Mathematica Centrum

Together, let's shape the mathematicians of the future

A. <u>You will need</u>:

1. A **blank response** form with the title "Mathematica", identical (except for the title) to the ones which are used for the Contests. Download this form and make as many copies as you need, so that your students can write the preparatory test and learn how to properly fill out a response form. (Remember that these copies cannot be used for the Contests. Your students will use the response forms that will be sent to you. Each student registered for a contest will receive a response form corresponding to the contest that he is writing. The only reason you are doing these copies is to show your students how to properly fill out a response form).

2. The **preparatory test** (this document), which your students can write to become familiar with multiple choice questions. Download this test and make as many copies as you need. (Remember that you are doing this to explain to your students the purpose of the preparatory test. The preparatory test defines the type of problems that appear in the actual contest.)

3. The **answer key**. Download the answer key and make as many copies as you need.

B. <u>How to fill out a response form properly</u>:

Use an **<u>HB pencil</u>** for coding all parts of the form. Do not use a ball point pen or felt-tip marker.

In the box at the top part of the form, tell your students to **PRINT** their school's name in full as well as their city/town and province. To the right of the box, tell them to **PRINT** their date of birth and sign their name to certify that the answers given represent their own work.

In the box on the mid-left of the form, tell your students to **PRINT** their last and first names. Tell them to code each letter by filling in the appropriate circle under each letter. (If your last name is Mathews, first you code the letter M by filling in the circle containing the M right under the letter M of Mathews, then you code the A by filling in the circle containing the A right under the letter A of Mathews. Do this for every other letter of your last name and for each letter of your first name). If the last name of a student is hyphenated, for example Jones-Smith, or if his/her first name is hyphenated, like Carol-Ann, inform the student to simply write Jones Smith and Carol Ann.

The mid-right part of the form outlines important instructions which are a reminder of what to do to code the response form correctly. The lower part of this box shows examples of incorrect coding. Remind your students to **completely** fill in each circle.

The box at the bottom of the form is made of circles which your students will fill in to record their answers to the questions. Again, tell them to fill each circle completely!

C. <u>Problems</u>:

Allow your students to write the preparatory test to be sure that they understand how to properly fill out the response form and to prepare them as to the type of problems that appear in the actual contests. It is important that your students do the problems intended for them :

Newton : all of the problems (# 1 to # 32)
Lagrange : all of the problems (except # 31, and 32)
Euler : all of the problems (except # 24, 27, 28, 29, 31, and 32)

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PREPARATORY TEST 2009

EULER (7th) – LAGRANGE (8th) – NEWTON (9th)

1. The average value of the angles in a quadrilateral is

A) 70° B) 75° C) 80° D) 90° E) 100°

2. The value of n in the equation: $2^4 \times 2^{11} = 2^n$ is

A) 16 B) 44 C) 15 D) 30 E) 8

3. $6^2 + 8^2 = ?$

A) 10^2 B) 9^2 C) 120 D) 14^2 E) 48^2

4. The number 51/24 is equal to

A) 2 3/8 B) 2 1/8 C) 2 1/3 D) 3 1/8 E) 2 5/12

5. $(-18 + 6) \div 4 = ?$

A) 3 B) -2 C) 6 D) -6 E) -3

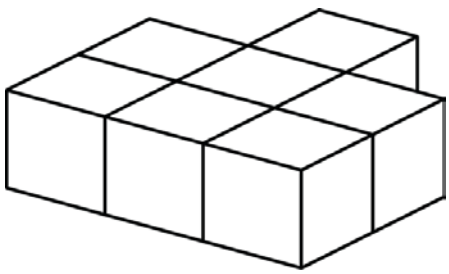
6. 1 km = ?

