Mathematica Centrum

Together, let's shape the mathematicians of the future

Euler 2020 contest

April 22, 2020

Time: 1h 15 min

Calculators are permitted

Instructions

1. You must wait for the contest supervisor's signal before starting the contest.
2. You may use scrap paper, a ruler and a compass to do your work.
3. Be sure that you understand the coding system of the response form. If you have any questions, ask the contest supervisor. Verify that you have received the response form with the title **Euler Contest.**
4. This contest is composed of 40 multiple choice questions. Each question is followed by 5 possible answers: A, B, C, D, and E. There is only one correct answer. When you make your choice, record your answer by filling in the appropriate circle.
5. If you change an answer, make sure to erase your first answer completely.
6. Each correct answer is worth one point. Incorrect answers will not be penalised.
7. After the supervisor's signal, you will have exactly 75 minutes to finish. Do not lose time on a specific problem; move on to the next one.
8. When you are finished, give the question booklet and the response form to the contest supervisor.

1. What is the sum of 10 and the opposite of 8?

A) 18 B) 2 C) 3 D) -2 E) 4

2. Which of the following is closest to the value of $\sqrt{100} + \sqrt{0.5}$?

A) 10 B) 10.25 C) 10.71 D) 10.31 E) 10.1

3. Which of the numbers below is not a prime number?

A) 11 B) 13 C) 15 D) 17 E) 19

4. The closest integer to the value of -1/2 x 3/4 + 1/2 x 8/4 is

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

5. The result of (-4 - 8) - 5(5 - (-2)) is

A) -47 B) -46 C) -43 D) 22 E) 23

6. The number of minutes in a day is

A) 1 000 B) 24 C) 86 400 D) 1 440 E) 60

7. 100% x 200% + 50% x 50% = ?

A) 2 B) 2.25 C) 1.25 D) 2.5 E) 50%

8. What is the sum of the digits of the smallest natural number that is divisible by 3, 4, and 5?

A) 30 B) 6 C) 3 D) 60 E) 9

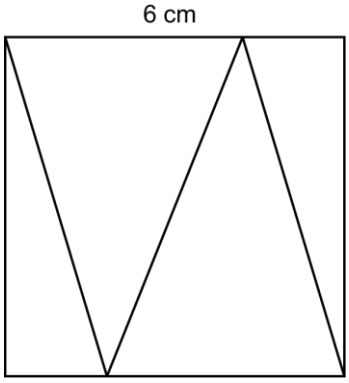
9. The remainder of 654 321 ÷ 1 000 is

A) 321 B) 4 321 C) 21 D) 312 E) 4 312

10. If n x 6 = -24, then -n x 4 is equal to

A) -18 B) 12 C) -16
D) -12 E) 16

11. What is the average area of the 4 triangles that form the square, on the right, whose side is 6 cm long?



A) 6 cm² B) 7 cm² C) 8 cm²
D) 9 cm² E) 10 cm²

12. The product of the digits of a 3-digit natural number cannot be equal to

A) 2 B) 125 C) 10 D) 5 E) 34

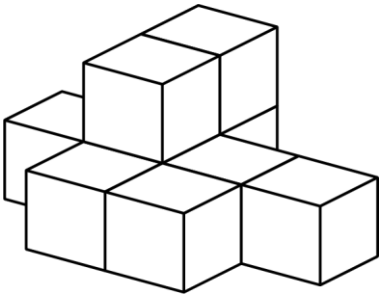
13. If 2! = 1 x 2 = 2 and 3! = 1 x 2 x 3 = 6, the value of 6! x 7 x 10 x 9 x 8 is equal to

A) 7! B) 8! C) 9! D) 10! E) 11!

14. The sum of all the factors of 6 is equal to

A) 11 B) 12 C) 10 D) 9 E) 13

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

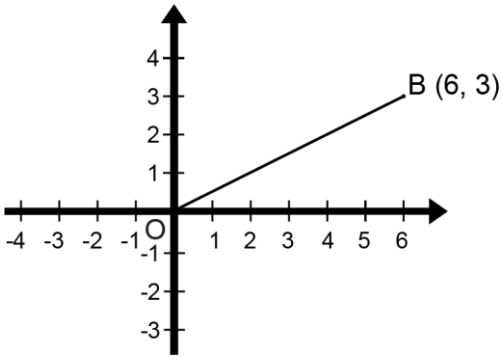


A) 20 B) 21 C) 22
D) 23 E) 24

16. What is the value of N in the equation:
1/2 x N = 3/8?

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

17. Line segment OB is rotated 90º clockwise about centre O. The coordinates of point B after the rotation are

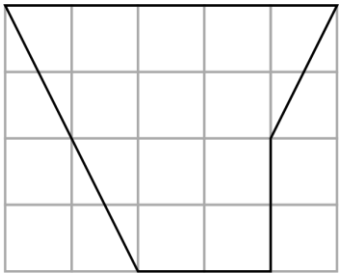


A) (3, -6) B) (6, -3)
C) (-6, 3) D) (3, -3)
E) (-3, -6)

