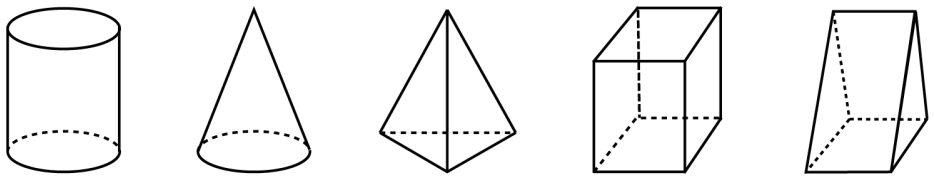
Mathematica Centrum

Together, let's shape the mathematicians of the future

PYTHAGORAS PREPARATORY TEST 2017
DETAILED SOLUTIONS

1. 3 + 1 + 6 = 10

2. The solid that has 4 flat faces, 6 edges and 4 vertices is C.



3. The product that has the smallest ones digit is 3 x 4 x 5. Its ones digit is 0.

4. 20 ÷ (7 - 5) = 20 ÷ 2 = 10.

5. There are 5 odd numbers (21, 23, 25, 27, and 29) between 19 and 31.

6. The value of X in the equation: 512 = 317 + X is (512 - 317) 195.

7. The answer is 11 000.

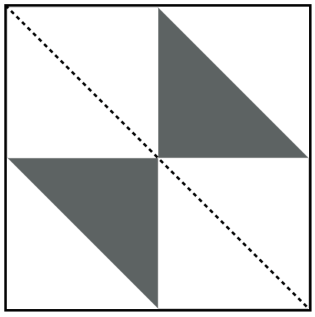
8. 10 nickels = 50¢ = 2 quarters.

9. Andrea counted backwards from 30 by 3's. Andrea counted 30, 27, 24, 21, 18, 15, 12, 9, … . The numbers that were not counted by Andrea are 8 and 14.

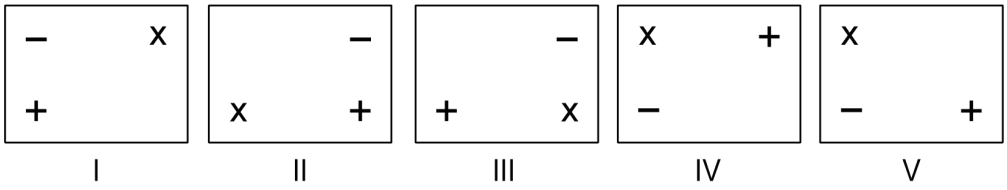
10. An answering machine can store 10 minutes or (10 x 60) 600 seconds of messages. It could store (600 ÷ 20) thirty 20 second messages.

11. 77 - 7 = 70. 70 ÷ 7 = 10 and 10 - 1 = 9. There are 9 natural numbers between 7 and 77 that are multiples of 7.

12. The square is composed of 8 identical triangles. Two are shaded. Two out of 8 triangles are shaded. This represents 1/4 of the figure.

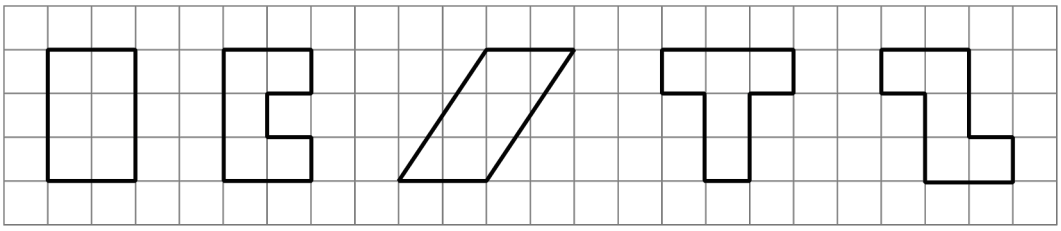


13. Figures III and IV are 180º rotation images of each other. When a figure is turned 180º, everything is reversed. The top becomes the bottom, the left becomes the right and vice versa. For example, look at the + symbol in figure III. It is at the bottom of the rectangle and on the left side. In figure IV, the + symbol is at the top of the rectangle and on the right side.



