Till läraren

Välkommen till Kängurutävlingen – Matematikens hopp 2023
Junior

- Tävlingen genomförs under perioden 16 mars – 24 mars. *Uppgifterna får inte användas tidigare.*
- Sista dag för redovisning av antalet deltagare är den *31 mars.* 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 *28 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 28 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						
5						
6						
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					SUMMA	

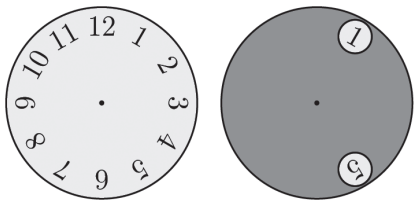
Namn:.....

Klass:.....

Kängurutävlingen – Matematikens hopp 2023
Junior

Three points problems

1 A grey circle with two holes is put on top of a clock-face, as shown.

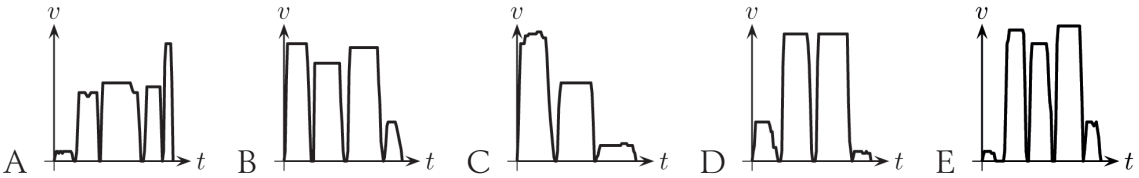


The grey circle is turned around the centre such that the number 10 appears in one hole. Which numbers is it possible to see in the other hole?

A 2 and 6 B 3 and 7 C 3 and 6 D 1 and 9 E 2 and 7

[Denmark]

2 Maria had to run to catch the subway, got off two stops later and then walked to school. Which of the following speed-time graphs would best represent her journey?



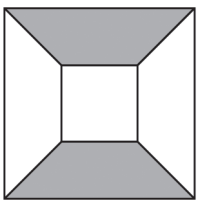
[Germany]

3 The positive integers m and n are both odd. Which of the following integers is also odd?

A $m(n+1)$ B $(m+1)\cdot(n+1)$ C $m+n+2$
D $m\cdot n+2$ E $m+n$

[Sweden]

4 A large square of side-length 10 cm contains a smaller square of side-length 4 cm, as shown in the diagram. The corresponding sides of the two squares are parallel.
What percentage of the large square is shaded?



A 25% B 30% C 40% D 42% E 45%

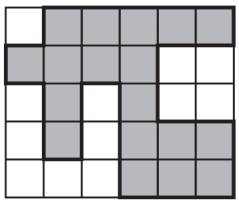
[Slovakia]

5 Today is Thursday. What day will it be in 2023 days' time?

A Tuesday B Wednesday C Thursday D Friday E Saturday

[Hungary]

6 The large rectangle in the diagram is divided into 30 equal squares, as shown. The perimeter of the shaded region is 240 cm.
What is the area of the rectangle?



A 480 cm^2 B 750 cm^2 C 1080 cm^2 D 1920 cm^2 E 2430 cm^2

[Mexico]

7 The ages of a family of five add to 80. The two youngest are 6 and 8. What was the sum of the ages of the family seven years ago?

A 35 B 36 C 45 D 46 E 66

[United Kingdom]

8 A wooden fence consists of a series of vertical planks, each joined to the next post by four horizontal planks. The first and last plank in the fence are vertical.
Which of the following could be the total number of planks in the fence?

A 95 B 96 C 97 D 98 E 99

[Italy]

Four points problems

9 The letters a and b are to be replaced by positive integers so that the equation is correct.
In how many different ways can this be done?

$$\frac{a}{5} = \frac{7}{b}$$

A 0 B 1 C 2 D 3 E 4

[Germany]

10 After having played 200 games of chess, my winning rate is exactly 49 %.
What is the smallest number of extra games I need to play to increase my winning rate to exactly 50 %?

A 0 B 1 C 2 D 3 E 4

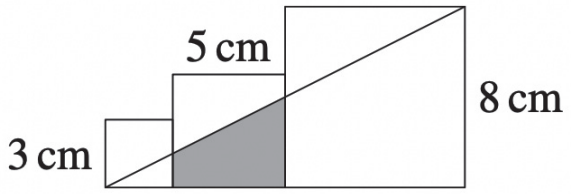
[Paraguay]

11 Jenni is trying to save water. She reduced the time she spent in her shower by a quarter. She also lowered the water pressure of her shower to reduce the rate the water comes out of the shower head by a quarter.
By what fraction did Jenni reduce the total amount of water she uses for a shower?

A by $\frac{1}{4}$ B by $\frac{3}{8}$ C by $\frac{5}{8}$ D by $\frac{5}{12}$ E by $\frac{7}{16}$

[Germany]

12 The diagram shows three squares of side-length 3 cm, 5 cm and 8 cm. What is the area, in cm^2, of the shaded trapezium?



A 13 B $\frac{55}{4}$ C $\frac{61}{4}$ D $\frac{65}{4}$ E $\frac{69}{4}$

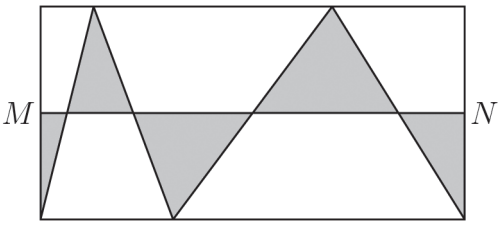
[United Kingdom]

13 A wire of length 95 m is cut into three pieces such that the length of each piece is 50 % more than the previous piece. What is the length of the largest piece?

