Mathlete Training Centre
2016 Questions

1. (SMOPS 16Q1) Find the value of $2016 + 2015 + 2014 - 2013 - 2012 - 2011 + 2010 + 2009 + 2008 - 2007 - 2006 - 2005 + ... + 6 + 5 + 4 - 3 - 2 - 1$.

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2. (SMOPS 16Q2) In the following figure, each of the three lines divide the shape into 2 equal parts. Compare the size of the shaded areas A and B.
(1) $A > B$ (2) $A < B$ (3) $A = B$ (4) Insufficient information

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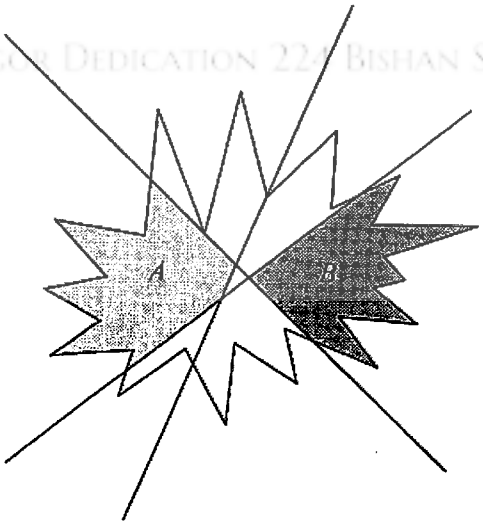
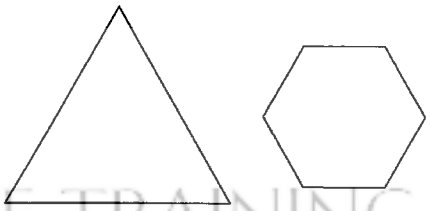


3. (SMOPS 16Q3) Among the fractions $\frac{1}{6}$, $\frac{2}{7}$, $\frac{3}{8}$, ..., $\frac{2010}{2015}$, $\frac{2011}{2016}$, how many of them are in their simplest form?

4. (SMOPS 16Q4) We define a new operation $\oplus$ as $a \oplus b = \frac{2}{a^2} + \frac{1}{b}$. Which one of the following equations are correct?

(1) $2 \oplus 4 = 4 \oplus 2$
(2) $3 \oplus 6 = 6 \oplus 3$
(3) $4 \oplus 8 = 8 \oplus 4$
(4) $1008 \oplus 2016 = 2016 \oplus 1008$

5. (SMOPS 16Q5) As shown, the equilateral triangle has side length 3 cm, and the regular hexagon has side length 1 cm. If the ratio of the area of the equilateral triangle to the area of the regular hexagon is a:2, find the value of a.



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6. (SMOPS 16Q6) As shown, the isosceles right-angled triangle ABC has a hypotenuse BC of length 6 cm. Point D is on BC; the line through D perpendicular to BC intersects AC at E, and intersects BA extended at F. Find the length of DE+DF.

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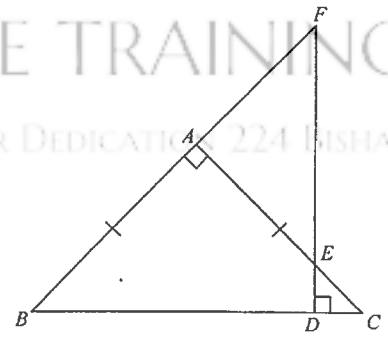
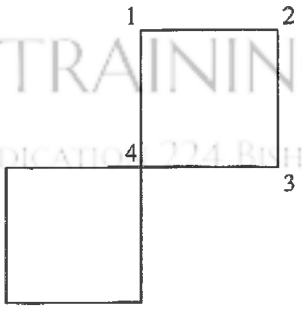


7. (SMOPS 16Q7) **Clair** drives his car according to the following instructions:
   Drive in a straight line for 20 metres, then turn left.
   Drive in a straight line for 20 metres, then turn right.
   Drive in a straight line for 20 metres, then turn right.
   Drive in a straight line for 20 metres, then turn right.
   And repeat the above instructions. The figure shows the path through which he has driven. From which point, 1, 2, 3, or 4, did he start driving?