A) 1 000 m B) 10 000 cm C) 1 000 cm D) 1 000 dm E) 100 m

7. Mathilda has written 18 consecutive integers in decreasing order. If the largest is 17, what is the smallest?

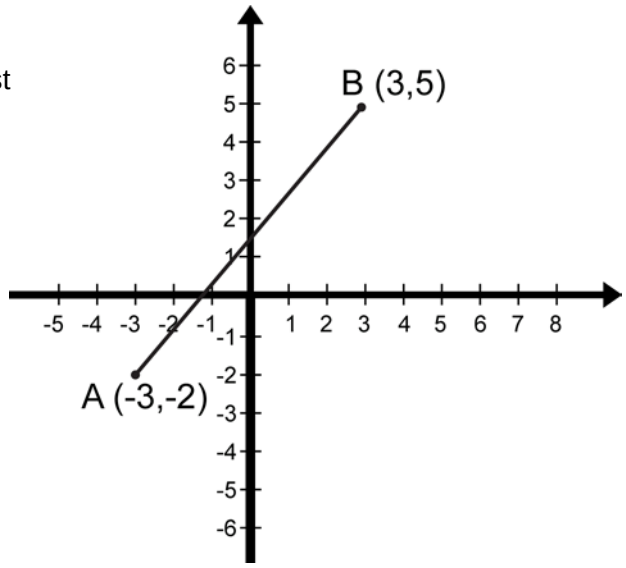
A) 1 B) -2 C) -1
D) 2 E) 0

8. Seven blocks have been glued together as shown in the diagram. How many faces of these blocks have glue on them?



A) 14 B) 12
C) 18 D) 20
E) 16

9. Line segment AB is reflected in the y-axis, then in the x-axis. The coordinates of the images of points A and B after the last reflection are, respectively,



A) (3,5) and (3,-2)
B) (-3,2) and (3,-5)
C) (3,2) and (-3,-5)
D) (-3,-2) and (3,5)
E) (-3,2) and (-3,-5)

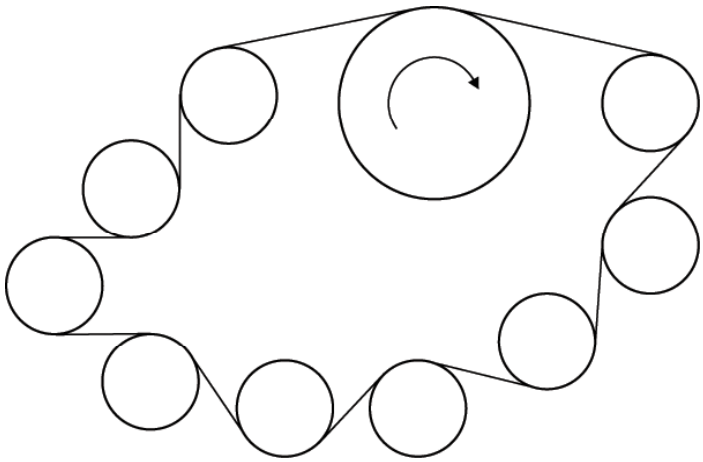
10. The measures of the 3 angles of a triangle are in the ratio 2 : 3 : 7. What is the value of the smallest angle?

A) 90° B) 30°
C) 80° D) 70°
E) 50°

11. A number is divided by 2 and the result is increased by 3; the new result is multiplied by 2 and gives a final answer of 20. What is the number?

A) 10 B) 11 C) 12 D) 14 E) 8

12. The big wheel turns in a clockwise direction and can transmit a movement to the other wheels by means of a belt. How many of the smaller wheels turn in a counter-clockwise direction?



A) 3 B) 4 C) 5 D) 6 E) 7

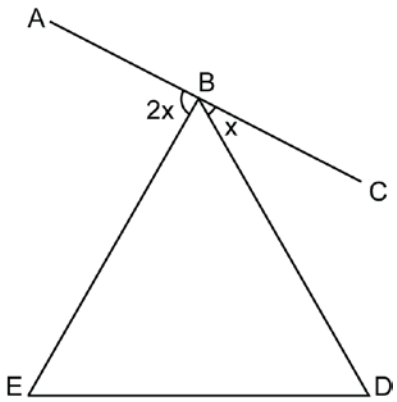
13. Choose 3 numbers, M, N and P from the following set: {-20, -9, -5, 0, 5, 6, 7} in such a way that the value of the expression M(N - P) is as small as possible. What is this minimum value?

A) -240 B) -200 C) -320 D) 0 E) -340

14. If the date of the second Wednesday of a month is a perfect cube, then the first day of this month is a

A) Tuesday B) Wednesday C) Thursday D) Monday E) Sunday

15. In the diagram opposite, BDE is an equilateral triangle and AC is a line segment that passes through point B. What is the value of angle ABE?



