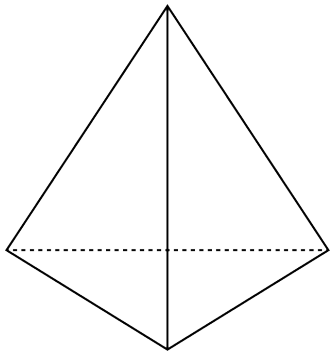
Mathematica Centrum

Together, let's shape the mathematicians of the future

PYTHAGORAS PREPARATORY TEST 2013
DETAILED SOLUTIONS

1. The number of faces of a triangular pyramid is 4.



2. 3 x 2 x 3 x 2 = 36.

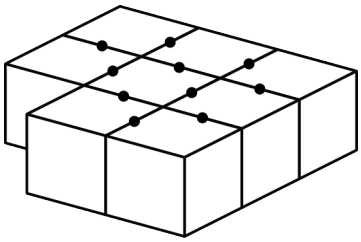
3. The number which is a multiple of 4 is (4 x 6) 24.

4. The value of ? in the equation 11 x 3 = ? + 3 is 30.

5. The greatest common factor of 15 and 30 (15) is also the least common multiple of 3 and 5 (15).

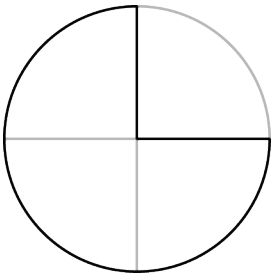
6. The number of sides of a square (4) + the number of vertices of a square (4) + the number of lines of symmetry in a square (4) is equal to 12.

7. The product of 50 x 10 x 2 is (500 x 2) 1 000.



8. Eight blocks have been glued together as shown in the diagram. These 8 blocks have a total of (8 x 6) 48 faces, 20 (10 x 2) of which are covered with glue (each dot in the diagram accounts for 2 glued faces). The number of faces of these blocks that have no glue on them is (48 -20) 28.

9. Mathilda has bought 2¢ and 3¢ stamps for a total of 40¢. The total being even, the number of 3¢ stamps bought must absolutely be even, otherwise the total would be odd. The number of 3¢ stamps cannot be 16 because 16 x 3¢ is equal to 48¢. The number of 3¢ stamps that she has bought could be 12.



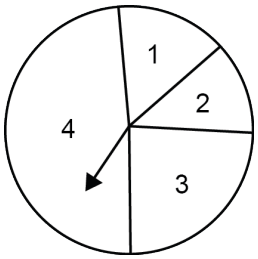
10. The result of 3 x 8 - 11 x 2 is (24 - 22) 2.

11. The fraction of the pie that has been eaten is 1/4.

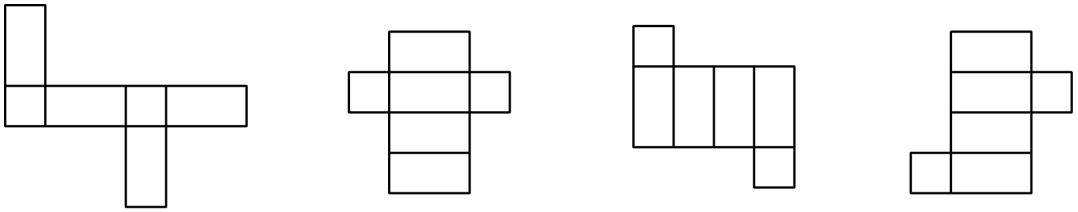
12. The divisors of 10 are {1, 2, 5, 10}, those of 12 are {1, 2, 3, 4, 6, 12}. Of these 5 numbers: 1, 2, 3, 4, and 5, only 2 (1 and 2) are common divisors of 10 and 12.

13. The value of 10 mm (1 cm) + 10 cm + 10 dm (100 cm) is 111 cm.

14. The circular sector 3 represents about a quarter of the spinner (a bit less than 90º). Mathew could expect to get a 3 approximately (1/4 of 1 000) 250 times.



15. Each one of the 4 nets below can form a rectangular prism because the 3 pairs of opposite faces are identical and disjoint (they have no common edges).