18. Melissa uses 150 g of sugar for every 6 eggs. How many eggs should she use with 350 g of sugar?

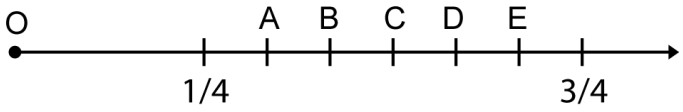
A) 13 B) 10 C) 12
D) 11 E) 14

19. Every small square in the grid has an area of 1 cm². What is the area of the pentagon shown in the diagram?



A) 11 cm² B) 12 cm² C) 13 cm²
D) 14 cm² E) 15 cm²

20. The fractions 1/4 and 3/4 are represented on the number line below. If the origin of the number line is 0, what letter represents the fraction whose value is closest to 60%?



21. The sum of two integers is 1 and their product is -12. Their quotient could be

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

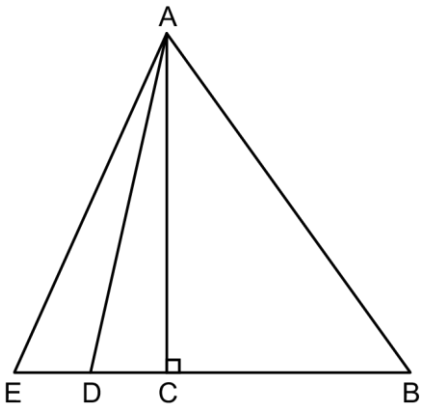
22. The sum of the prime factors of 30 is equal to

A) 10 B) 30 C) 20 D) 15 E) 11

23. 100 cm² = ? mm²

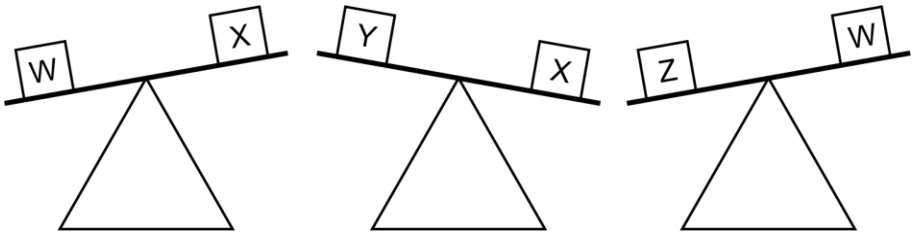
A) 10 B) 100 C) 1 000
D) 100 000 E) 10 000

24. If ED = DC and CB = 2EC, the area of triangle ABE is how many times larger than the area of triangle ACE?



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

25. Which of the inequations below is false?

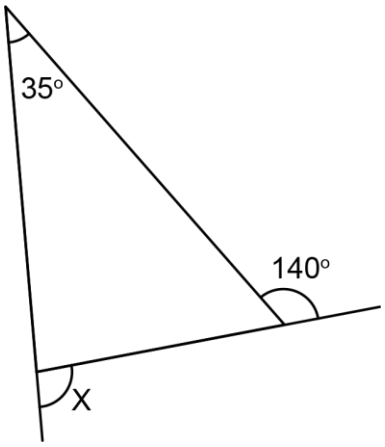


A) Z > Y B) W > X C) X > Y D) Y > Z E) Z > W

26. A plane is moving at 100 m/s. Which of the given speeds is equivalent to 100 m/s?

A) 300 km/h B) 240 km/h C) 360 km/h
D) 400 km/h E) 100 km/h

27. What is the measure of angle X?

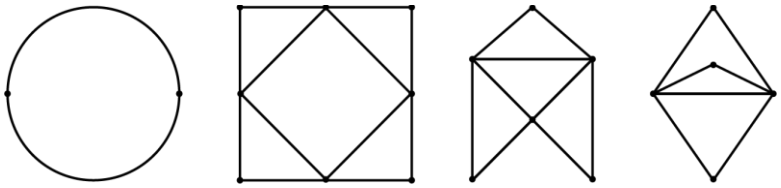


A) 70° B) 75° C) 76°
D) 60° E) 80°

28. Instead of building a road that is 50 m wide, a construction company builds one that is 50 dm wider. What is the cost increase if the length and depth of the road are not changed?