A) 90° B) 110° C) 88°
D) 80° E) 70°

16. The sum of 12 consecutive even integers is 12. What is the largest of these numbers?

A) 12 B) 10 C) 14
D) 8 E) 16

17. If 2% of a number is equal to M, then 5% of this same number is equal to

A) 2.5 M B) 3.5 M C) 2 M D) 3 M E) 2.4 M

18. How many even natural numbers between 0 and 20 are multiples of 3?

A) 2 B) 3 C) 4 D) 5 E) 6

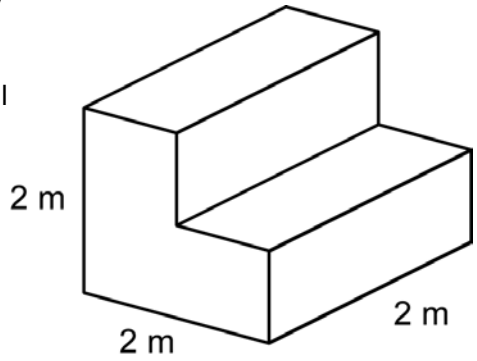
19. The average of 1/4 and 1/2 is

A) 1/6 B) 13/36 C) 2/5 D) 1/8 E) 3/8

20. The reciprocal of 10 is equal to

A) 100 B) 0.01 C) 0.11 D) 0.1 E) 1

21. At a competition, athletes can access a podium by going up a small staircase. The steps have equal heights and equal depths. All the edges that meet are perpendicular. What is the volume of this small staircase?



A) 6 m^3 B) 5 m^3
C) 4.5 m^3 D) 4 m^3
E) 3 m^3

22. -1 + 2 - 3 + 4 - 5 + 6 - 7 + 8 - 9 + 10 = ?

A) 10 B) 6 C) 5
D) 7 E) 4

23. What is the value of the complex fraction shown on the right?

$$1 + \cfrac{1}{1 + \cfrac{1}{1 + 1}}$$

A) 7/5 B) 5/3 C) 7/4
D) 3/2 E) 8/5

24. The number of zeros at the end of the product of 10! is

A) 4 B) 3 C) 1 D) 5 E) 2

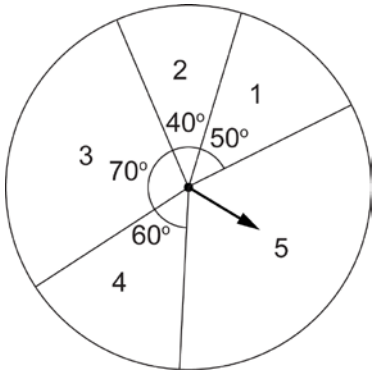
25. How many natural numbers between 1 and 10 can divide both the numbers 960 and 1 000 without a remainder?

A) 6 B) 2 C) 3 D) 4 E) 8

26. Mathilda prepares 120 g of a mixture of sand and water of which 90% is water. An hour later, she draws 20 g of water from the initial mixture (you can draw water from the mixture without drawing sand because sand and water form a heterogeneous mixture). The new mixture contains what percentage of water?

A) 90% B) 81% C) 88% D) 91% E) 99%

27. Mathew has made a circular spinner like the one shown in the diagram. If he spins the spinner only once, what is the probability that he will get an even number?



A) 7/18 B) 5/18
C) 1/3 D) 1/4
E) 2/9

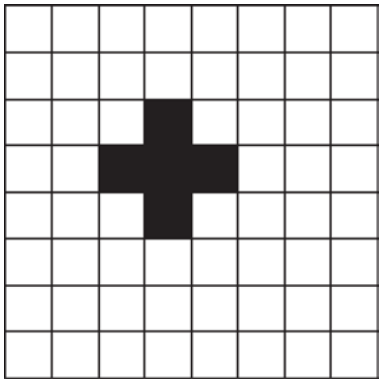
28. If x = 3, the value of $x^2 - 2x + 6$ is

A) 3 B) 21 C) 19
D) 9 E) 22

29. The perimeter of a circle is equal to that of a square. The area of the circle is how many times greater than the area of the square?

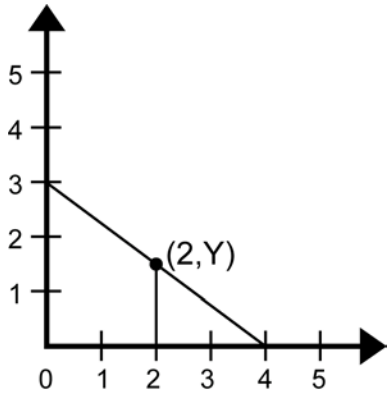
A) 5/π B) 6/π C) 2
D) π E) 4/π

30. How many different crossword puzzle grids containing a single block of 5 black squares, shaped exactly like the one shown in the diagram, can be made from 8 x 8 grids of white squares?



A) 36 B) 40 C) 38
D) 48 E) 32

31. What is the value of Y, the second coordinate of the point (2,Y) shown in the diagram on the right?



A) 3/2 B) 1.4 C) 1.2
D) 2 E) 4/3

32. If n/3 = m/5, the value of (3m + 15n) ÷ 3m = ?

A) 2 B) 3 C) 4
D) 5 E) 6