F , while the blue and the beige region in the figure have area G and H , respectively. Which statement is true?

- A $F = G < H$ B $F = G = H$ C $F = G > H$ D $F > G > H$
E $F < G < H$



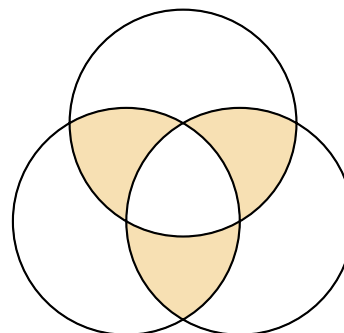
Problem 16

The sum of three different positive integers is a prime number, and their product equals 1024. What is the largest of the three numbers?

- A 64 B 128 C 192 D 256 E 512

Problem 17

Three circles all have radius 1. The centre of each lies on an intersection between the other two circles. How large is the area that lies within two circles, but not within all three?

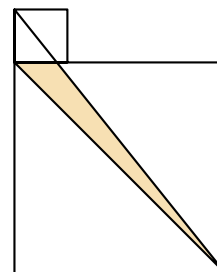


- A $\frac{\pi}{3} + \frac{\sqrt{3}}{4}$ B $\frac{\pi}{6} + \frac{\sqrt{3}}{2}$ C $\frac{3\pi}{4} - \frac{3\sqrt{3}}{8}$
D $\frac{2\pi}{3}$ E $\frac{\pi}{2}$

Problem 18

Both the smallest square and the filled triangle have area 1. What is the area of the larger square?

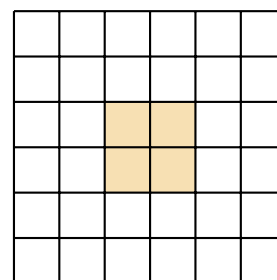
- A $2 + 2\sqrt{5}$ B $6 - \sqrt{3}$ C $3 + 3\sqrt{2}$
D $5\sqrt{2} - 2$ E $4 + 2\sqrt{3}$



Problem 19

How many rectangles in the figure do not contain any of the filled squares?

- A 216 B 324 C 360 D 441 E 882



Problem 20

Nils bought three kinds of sandwiches for his class, one for each pupil. He paid 1993 kr, and we know that the price of the three kinds of sandwiches is 77 kr, 91 kr, and 143 kr, respectively. How many pupils are in the class?

- A 18 B 19 C 20 D 21 E 22