14. 1 dm + 20 mm = 10 cm + 2 cm = 12 cm.

15. The second, the fourth and the fifth figures all have a perimeter of 12.



16. The number of lines of symmetry (6) shown in fig.1 plus the number of diagonals (9) shown in fig.2 is equal to 15.

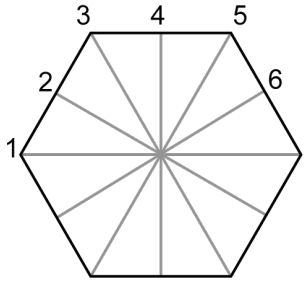


fig. 1

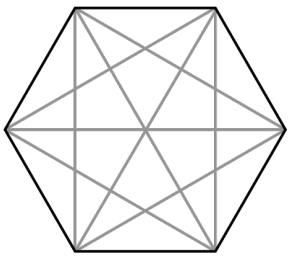
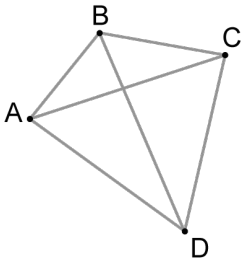


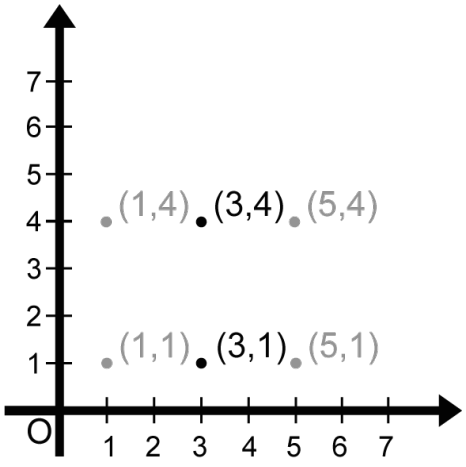
fig. 2



17. There are six 4-digit natural numbers between 1 000 and 2 000. These are 1 234, 1 243, 1 324, 1 342, 1 432, and 1 423. By symmetry, we know that there are 6 between 2 000 and 3 000 and 6 more between 3 000 and 4 000. In all, there are 18 such numbers.

18. Using point A, you can draw 3 line segments: AB, AC, and AD. Using point B, you can draw only 2 line segments: BC and BD (line segment BA is already drawn). Using point C, you can draw only 1 line segment: CD. Using the 4 points in the diagram, you can draw (3 + 2 + 1) 6 line segments.

19. The coordinates of the other two vertices of the rectangle could be (1 , 1), (1 , 4), (5 , 1), and (5 , 4). The coordinates could not be (2 , 3).

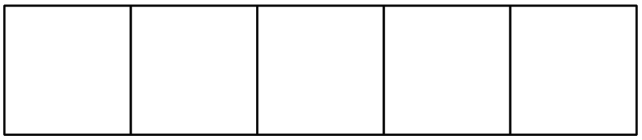


20. Each term of the second series: 9 + 18 + 27 + 36 + 45 + … + 900 is (9/3) 3 times larger thAn the corresponding term of the first series: 3 + 6 + 9 + 12 + 15 + …+ 300. The second series is equal to (15 150 x 3) 45 450.

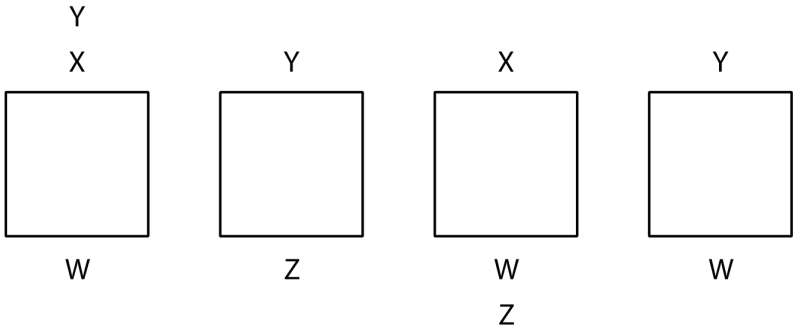
21. You can form (1 x 24, 2 x 12, 3 x 8, and 4 x 6) 4 different rectangles whose areas are 24 cm^2.

