



Till läraren

Välkommen till Kängurutävlingen – Matematikens hopp 2022

Student

- Tävlingen genomförs under perioden 17 mars – 25 mars. *Uppgifterna får inte användas tidigare.*
- Sista dag för redovisning av antalet deltagare är den 1 april. Du får då tillgång till facit och ett kalkylblad där du matar in elevernas svar och sedan får du en sammanställning av klassens resultat.
- Redovisa resultatet senast 29 april.
- *Tävlingen är individuell* och eleverna får arbeta i 60 minuter. De tre delarna ska genomföras vid *ett och samma tillfälle.*
- Eleverna behöver ha tillgång till papper för att kunna göra anteckningar och figurer. Linjal behövs inte.
- *Miniräknare eller sax får inte användas. Observera att telefoner, datorplattor och datorer inte heller får användas.*
- Läs igenom problemen själv i förväg så att eventuella oklarheter kan redas ut.
- Kontrollera att kopiorna blir tillräckligt tydliga så att nödvändiga detaljer syns.
- Besök *Kängurusidan* på ncm.gu.se/kanguru där vi publicerar eventuella rättelser och ytterligare information. Där finns också information om hur kalkylbladet fungerar.
- Samla in problemformulären efter tävlingen. Problemen får inte spridas utanför klassrummet förrän efter 29 april, men ni får gärna arbeta med problemen i klassen.

Mikael Passares stipendium

Mikael Passare (1959–2011) var professor i matematik vid Stockholms universitet. Han hade ett stort intresse för matematikundervisning på alla nivåer och var den som tog initiativ till Kängurutävlingen i Sverige. Mikael Passares minnesfond har instiftat ett stipendium för att uppmärksamma elevers goda matematikprestationer. Information om hur du nominerar elever kommer tillsammans med facit och kommentarer.

Lycka till med årets Känguru!

e-post: kanguru@ncm.gu.se

För administrativa frågor, vänd dig till Ann-Charlotte Forslund:

Ann-Charlotte.Forslund@ncm.gu.se

031–786 69 85

För innehållsfrågor, vänd dig till Ulrica Dahlberg eller Johan Häggström:

ulrica.dahlberg@ncm.gu.se

johan.haggstrom@ncm.gu.se



Svarsblankett

Markera ditt svar i rätt ruta

Uppgift	A	B	C	D	E	Poäng
1						
2						
3						
4						
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SUMMA						

Namn:.....

Klass:.....

Kängurutävlingen – Matematikens hopp 2022

Student



Three points problem

- 1 On Henry's smartphone, the diagram shows how much time he spent last week on each of his apps. The apps are ordered from greatest to least time spent. This week, he spent exactly the same amount of time as last week on two of his apps, but only half as much time on the other two.



Which of the diagrams below cannot be the diagram for this week?



[Germany]

- 2 How many positive three-digit integers are divisible by 13?

A 68 B 69 C 70 D 76 E 77

[Hong Kong]

- 3 Bella is older than Charlie and younger than Lily. Teddy is older than Bella. Which two people could be the same age?

A Charlie and Teddy B Teddy and Lily C Lily and Charlie
D Bella and Lily E Teddy and Bella

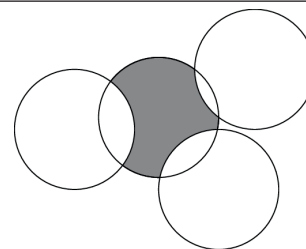
[Korea]

- 4 The product of the digits of a 10-digit integer is 15. What is the sum of the digits of this number?

A 8 B 12 C 15 D 16 E 20

[Greece]

- 5 Four circles, each of radius 1, intersects as shown. What is the perimeter of the shaded region?



A π B Some number between $\frac{3\pi}{2}$ and 2π C $\frac{3\pi}{2}$ D 2π E π^2

[Greece]



- 6 David writes, in increasing order, all the integers from 2 to 2022 which use only 0s and 2s. What is the number in the middle of his list?