A 36 m B 42 m C 45 m D 46 m E 48 m

[Catalonia]

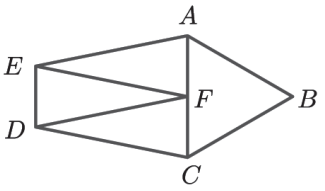
14 Points M and N are the midpoints of two sides of the rectangle. What fraction of the area of the rectangle is shaded?



A $\frac{1}{6}$ B $\frac{1}{5}$ C $\frac{1}{4}$ D $\frac{1}{3}$ E $\frac{1}{2}$

[Paraguay]

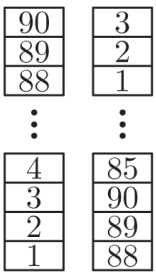
15 Pentagon $ABCDE$ is divided into four triangles with equal perimeter. Triangle ABC is equilateral and AEF, DFE and CDF are three identical isosceles triangles. What is the ratio of the perimeter of the pentagon $ABCDE$ to the perimeter of triangle ABC?



A $\frac{2}{1}$ B $\frac{3}{2}$ C $\frac{4}{3}$ D $\frac{5}{3}$ E $\frac{5}{2}$

[Catalonia]

16 On the table there is a tower made of blocks numbered from 1 to 90. Bob takes blocks from the top of the tower, three at a time, to build a new tower, as shown. When he has finished building the new tower, how many blocks will be between the blocks numbered 39 and 40?

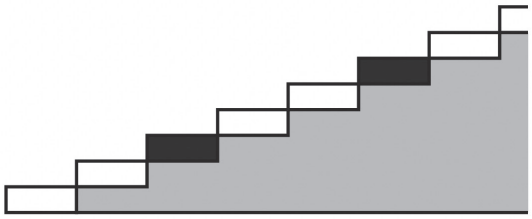


A 0 B 1 C 2 D 3 E 4

[Polaand]

Five points problems

17 Every third step of a staircase with 2023 steps is coloured black. The first seven steps are shown in the diagram. Anita walks up the steps one at a time, starting with either her right or left foot, alternating each step.



What is the smallest number of black steps she will step on with her right foot?

A 0 B 333 C 336 D 337 E 674

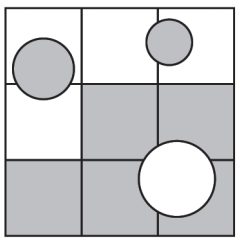
[Austria]

18 We call a two-digit number *power-less* if none of its digits can be written as an integer to a power greater than 1. For example, 53 is power-less, but 54 is NOT power-less since $4 = 2^2$.
Which of the following is a common divisor of the smallest and the largest power-less numbers?

A 3 B 5 C 7 D 11 E 13

[United Arab Emirates]

19 A square of side 30 cm is divided into nine identical smaller squares. The large square contains three circles with radii 5 cm (bottom right), 4 cm (top left) and 3 cm (top right), as shown.
What is the area of the shaded part?



A $400\ \text{cm}^2$ B $500\ \text{cm}^2$ C $(400+50\pi)\ \text{cm}^2$
D $(500-25\pi)\ \text{cm}^2$ E $(500+25\pi)\ \text{cm}^2$

[Greece]

20 Tim calculates the mean of five different prime numbers. His answer is an integer.
What is the smallest possible integer he could have obtained?

A 2 B 5 C 6 D 12 E 30

[Paraguay]

21 When it is given a list of four numbers, the Kangaroo Machine continues the list by typing the smallest non-negative integer that is different to each of the four preceding terms and then repeats this process over and over again. Jacob types in the numbers

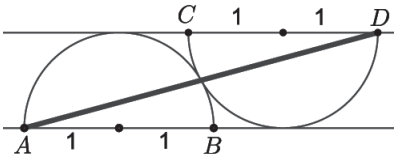
2, 0, 2, 3,

into the machine. What number will be the 2023rd in the list?

A 0 B 1 C 2 D 3 E 4

[Poland]

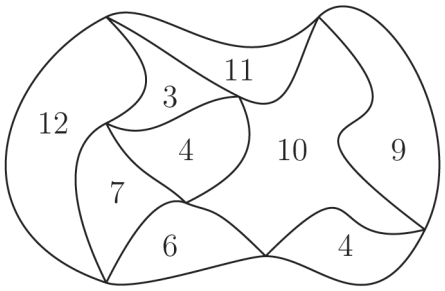
22 The diagram shows two touching semicircles of radius 1 and parallel diameters AB and CD.
What is the square of the distance AD?



A 16 B $8+4\sqrt{3}$ C 12 D 9 E $5+2\sqrt{3}$

[Catalonia]

23 The diagram shows a map of a park. The park is divided into regions. The number inside each region gives its perimeter, in km.
What is the outer perimeter of the park?

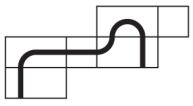


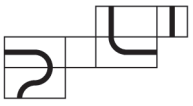
A 22 km B 26 km C 28 km D 32 km E inget av de föregående

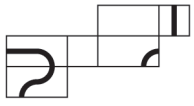
[Greece]

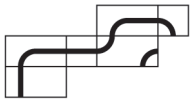
24 Leon has drawn a closed path on a cuboid and then unfolded it to give a net.
Which of the nets shown could not be the net of Leon's cuboid?

A

B 

C 

D 

E 

[Slovenia]