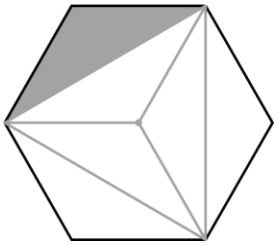
Mathematica Centrum

Together, let's shape the mathematicians of the future

PYTHAGORAS PREPARATORY TEST 2019
DETAILED SOLUTIONS

1. The missing number in the equation: 8 x 3 = 4 x ? is 6.



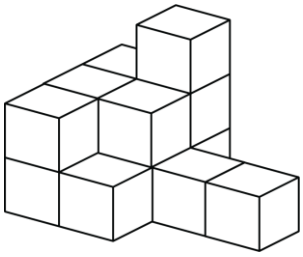
2. The sum of 8 + 50 + 200 + 6 000 is 6 258.

3. The value of (15 ÷ 3) x (16 - 9) is a multiple of (5 X 7) 5.

4. 20 nickels = 4 quarters.

5. The fraction of the hexagon that is shaded is 1/6.

6. A natural number is multiplied by 7. The result could not be 88.



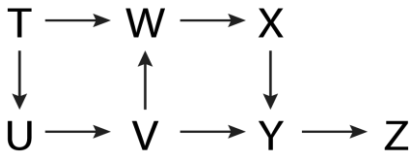
7. There are ((2 x 6 - 1) + 3) 14 blocks in the pile?

8. If the last day of January is a Wednesday, then January 10 (31, 24, 17, 10) was a Wednesday and January 11 was a Thursday.

9. When twice 100 (200) is multiplied by one quarter of 12 (3), the result is (200 x 3) 600.

10. 10 dm = 1 m

11. T, U, V, W, X, Y, and Z are players that participated in a chess tournament. T → U means that T has won a game against U. Only one player (Z) has not won a single game.

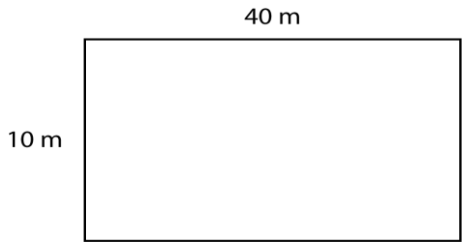


12. A 2-digit natural number is multiplied by a 2-digit natural number. The product could have a minimum of (10 x 10 = 100) 3 digits, but must have less than (100 x 100 = 10 000) 5 digits. The product could be a natural number that has 4 digits.

13. The 3!! does not refer to the double factorial function (which is way beyond the scope of this test) but to the factorial function iterated twice. The expression 3!! means here (3!)!. The value of 3!! is (3!)! = 6!. The expression 2! x 3!! (2 x 6!) is the largest. By the way 2! = 2!! = 2!!! = 2.

14. Andrea removed 7 coins having a total value of 82¢. She removed 2 pennies, 2 quarters, and 3 dimes.

15. The perimeter will increase by (2 x 5 + 2 x 5) 20 m.

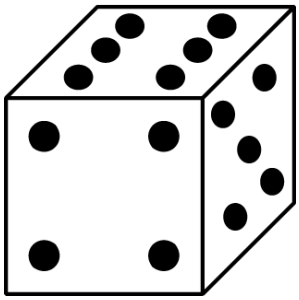


16. If I weigh 20 kg more than half of my weight, half of my weight must be equal to 20 kg. I must weigh (2 x 20 kg) 40 kg.

17. If you could spend $1 every second, you could spend (60 x $1) $60 every minute.

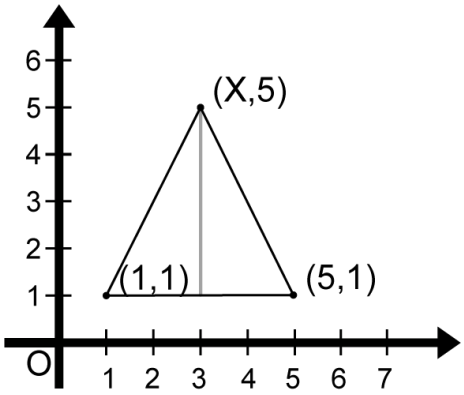
18. A die is rolled once. The probability of getting a 6 is (1 chance out of 6 possible outcomes) 1/6.

19. All even multiples of 3 are multiples of (2 x 3) 6. The first multiple of 6 between 0 and 100 is 6 = 1 x 6, the second is 12 = 2 x 6, the third is 18 = 3 x 6, … .). The last multiple of 6 between 0 and 100 is 96 = 16 x 6. There are 16 even multiples of 3 between 0 and 100.