A 200 B 220 C 222 D 2000 E 2002

[France]

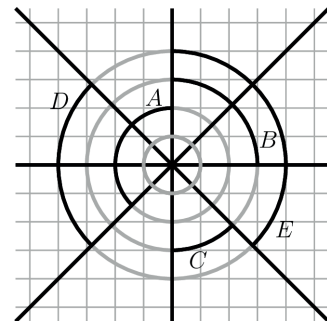
- 7 How many real solutions does the equation $(x - 2)^2 + (x + 2)^2 = 0$ have?

A 0 B 1 C 2 D 3 E 4

[Austria]

- 8 Four lines intersect forming eight equal angles.

Which black arc has the same length as the small grey circle?



A A B B C C D D E E

[Malaysia]

Four points problem

- 9 Let a, b, c be non-zero numbers. The numbers $-2a^4b^3c^2$ and $3a^3b^5c^{-4}$ have the same sign. Which of the following is definitely true?

A $ab > 0$ B $b < 0$ C $c > 0$ D $bc > 0$ E $a < 0$

[Greece]

- 10 The diagram shows a line with four marked points A, B, C and D .



The distance between A and C is 12 cm and between B and D , 18 cm.

What is the distance between the midpoint of AB and the midpoint of CD ?

A 15 cm B 12 cm C 18 cm D 6 cm E 9 cm

[Catalonia]

- 11 When Tony looks at the water meter in his bathroom, he notices that all the digits on the meter are different. How much water will be used until the next time all the digits on the meter are different?

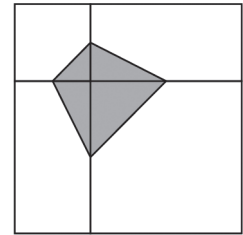


A $0,006\text{ m}^3$ B $0,034\text{ m}^3$ C $0,086\text{ m}^3$ D $0,137\text{ m}^3$ E $1,048\text{ m}^3$

[Germany]



- 12 A large square is divided into two unequal squares and two equal rectangles, as shown. The vertices of the shaded quadrilateral are the midpoints of the sides of the two squares. The area of the shaded quadrilateral is 3.



What is the area of the unshaded part of the large square?

- A 12 B 15 C 18 D 21 E 24

[Brazil]

- 13 What is the greatest common divisor of $2^{2021} + 2^{2022}$ and $3^{2021} + 3^{2022}$?

- A 2^{2021} B 1 C 2 D 6 E 12

[France]

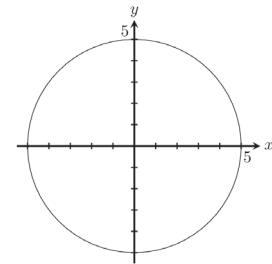
- 14 Five numbers have a mean of 24. The mean of the three smallest numbers is 19 and the mean of the three largest numbers is 28. What is the median of the five numbers?

- A 20 B 21 C 22 D 23 E 24

[UK]

- 15 A circle with centre $(0, 0)$ has radius 5.

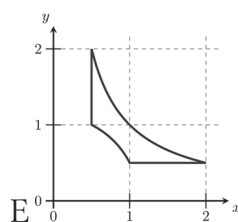
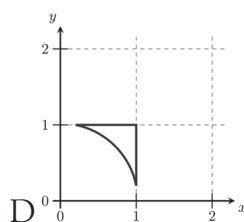
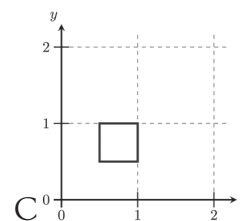
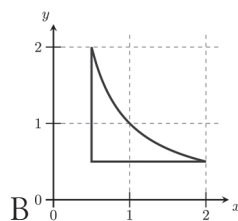
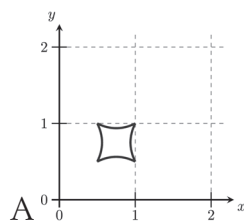
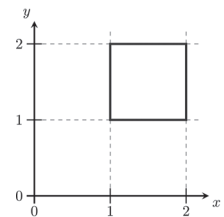
At how many points on the perimeter of the circle are both coordinates integers?



