Mathematica

Let's shape together 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 # 30)
Lagrange : all of the problems (except # 15, 19, 20, and 22)
Euler : all of the problems (except # 15, 19, 20, 22, 26, and 29)

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PREPARATORY TEST 2008

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

1. 40% of 150 is equal to

A) 40 B) 50 C) 60 D) 70 E) 60%

2. $2^2 \times (3^2 + 5) = ?$

A) 44 B) 56 C) 30 D) 46 E) 9

3. $\sqrt{36} + \sqrt{25} = ?$

A) $\sqrt{61}$ B) 23 C) 61 D) 11 E) $\sqrt{31}$

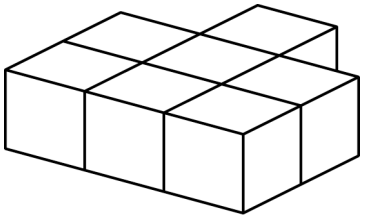
4. All of the natural numbers between 0 and 1 000 are placed in a lottery drum. What is the probability of randomly choosing a number which is a multiple of 4?

A) 4/10 B) 83/333 C) 1/6 D) 1/2 E) 1/4

5. The product of (-1) x 2 x (-3) x 4 x (-5) is equal to

A) -120 B) -24 C) 120 D) 24 E) -60

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

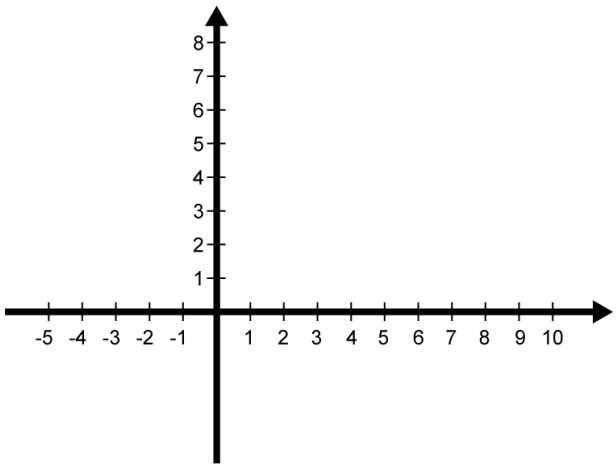


A) 14 B) 12 C) 20
D) 18 E) 16

7. The value of the denominator in the equation: 1/6 + 1/12 = 1/? is

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

8. Join the points represented by the following set of ordered pairs: A (-3 , 2), B (-3 , 4), C (7 , 4), and D (7 , 2). Polygon ABCD is a



A) trapezium B) rectangle
C) square D) rhombus
E) parallelogram

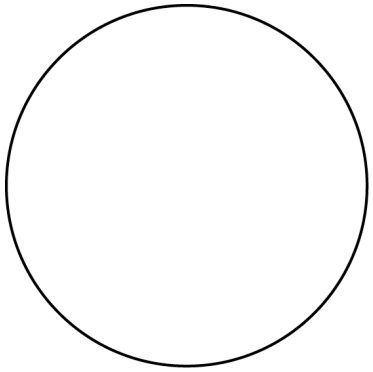
9. A speed of 10 m/s is equivalent to a speed of

A) 18 km/h B) 9 km/h C) 36 km/h D) 300 m/h E) 900 m/h

10. If n x 6 = 50, then n x 21 is equal to

A) 175 B) 125 C) 150 D) 100 E) 200

11. Choose 3 different points on the circle (circumference) and draw all possible chords by joining these points 2 by 2. The surface of the circle is then divided into how many regions?



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

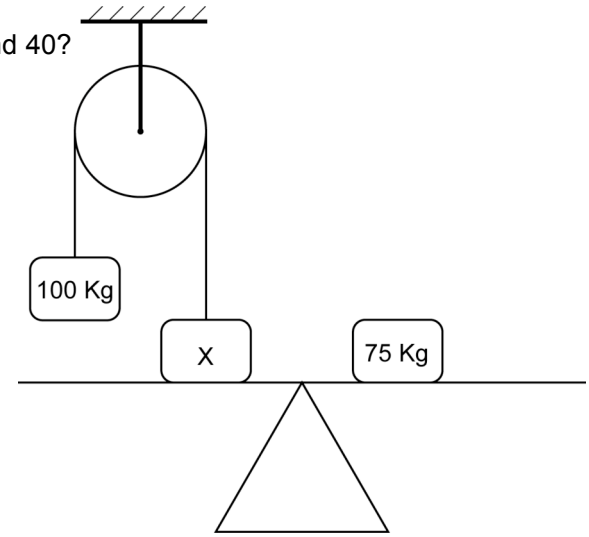
12. In a recipe, we must use 4 eggs per 480 grams of flour. How many eggs must we use for 720 grams of flour?

