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Junior Division Round 2

Questions 1 to 5, 4 marks each

1. Michael bought 6 pens and 3 notebooks while Wallace bought 3 pens and 6 notebooks. The pens are identical and so are the notebooks. Michael's bill is 6 dollars higher than Wallace's. How many dollars is the price of a pen higher than the price of a notebook?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

Answer : _____

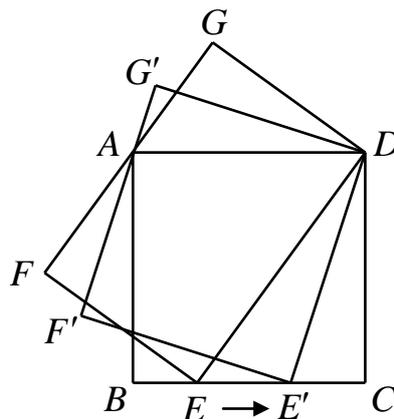
2. If all the divisors of 2016 are arranged in decreasing order, by how much is the third divisor larger than the fourth divisor?
- (A) 12 (B) 48 (C) 168 (D) 672 (E) 2016

Answer : _____

3. Which of the following is equal to $xr + ys$ if $r = 3x + 2y$ and $s = xy - x - y$?
- (A) $x^2y - x^2 + 2xy + 2y^2$ (B) $xy^2 + 3x^2 + xy - y^2$ (C) $x^2y + 2x^2 + xy$
(D) $xy^2 + 2x^2 + 2xy$ (E) $x^2y^2 + x + y$

Answer : _____

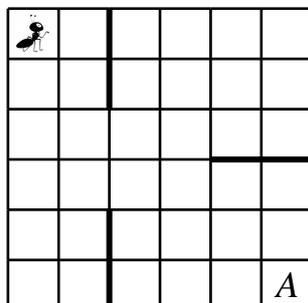
4. E is a variable point on the side BC of a square $ABCD$. $DEFG$ is a rectangle with FG passing through A . As the point E moves from B towards C , how does the area of $DEFG$ change?



- (A) Steadily increasing (B) Steadily decreasing
(C) Decreasing and then increasing (D) Increasing and then decreasing
(E) Remaining constant

Answer : _____

5. The diagram shows a 6 by 6 board with three barriers. An ant is at the top left corner and wishes to reach the bottom right corner. It may only crawl between squares which share a common side, and only towards the bottom or the right. It cannot pass through any barrier. How many different paths can it follow?

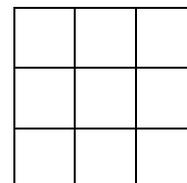


- (A) 88 (B) 90 (C) 92 (D) 96 (E) 112

Answer : _____

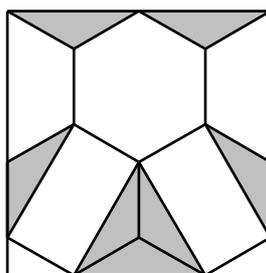
Questions 6 to 13, 5 marks each

6. One square in a 3 by 3 board is to be painted black, a second square blue and a third square red. If no two of these three squares are in the same row or in the same column, how many different ways of painting them are there?



Answer : _____ ways

7. The diagram shows a tile divided into regular hexagons of side length 1 cm. What is the total area, in cm^2 , of the parts of the tile which are shaded?

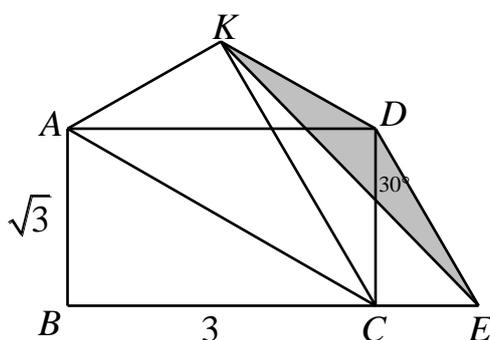


Answer : _____ cm^2

8. Let a , b , c and d be real numbers such that $|a+b|$, $|a-b|$, $|c+d|$ and $|c-d|$ are 6, 7, 8 and 9 in some order. What is the value of $a^2 + b^2 + c^2 + d^2$?

Answer : _____

9. A rectangle $ABCD$ with $BC = 3$ cm and $AB = \sqrt{3}$ cm is folded along AC so that the point B lands on the point K symmetric to it about AC . What is the area, in cm^2 , of triangle KDE , where E is the point on the extension of BC such that $\angle CDE = 30^\circ$?



Answer : _____ cm^2

10. In the expression $((10 \square 2) \square 2) \square 2 \square 2$, each \square is to be replaced by a different one of $+$, $-$, \times and \div . How many different values can this expression take?

Answer : _____

11. Let a , b and c be real numbers such that $abc = 1$, $(a+1)(b+1)(c+1) = 16$ and $(a+2)(b+2)(c+2) = 53$. What is the value of $(a-1)(b-1)(c-1)$?

Answer : _____

12. The area of triangle ABC is 120 cm^2 and $BC = 16$ cm. What is the minimum length, in cm, of the perimeter of ABC ?

Answer : _____ cm

13. Let a, b, c and d be four different non-zero digits. The greatest common divisor of the four-digit numbers \overline{abcd} and \overline{acbd} is n . What is the largest possible value of n ?

Answer : _____

Questions 14 to 15, 20 marks each

Detailed solutions are needed for these two problems

14. The first diagram shows a 6 by 6 board, and the second diagram shows an L-shaped piece consisting of four 1 by 1 squares. Paint as few of the squares of the 6 by 6 board black so that wherever the L-shaped piece is placed on the board covering four squares, at least one of the squares will be black. The L-shaped piece may be turned about or flipped over

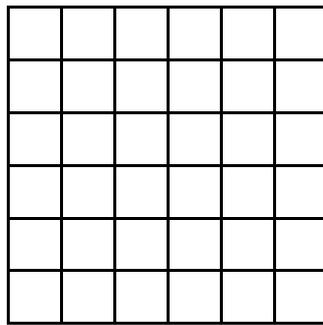


Fig. 1

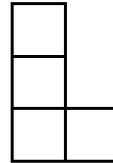
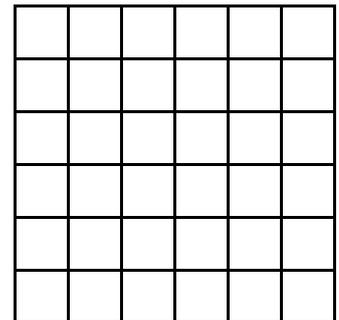


Fig. 2



Answer : At least paint squares black,

15. P and Q are points on the bisector of the exterior angle at A of triangle ABC , with A between P and Q , such that BP is parallel to CQ . D is the point on BC such that $DP=DQ$. Prove that AB is parallel to DQ .