- A 5 B 8 C 12 D 16 E 20

[Finland]

- 16 A square lies in a coordinate system, as shown. Each point (x, y) on the square is moved to $(\frac{1}{x}, \frac{1}{y})$. What will the resulting figure look like?

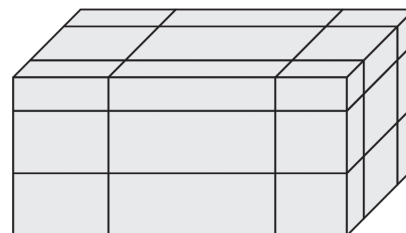


[Finland]



Five points problem

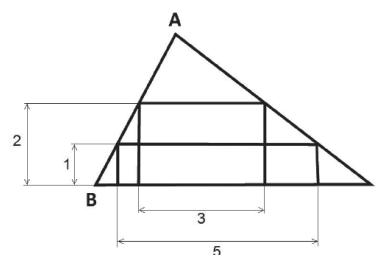
- 17 A cuboid of surface area S is cut by six planes, as shown. Each plane is parallel to a face, but its distance from the face is random. Now the cuboid is separated in 27 smaller parts. What, in terms of S , is the total surface area of all 27 smaller parts?



- A $2S$ B $\frac{5}{2}S$ C $3S$ D $4S$ E none of the previous

[Greece]

- 18 Two rectangles are inscribed inside a triangle ABC . The dimensions of the rectangles are 1×5 and 2×3 , respectively, as shown. What is the height of the triangle with base BC ?



- A 3 B $\frac{7}{2}$ C $\frac{8}{3}$ D $\frac{16}{5}$ E none of the previous

[Greece]

- 19 A rectangle is divided into 11 smaller rectangles, as shown. All 11 rectangles are similar to the original large rectangle. The orientation of the smallest rectangles is the same as the largest. The length of the base of the smallest rectangle is 1. What is the perimeter of the large rectangle?



- A 20 B 24 C 27 D 30 E 36

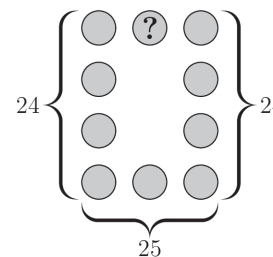
[Australia]

- 20 How many positive three-digit integers are there that are equal to five times the product of their digits?

- A 1 B 2 C 3 D 4 E 5

[Tokelau]

- 21 The numbers 1 to 10 are placed, once each, in the circles of the figure shown. The sum of the numbers in the left column is 24; the sum of the numbers in the right column is also 24 and the sum of the numbers in the bottom row is 25. What number is in the circle containing the question mark?



- A 2 B 4 C 5 D 6 E none of the previous

[Greece]



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- 22 The vertices of a 20-gon are numbered from 1 to 20 in such a way that the numbers of adjacent vertices differ by either 1 or 2. The sides of the 20-gon whose ends differ by only 1 are coloured red.

How many red sides are there?

- A 1 B 2 C 5 D 10 E there are multiple possibilities

[Mexico]

- 23 Martina is playing in an 8 player tournament. She knows she will beat everyone except Ash, who will beat everybody. In the first round, players are organised randomly into four pairs, and the winner of each match proceeds to the second round. In the second round, there are two matches with random pairs and the winners of these matches proceed to the final.

What is the probability that Martina does not get to the final?

- A 1 B $\frac{1}{2}$ C $\frac{2}{7}$ D $\frac{3}{7}$ E $\frac{4}{7}$

[Italy]

- 24 Let N be a positive integer.

How many integers are there between $\sqrt{N^2+N+1}$ och $\sqrt{9N^2+N+1}$?

- A $N+1$ B $2N-1$ C $2N$ D $2N+1$ E $3N$

[Greece]