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

13. How many prime numbers are there between 30 and 40?

A) 0 B) 1 C) 2
D) 3 E) 4

14. What is the value of X, if the system (lever, pulley, masses, …) is in a state of equilibrium?



A) 175 kg B) 75 kg C) 25 kg
D) 50 kg E) 150 kg

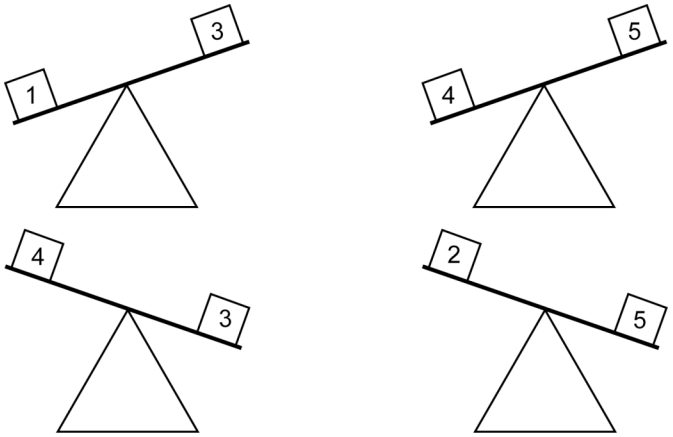
15. The value of $12^3 \times 13^3$ is

A) 156^3 B) 25^3 C) 156^6
D) 25^6 E) 156^9

16. The square of $\sqrt{5}$ is equal to

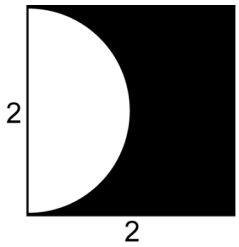
A) 12.5 B) 10 C) 4.5 D) 5 E) 4.9

17. Judging from the diagram below, which of the five boxes is the lightest?



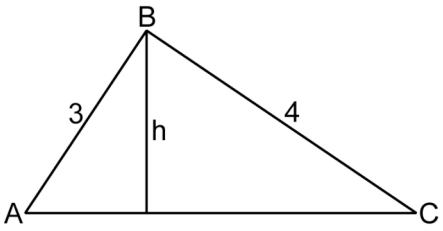
A) 1 B) 2 C) 3 D) 4 E) 5

18. The area of the shaded region shown in the diagram is equal to



A) $4 - \pi$ B) $8 - \pi$ C) $8 - 4\pi$
D) $8 - \pi/2$ E) $4 - \pi/2$

19. The height (altitude) h of the right-angled triangle ABC (angle ABC being equal to 90°) shown in the diagram is equal to

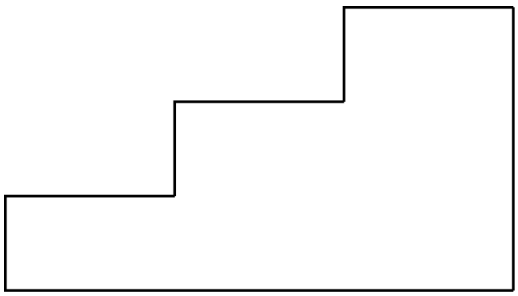


A) 1.2 B) 1.4 C) 1.6
D) 2.2 E) 2.4

20. The radius of the base of a right cylinder is 5 cm; its height (altitude) is 20 cm. The volume of this cylinder is

A) 100π cm^3 B) 200π cm^3
C) 300π cm^3 D) 400π cm^3
E) 500π cm^3

21. To go up a staircase, I can climb either 1 stair at a time or 2 stairs at a time (by skipping a stair). In how many different ways can I climb up a flight of 3 stairs?



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

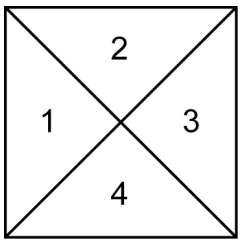
22. $(\sqrt{2} + 1)^2$ is equal to

A) $\sqrt{3} + 2$ B) $2 + \sqrt{2}$ C) 3
D) $3 + 2\sqrt{2}$ E) $3 + \sqrt{2}$

23. Melissa has written all the natural numbers from 1 to 100. The 100th digit that she has written is a

A) 1 B) 3 C) 5
D) 7 E) 4

24. What is the area of one of the 4 triangles (1, 2, 3, and 4) that form a square with a side of 4 cm?

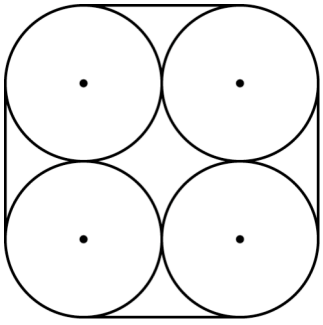


A) 2.5 cm2 B) 2 cm^2 C) 3 cm^2
D) 4 cm^2 E) 5 cm^2

25. The expression $1^n + 2^n$ is divisible by 3 for an infinite number of positive integral values of n. Which of the following is a value of n for which $1^n + 2^n$ is divisible by 3?

A) 2 B) 3 C) 4
D) 8 E) 100

26. Four congruent circles (radius equal to 1) are tangent to each other. What is the length of the line that circumscribes the 4 circles?



A) $\pi + 10$ B) $\pi + 12$ C) $2\pi + 8$
D) $2\pi + 6$ E) $2\pi + 4$

27. Mathusalem's two daughters were born after his 25th birthday, but before his 40th. Andrea is 4 years older than Melissa. Andrea was born when Mathusalem was 1 year older than a certain prime number (of years) and Melissa was born when he was 1 year younger than another prime number. What was Mathusalem's age when Andrea was born?

A) 26 years old B) 32 years old C) 34 years old D) 36 years old E) 38 years old

28. 120% is equal to

A) 0.12 B) 6/5 C) 7/5 D) 12 E) 120

29. Find the largest 2-digit natural number which is equal to 7 times the sum of its digits. The product of its digits is equal to

A) 32 B) 18 C) 72 D) 21 E) 63

30. If n is a natural number greater than 1 and if n! = 1 x 2 x 3 x 4 x … x n, then the value of 4! is

A) 10 B) 12 C) 24 D) 20 E) 40