Mathematica Centrum
Together, let's shape the mathematicians of the future

LAGRANGE PREPARATORY TEST 2016

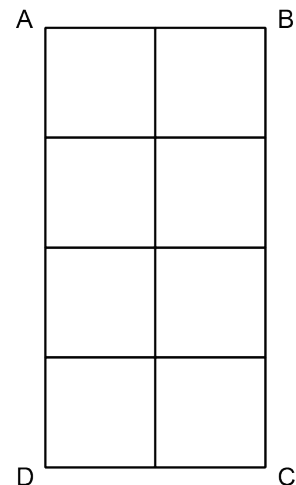**1.** What is the largest prime factor of 333?

A) 2 B) 7 C) 47 D) 37 E) 3

2. How many of the following numbers:1, 4, 9, 27, 64, and 100 are perfect squares and cubes?

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

3. Rectangle ABCD has been divided into 8 small squares. How many rectangles (not including squares) can you count in the diagram?

A) 19 B) 17 C) 18
D) 21 E) 20

4. How many cubes with edges 2 cm long are needed to form a cube with edges 6 cm long?

A) 25 B) 9 C) 27
D) 36 E) 18

5. Which of the following choices represents the average of the other four?

A) 4 B) -3 C) -4 D) -17 E) 5

6. I gave away half of one third of one quarter of my money. What fraction did I give away?
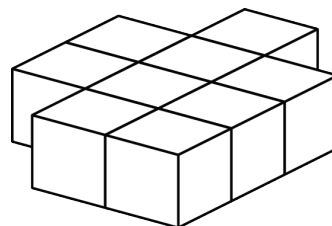
A) 47/48 B) 1/24 C) 3/5 D) 1/12 E) 23/24

7. The sum of all natural numbers from 1 to 2 000 is equal to

A) 2 001 000 B) 2 000 000 C) 1 001 000
D) 1 000 000 E) 500 550

8. Nine blocks have been glued together, as shown in the diagram. How many blocks have at least two faces that are covered with glue?

A) 9 B) 5 C) 6
D) 7 E) 8

9. If half of N is 12, what is the value of 4 times N?

A) 96 B) 36 C) 48 D) 72 E) 144

10. If the length of each side of a square were reduced by 25%, the area of the square would be reduced by
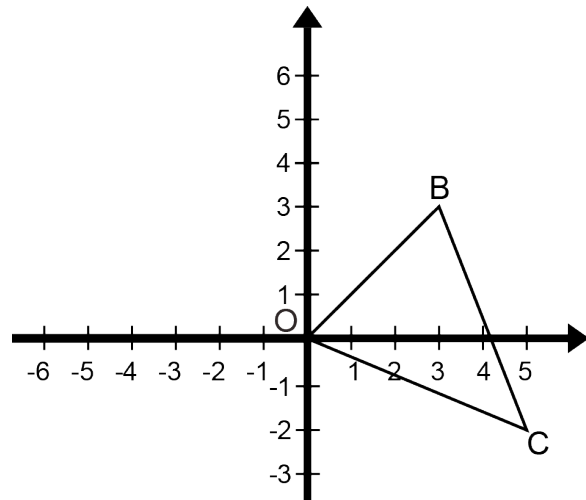
A) 50% B) 75% C) 25%
D) 56.25% E) 43.75%

11. The LCM (3, 7) x the GCD (12, 18) is equal to

A) 252 B) 126 C) 146
D) 130 E) 96

12. Rotate △ OBC 180° about the origin O. The coordinates of B' (image of B) are

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

13. Mathusalem has lost 40% of his weight during the summer. Rounded to the nearest kg, what was his weight at the beginning of the summer, if his weight at the end of the summer was 100 kg?

A) 160 kg B) 170 kg C) 188 kg D) 167 kg E) 171 kg

14. If 1/2 + 1/3 + 1/n = 53/6, then n is equal to

A) 8 B) 4 C) 1/8 D) 1/4 E) 6

15. Mathilda has 4 sweaters (one yellow, one green, one blue, and one red) and 2 skirts (one cotton and one wool). If she randomly chooses a sweater and a skirt, what is the probability that she will choose the yellow sweater and the wool skirt?

A) 1/6 B) 1/3 C) 1/12 D) 1/8 E) 1/7

16. Using the digit 1, you can form only one 1-digit natural number (1). Using the digits 1 and 2, you can form four 2-digit natural numbers (11, 22, 12, and 21). How many 3-digit natural numbers can you form using the digits 1, 2, and 3?