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8. (SMOPS 16Q8) Three cubes have edge lengths of 3cm, 4cm, and 5cm respectively, and all their faces are coloured red. If we cut these cubes into small cubes of edge length 1cm, find the number of small cubes that have at least one face coloured red.

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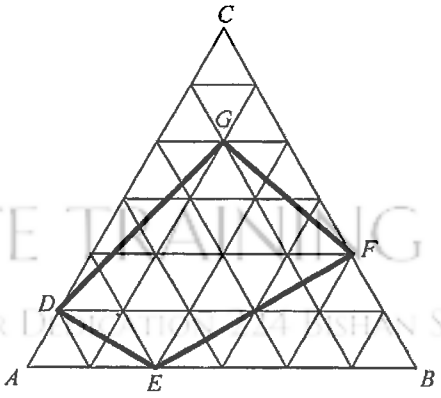
9. (SMOPS 16Q9) As shown, equilateral triangle ABC has had each of its edges divided into 6 equal pieces. If each of the smallest equilateral triangle in the figure has an area of 1 cm^2, then what is the area of quadrilateral DEFG?



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10. (SMOPS 16Q10) Two rabbits **Blanche** and **Fleur** depart at the same time from points A and B respectively, travelling towards each other. **Fleur**'s speed is 1.5 times that of **Blanche**. We know that the place where they met each other during their journey is 12 metres away from the midpoint of AB. Find the length of AB.

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11. (SMOPS 16Q11) The ratio of the areas of three different faces of a cuboid is 2:3:5, and the sum of the length of all the edges of this cuboid is 124 cm. Find the volume of this cuboid.

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12. (SMOPS 16Q12) Write the first 300 natural numbers in a row. (i.e. 1, 2, 3, ..., 299, 300.) If we erase all those which are divisible by 5 or by 7, what is the 123^{th} number left in line?

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13. (SMOPS 16Q13) Place 2016 points inside ΔABC, such that no three of these 2019 points (including A, B, and C themselves) lie on a straight line. Using these 2019 points as vertices, how many small triangles can ΔABC be divided into?

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14. (SMOPS 16Q14) Find the value of $84 \times \left(\frac{1}{1\times3} - \frac{2}{3\times5} + \frac{3}{5\times7} - \frac{4}{7\times9} + \ldots + \frac{9}{17\times19} - \frac{10}{19\times21}\right)$

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15. (SMOPS 16Q15) We know that a, b, and c are three prime numbers (they can be identical), and that a×b×c can be represented as the sum of 13 consecutive whole numbers. Find the minimum value of a+b+c.

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16. (SMOPS 16Q16) How many consecutive '0's are there at the end of $1\times4\times7\times10\times...\times697\times700$?

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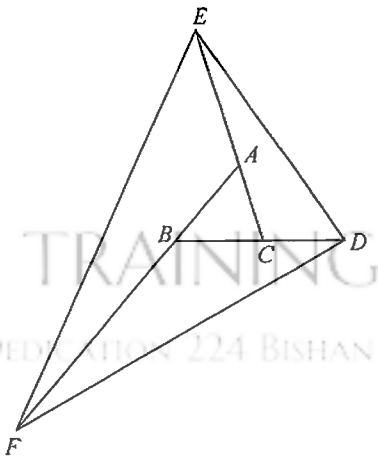
17. (SMOPS 16Q17) The area of ΔABC is 1 cm^2. Extend BC, CA, and AB to points D, E, and F, such that BD=2BC, CE=3CA, and AF=4AB. Find the area of ΔDEF.



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18. (SMOPS 16Q18) 6 10-cent coins stacked together is as tall as 5 20-cent coins stacked together, 4 10-cent coins stacked together is as tall as 3 50-cent coins. Now, using a total of 124 coins, 3 stacks of equal height are made, with one stack of only 10-cent coins, another stack of only 20-cent coins, and another with only 50-cent coins. What is the total value of the coins in these 3 stacks combined?