22. If 1 tic = 3 tocs and 1 toc = 3 tacs, then 3 tics are equal to (3 x 3 tocs) 9 tocs and 9 tocs are equal to (9 x 3 tacs) 27 tacs.

23. A square table can sit 4 people. If you line up 5 square tables, as shown in the diagram, you can sit 12 people. If 100 square tables were lined up in the same manner, you could sit (100 x 2 + 2) 202 people.



24. Four friends W, X, Y, and Z are walking in a straight line. Y is not second. X is right behind Y. Z is right behind W, who is not third. Taking into account all of these constraints, we can draw the diagram below. We can see in this diagram, that only Y or Z can be third. Z cannot be third because the constraints of the problem are not respected. Indeed if Z were third, X could not be right behind Y because W would have to be second. Y must be third. This hypothesis does take into account the constraints of the problem.



25. The prime factorisation of 36 is 2 x 2 x 3 x 3. Combining these prime factors, we must find 3 natural numbers between 1 and 10 whose product is 36. These 3 natural numbers can only be 2. 3, and 6 (2 x 3). The sum of these three numbers is (2 + 3 + 6) 11.

26. 2^1 = **2**, 2^2 = **4**, 2^3 = **8**, 2^4 = 1**6**, 2^5 = 3**2**, 2^6 = 6**4**, … . The ones' digit of a power of 2 can only be 2, 4, 8, or 6. The sequence of the ones' digits of a power of 2 can be written as: 2, 4, 8, 6, 2, 4, 8, 6, … . The same digit reappears periodically 4 terms further in the sequence. The ones' digit of 2^8 is 6.

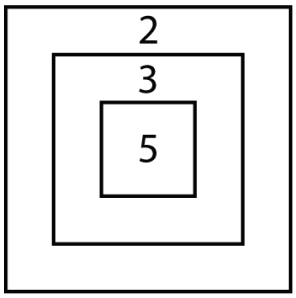
27. If 3/10 x N = 1/2, then the number N = 1/2 ÷ 3/10. N is equal to (1/2 x 10/3) 10/6 or 5/3.

28. There are 3 prime numbers (41, 43, and 47) between 40 and 50. The average of the two prime numbers closest to 42 is (41 + 43 = 84 and 84 ÷ 2 = 42) 42.

29. All the numbers except 30 (5 x 6) are multiples of 7 (21 = 3 x 7, 35 = 5 x 7, 70 = 10 x 7, and 49 = 7 x 7).

30. Mathew's car is travelling at 100 km/h. In 90 minutes or 1.5 hours, it can cover (1.5 x 100) 150 km.

31. Mathusalem had seven shots and scored 28 points. He could not have hit the 5-point area 5 times or more because 5 x 5 = 25 and this would make it impossible to achieve a total of 28 points with two extra hits. He could not have hit the 5-point area 3 times or less because 3 x **5** + 4 x **3** equals 27. He must have hit the 5-point area 4 times. Indeed 4 x **5** + 2 x **3** + 1 x **2** = 28. He hit the 3-point area twice.



32. There are 60 seconds in a minute. A second is 1/60 of a minute.

33. The clock shown in the diagram has just lost its minute hand. It lost it at approximately 10:30, because the hour hand is half way between the 10 and the 11. If it were 10:00, the hour hand would be right on the 10. If it were 10:05, the hour hand would be very close to the 10. If it were 10:22, the hour hand would be approximately 1/3 of the way between the 10 and the 11, and if it were 10:45, the hour hand would be 3/4 of the way between the 10 and the 11.