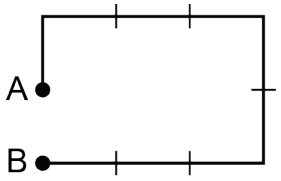
I II III IV

16. Together, they pour a total of (45 ml + 40 ml) 85 ml of water. Andrea will be able to pour the 40 ml of water at least 11 times (85 ml x 11 = 935 ml) whether she pours the water before or after Melissa. When Melissa will pour the 45 ml for the 12th time, she will pour them first because she is the one that pours first at each even term of the sequence: A-M, M-A, A-M, M-A … . The beaker will then contain a total of (935 ml + 45 ml) 980 ml of water. Andrea will not be able to pour the 40 ml of water completely in the 1 000 ml beaker a 12th time without the water overflowing.

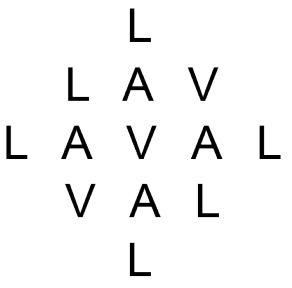
17. Of the five natural numbers given, the only one that yields an odd remainder when divided by 6 (53 ÷ 6 = 8 R 5) is 53. The number that we are seeking could be 53.

18. The second circle has twice the dots of the first circle. The 3rd circle has one dot more than the second. The fourth circle has twice the dots of the 3rd. The 5th has one dot more than the 4th. The mathematical rule of this sequence is x 2 + 1. To continue the sequence, the next circle must have (7 x 2) 14 dots.

19. Mathilda leaves from A and ends her journey at B. She ended her journey1 km (south) of her house (see diagram).



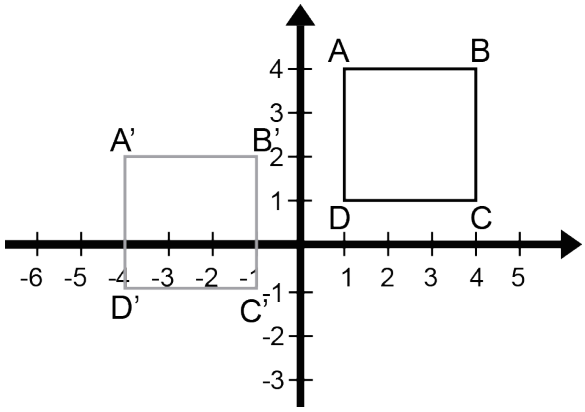
20. Using the L of the first line, we can read the word LAVAL in 6 different ways. Indeed, if you start from this L and stop at the first A, then read from left to right and from top to bottom, you will be able to read the word LAVAL in 2 different ways. If you start again from this same L and move down vertically to the first V, then read from left to right and from top to bottom, you will be able to read the word LAVAL in two other ways. If you move down vertically to the second A, you will be able to read the word LAVAL in two more ways. Going through the same process, but using the first L of the third line, you will be able to read the word LAVAL in another 6 ways. Using the L of the 2nd line, you can read the word LAVAL in 12 other ways, because if you use the A just to its right, you can read the word LAVAL in the same 6 ways you would be reading it if you were using the L of the first line (except the L itself). If you use the A right below it, you can read the word LAVAL in the same 6 ways you would be reading it if you were using the L from the third line (except the L itself). In all, you can read the word LAVAL in 24 different ways.



21. If Andrea takes 36 minutes to wax the car, Mathew takes 12 minutes. In 36 minutes, Mathew can wax 3 identical cars. Together, in 36 minutes, they can wax 4 cars. Together, they can wax the same car in (36 ÷ 4) 9 minutes.

22. The ones digit of the following product: 13 x 12 x 11 x 10 x 9 x 8 x 7 is 0.

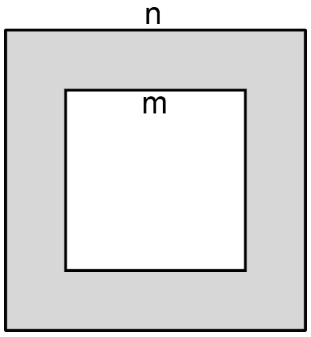
23. If the square is moved (translation) 5 units to the left, then 2 units down, the coordinates of C' are (-1 , -1).



24. When I will be ''n'' years old, I will be (n - 10) years older. My mother will have deposited the $3 000 (n - 10) times. I will have in my bank account an amount of $9 000 + (n - 10) x $3 000. The total amount I will have (in thousands of $) in my bank account when I will be ''n'' years old will be 9 + (n - 10) x 3.

25. The number 2 012 is not prime because it is even.

26. We know that m is even and that it is smaller than 10. It can have a value of 2, 4, 6 or 8. We also know that n is a natural number that must be even (the area of the square of side n is the sum of the area of the square of side m plus 64 cm^2). The only value of m that will give an n that satisfies these conditions is m = 6. The value of n is (36 cm^2 + 64 cm^2 = 100 cm^2) 10 cm.