A) 6 B) 4^3 C) 26 D) 4^4 E) 3^3

17. If $P = 10 + 10^2 + 10^3 + 10^4 + 10^5$, then the sum of P's digits is
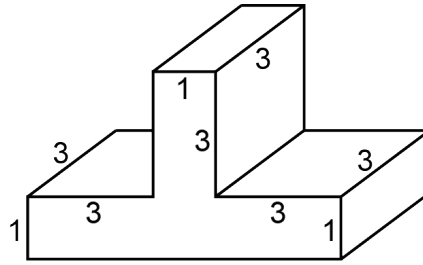
A) 7 B) 8 C) 9 D) 6 E) 5

18. The algebraic expression 3n + 1 (n being a natural number) can generate the sequence of all the numbers that yield a remainder of 1 when divided by 3. Indeed, if n takes the successive values of 0, 1, 2, 3, …, we get the sequence 1, 4, 7, 10, 13, …. Which of the following algebraic expressions can generate the sequence of numbers that yield a remainder of 2 when divided by 4?

A) 3n + 3 B) 4n + 4 C) 4n + 2 D) 3n + 4 E) 4n + 3

19. What is the volume, in cm^3, of the rectangular solid shown if all measurements in the diagram are in centimetres?
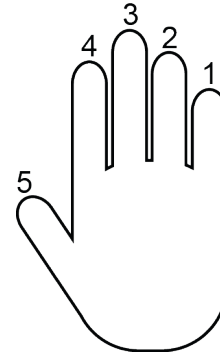
A) 28   B) 29   C) 30
D) 31   E) 32

20. If x = -2, what is the value of -3x +2x^2 - 2x^3?

A) -5   B) -2   C) 30
D) 28   E) 27

21. Binary Ben has only one hand, but he found a way to represent certain numbers. When his 5 fingers are all straight, as in the diagram, it represents the number 31. If all his fingers are curled into a fist, it represents the number 0. If fingers 2, 3, and 4 are straight and the other two fingers are curled, it represents 14. Which fingers must he hold straight if he wants to represent the number 7?

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

22. A, B, C, D, and E represent 5 different non-zero digits. What is the value of D?

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

$$\begin{array}{r} A\ B\ C\ B \\ \times\quad\quad\ 5 \\ \hline D\ E\ D\ B \end{array}$$

23. The digits of a 3-digit natural number are all different. If the product of the 3 digits is equal to 210, what is their sum?

A) 18   B) 17   C) 15   D) 16   E) 19

24. Number p is greater than number q. If p is reduced by 50% and q is increased by 20%, what fraction of its initial value will the expression p^{2}q^2 lose?
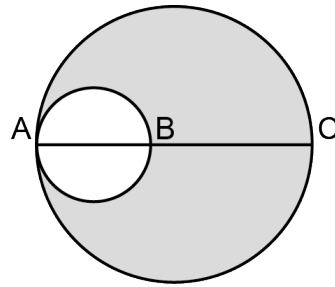
A) 16/25   B) 9/25   C) 3/4
D) 39/64   E) 3/5

25. A geometry teacher has 3 boxes full of triangles and squares, as indicated in the diagram. Box A contains m triangles and n squares, for a total of 35. Box B contains m triangles and p squares, for a total of 50. Box C contains p triangles and n squares for a total of 45. How many squares are in box B?
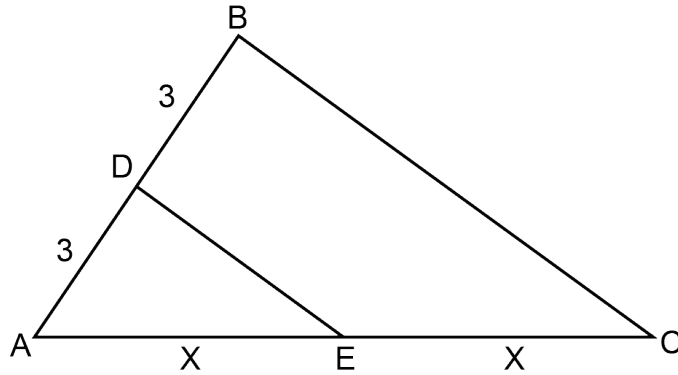
A) 32   B) 28
C) 35   D) 30
E) 25

	△	□	Total
A	m	n	35
B	m	p	50
C	p	n	45

26. Two circles are tangent to each other, as shown in the diagram on the right. The ratio of the lengths of line segments AC and AB is given by the equation: AC : AB = 4. The area of the shaded surface is what fraction of the area of the larger circle ?

A) 4/5   B) 7/8   C) 3/4
D) 5/6   E) 15/16

A ———— B ———— C

27. In triangle ABC, AD = 3 cm, DB = 3 cm, and AE = EC = X cm. If the area of Δ ABC is equal to 20 cm^2, what is the area of Δ ADE?

A) 6 cm^2 B) 7 cm^2 C) 4 cm^2 D) 5 cm^2 E) 3 cm^2