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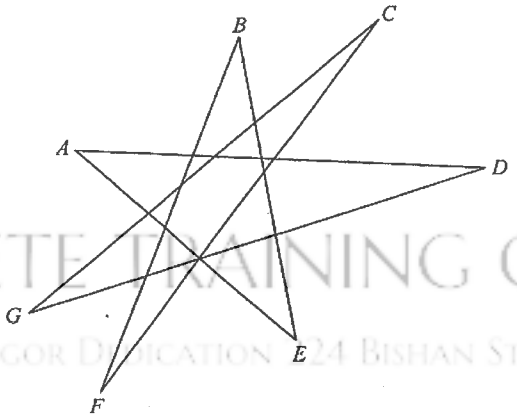
19. (SMOPS 16Q19) How many 10-digit whole numbers has the product of all its digits equals to 2^{27}?

20. (SMOPS 16Q20) As shown, calculate $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F + \angle G$.



21. (SMOPS 16Q21) Three football teams are in a championship, where each team plays with each the other two teams once. After all the matches are over, one sports reporter enquired part of the scorings: team A scored 6 goals, and conceded less than 5 goals; team B conceded 3 goals; team C scored at least 7 goals. What is the result of the match between team A and team C?

    i.e. if the score is 22:0, then A scored 22 goals, and conceded 0; C scored 0 and conceded 22.

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22. (SMOPS 16Q22) A natural number N is divisible by 18 numbers from 1 to 20. The two numbers, which N is not divisible by, are consecutive numbers. What is their sum?

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23. (SMOPS 16Q23) Rouge lives in city A, and he needs to go to city B, which is 60 km away. There are two bus services: small bus and large bus. The small bus has a stop every 2 km, and charges \$3 every 2 km. The large bus has a stop every 3km, and charges \$4 every 3 km. If Rouge needs to get off at stops which are 4, 16, 33, and 44 km away from city A, at least how much money does his journey to city B cost?

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24. (SMOPS 16Q24) Find the smallest number whose sum of digits is 35, the last two digits are '35', and is divisible by 35.

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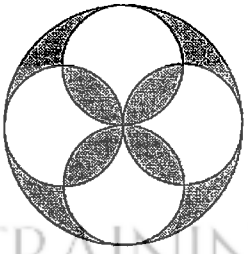
25. (SMOPS 16Q25) As shown, the biggest circle has radius 7 cm. Find the area of the shaded part, let $\pi = \frac{22}{7}$.



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26. (SMOPS 16Q26) A computer program arranges all words made with the alphabets A, P, M, O, P, S alphabetically. The sequence generated is: AMOPPS, AMOPSP, AMOSPP, AMPOPS, ..., SPPMOA, SPPOAM, SPPOMA. Find the position of POAMSP.

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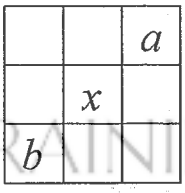
27. (SMOPS 16Q27) In the following 3×3 square, the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 are to placed such that any two consecutive numbers are placed in neighbouring cells (i.e. 1 and 2 are neighbours, 2 and 3 are neighbours, ..., 8 and 9 are neighbours). If a+b=12, what is the sum of the possible values that the centre cell x can take?
If two cells share an edge, they are neighbours.



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28. (SMOPS 16Q28) A charity concert has tickets priced as such: adults $23, students $15, children $7. A total of 136 tickets were sold, with a total of $2016. If children make up the greatest proportion, and adults make up the smallest proportion of the audience, how many student tickets were sold?

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29. (SMOPS 16Q29) Among 5 consecutive two-digit numbers, the sum of 3 of them is divisible by 37, and the sum of another 3 of them is divisible by 60. What is the greatest number among these 5 numbers?

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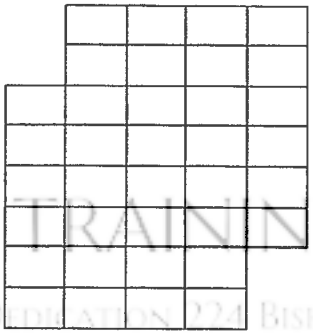
30. (SMOPS 16Q30) How many rectangles (including squares) are there in the following figure?



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