27. The number of sides of a quadrilateral (4), plus the number of sides of a pentagon (5), plus the number of sides of an hexagon(6) is equal to 15.

28. The equation 15 x 14 = 21 x n x m can be written as 3 x 5 x 2 x 7 = 3 x 7 x n x m or better still, it can be written as 3 x 7 x 2 x 5 = 3 x 7 x n x m. The value of n + m is equal to (2 + 5) 7.

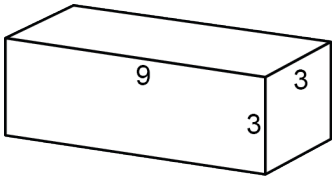
29. A natural number n is always equal to (n x n) times its reciprocal. Two is (2 x 2) 4 times larger than its reciprocal 1/2, 4 is 16 times larger than 1/4, … . The natural number which is equal to 25 times its reciprocal is thus (5 ÷ 1/5 = 25) 5.

30. Because the number of red cards represent 3/5 of the black cards (he has 3 red cards for every 5 black cards), we must find the equivalent fraction of 3/5 where the numerator (the red cards) is 6 less than the denominator (black cards). This fraction is (3/5 = 9/15) 9/15. Mathusalem must have 15 black cards.

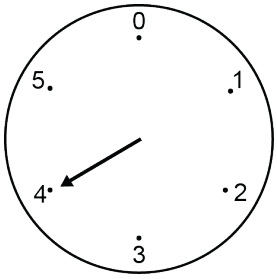
31. The universe of all possible pairs (6 x 6 = 36 pairs) is represented in the diagram on the right. All pairs where the sum of the two numbers is 5 or less are represented in bold print. The probability that the outcome is one of these pairs is (10/36) 5/18.

(1,1)	**(1,2)**	**(1,3)**	**(1,4)**	(1,5)	(1,6)
(2,1)	**(2,2)**	**(2,3)**	(2,4)	(2,5)	(2,6)
(3,1)	**(3,2)**	(3,3)	(3,4)	(3,5)	(3,6)
(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

32. The total area of this rectangular solid is equal to (2 x 9cm^2 + 2 x 27 cm^2 + 2 x 27 cm^2) 126 cm^2.

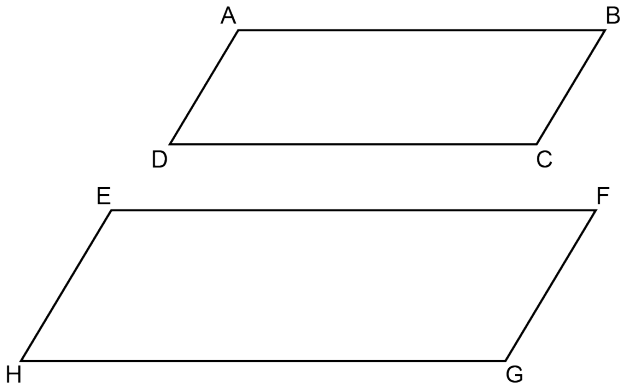


33. Using the clock in the diagram, we can write the following equations: 4 + 2 = 0, 5 + 3 = 2, 2 - 2 = 0, 1 - 3 = 4, 2 x 4 = 2, 5 x 3 = 3. The value of $\underline{2 \times 4} + \underline{2 \times 5}$ according this clock's arithmetic is $\underline{2} + \underline{4}$. This sum is equal to 0.



34. A speed of 36 km/h is equivalent to a speed of (36 000 m in 60 minutes) 600 m/min. In one minute, this race horse covers a distance of 600 metres.

35. The diagram on the right is made of 2 parallelograms. Line segment AB is parallel to line segment EF. We can count a total of 12 pairs of parallel line segments. Indeed, each side of parallelogram ABCD is parallel to 3 other sides (AB-DC, AB-EF, and AB-HG). For the 4 sides of this parallelogram, we can count (4 x 3) 12 pairs of parallel line segments. For the 4 sides of parallelogram EFGH, we can also count 12 pairs of parallel line segments. Calculated in this manner, each pair of parallel line segments is counted twice (AB-HG is the same pair as HG-AB). In this diagram, we can count a total of (24 ÷ 2) 12 pairs of parallel line segments.



IMPORTANT CORRECTION

Attention: Contest supervisor for grades 3, 4, 5, and 6

Please note:

Number 29 ''D'' of the 2013 Contest should be ''10'' instead of ''8''