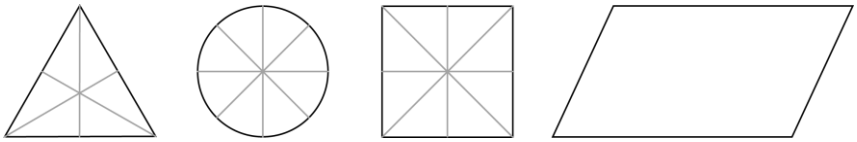
20. The value of $1 + 3 = 4 = 2^2$. The value of $1 + 3 + 5 = 9 = 3^2$. The value of $1 + 3 + 5 + 7 = 16 = 4^2$. If we know how many consecutive odd numbers (starting from 1) there are in a series, it is very easy to find its value. But how do we find out how many odd numbers there are in a series? In the series: 1 + 3 there are 2. To find out how many odd numbers there are, just find the average of 1 and 3. The average of 1 and 3 is ((1 + 3) ÷ 2) 2. The series: 1 + 3 + 5 + 7 has ((1 + 7) ÷ 2) 4 terms. The series: 1 + 3 + 5 + 7 + 9 + … 51 has ((1 + 51) ÷ 2) 26 terms. The value of this series is (26^2) 676.

21. Points (1, 1), (5, 1), and (X, 5) are the 3 vertices of an isosceles triangle. The value of coordinate X is ((1 + 5) ÷ 2) 3.

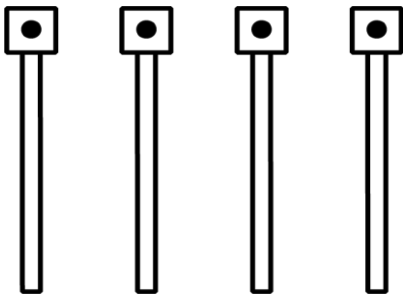


22. The factors of 10 are {1, 2, 5, 10}. The factors of 40 are {1, 2, 4, 5, 8, 10, 20, 40}. These two numbers have 4 factors in common.

23. The circle and the square have at least 4 lines of symmetry. The square has 4 and the circle has an infinite number of lines of symmetry. The equilateral triangle has 3 and the parallelogram has 0.



24. The unit's digit of the product 9 x 9 x 9 x 9 is 1.



25. The marine rock must lose (0.1% of 10 000 000 kg) 10 000 kg. At a rate of 1 000 kg per year, it will take (10 000 kg ÷ 1 000 kg) 10 years to lose 0.1% of its mass.

26. If the white belt is first, she can hang the belts in 6 different ways (W-B-R-G, W-B-G-R, W-R-B-G,

W-R-G-B, W-G-B-R, W-G-R-B). If the blue is first, she can hang the belts in 6 different ways again. In all, she can hang her 4 belts in (6 x 4) 24 different ways.

27. The numbers 2, 3, and 17 are prime. The numbers 9 and 1 119 are multiples of 3 (the sum of the digits of 1 119 is 12 and 12 is a multiple of 3). Of the five given numbers, only three are prime.

28. The value of $2^2 + 2^3 + 2^4$ is (4 + 8 + 16) 28. The only choice given that has a value of 28 is $2^5 - 2^2$ (32 - 4).

29. You need 4 cubes with edges 4 cm long to form the top layer of a cube with edges 8 cm long. You need another 4 cubes to form the bottom layer. In all, you need 8 cubes with edges 4 cm long to form a cube with edges 8 cm long.

30. X is equal to (1/3 + 7/8) ÷ 2. The average of 1/3 and 7/8 is (8/24 + 21/24 = 29/24 and 29/24 ÷ 2) 29/48. The average of X and 1/3 is ((29/48 + 16/48) ÷ 2) 45/96.

31. The factors of 1 000 are {1, 2, 4, 5, 8, 10, 20, 25, 40, 50, 100, 125, 200, 250, 500, 1 000}. The number 1 000 has 16 factors.

32. Andrea has 33 jujubes. She has twice as many yellow jujubes as green jujubes, three less blue ones than green ones, and one more red one than green ones. Let us suppose that there are X green jujubes. Then there must be 2X yellow jujubes, X - 3 blue jujubes, and X + 1 red jujubes. The sum of all these jujubes is 33. We can write the following equation: X + 2X + X - 3 + X + 1 = 33. This equation becomes 5X - 2 = 33. We find X = 7. She has 7 green jujubes, 14 yellow jujubes, 4 blue jujubes, and 8 red jujubes. The sum of the red and blue jujubes is (8 + 4) 12.

33. You can put 1, 2, or 3 balls in the third box. With 1 ball in the third box, we can find 3 ways: 0-2-1, 2-0-1, and 1-1-1. With 2 balls in the third box, we can find 2 ways: 1-0-2 and 0-1-2. With 3 balls, we can find one way: 0-0-3. In all, there are 6 different ways to put 3 balls in the 3 boxes if the third one must have at least one.