A) 10% B) 5% C) 1% D) 1/2% E) 8%

29. How many of the networks shown below are Eulerian circuits?



A) 1 B) 2 C) 3 D) 4 E) none

30. What is the product of the LCM and the GCD of 3 and 6?

A) 6 B) 3 C) 18 D) 12 E) 9

31. Point C is the midpoint of line segment AB. Point D is the midpoint of AC. If E is the midpoint of CB, we can affirm that

A) DB = 3CE B) AD = CB C) DE = EB D) CB = 2 AC E) DB = 2AC

32. If x = 3, what is the value of $x^3 + 2x$?

A) 21 B) 33 C) 15 D) 16 E) 34

33. The average of all multiples of 8 between 0 and N is 44. Which of the following cannot represent a possible value of N?

A) 85 B) 86 C) 89 D) 88 E) 87

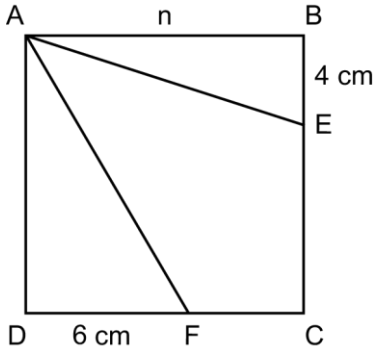
34. Andrea poured 6 litres of 10% cream into 3 litres of 15% cream. What is the percentage of cream in the final mixture?

A) 12 1/3% B) 11 2/3% C) 11 1/2% D) 16% E) 15%

35. The infinite sequence: 0, 1, 2, 5, 12, 29, 70, … is called Pell's sequence. When the 10th term is divided by the 9th term of the sequence, we get a value that is very close to the silver ratio (the ratio we get when a term infinitely far is divided by the term that just precedes it). What is the value of the silver ratio?

A) $2\sqrt{2}$ B) $\sqrt{3} + 1/2$ C) $1 + \sqrt{3}$
D) $1 + \sqrt{2}$ E) $\sqrt{2}$

36. The side of square ABCD measures n cm. We know that n is a natural number and that the area of quadrilateral AECF is 66 cm^2. What is the perimeter of the square whose side measures 2n cm?



A) 72 cm B) 76 cm C) 80 cm
D) 84 cm E) 88 cm

37. Some prime numbers ''p'' can be written as the sum of two squares. Thus $p = 5 = 1^2 + 2^2$, $p = 13 = 2^2 + 3^2$, $p = 17 = 1^2 + 4^2$, and $p = 29 = 2^2 + 5^2$. How many of the following primes: 31, 37, 41, 43, and 53 can be written this way?

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

38. Which of the answers below represents a congruency with a remainder of 4?

A) $18 \equiv 25 \bmod 7$ B) $17 \equiv 7 \bmod 10$ C) $8 \equiv 15 \bmod 7$ D) $7 \equiv 21 \bmod 7$ E) $5 \equiv 17 \bmod 12$

39. Half of the students in a class are 12 years old or less and one sixth are 13 years old or more. The number of students that are between 12 and 13 years old is 5 more than the number of students that are 13 years old or more. How many students are between 12 and 13 years old?

A) 12 B) 13 C) 9 D) 10 E) 14

40. The outer covering of a soccer ball is made of 12 pentagons and 20 hexagons. How many ''edges'' or ''sides'' could you count on a soccer ball?

A) 80 B) 84 C) 85 D) 90 E) 100

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Name: _____ Contest: _____

1	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	11	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	21	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	31	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	41	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
2	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	12	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	22	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	32	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	42	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
3	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	13	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	23	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	33	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	43	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
4	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	14	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	24	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	34	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	44	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
5	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	15	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	25	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	35	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	45	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
6	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	16	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	26	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	36	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	46	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
7	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	17	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	27	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	37	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	47	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
8	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	18	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	28	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	38	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	48	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
9	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	19	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	29	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	39	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	49	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
10	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	20	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	30	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	40	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	50	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