SCIENCE OLYMPIAD FOUNDATION

IMO

SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2025-26

CLASS 11

QUESTION PAPER SET A

Total Questions : 50 | Time : 1 hr.

Guidelines for the Candidate

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. The Question Paper comprises four sections:
   Section - 1 : **Logical Reasoning** (15 Questions)
   Section - 2 : **Mathematical Reasoning** (20 Questions) or **Applied Mathematics** (20 Questions)
   Section - 3 : **Everyday Mathematics** (10 Questions)
   Section - 4 : **Achievers Section** (5 Questions)
4. **Section-1, 3 and 4 are compulsory for all**. In Section-2 opt for Mathematical Reasoning OR Applied Mathematics and mark the same on the OMR Sheet.
   Each question in Achievers Section carries 3 marks, whereas all other questions carry 1 mark each.
5. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
6. There is only ONE correct answer. Choose only ONE option for an answer.
7. To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.
   Q. 16: Navya purchased a hand bag for ₹ 345.50, a pair of shoes for ₹ 480.25 and a cap for ₹ 75.50. How much money did she spend in all?
   A. ₹ 901.25 B. ₹ 785.50 C. ₹ 895.75 D. ₹ 920.25
   As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet. 16. ● Ⓑ Ⓒ Ⓓ
8. Rough work should be done in the blank space provided in the booklet.
9. Return the OMR Sheet to the invigilator at the end of the exam.
10. Please fill in your personal details in the space provided before attempting the paper.

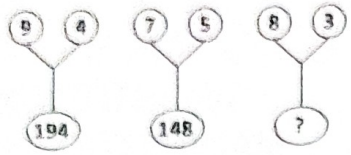
Name:.....

SOF Olympiad Roll No.:.....

Contact No.:.....

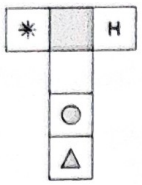
DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

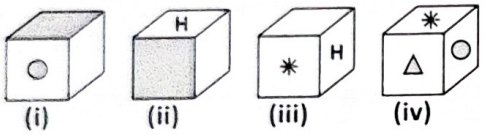
1. Find the missing number, if same rule is followed in all the three figures.



A. 186
B. 146
C. 172
D. 138

2. Select the box(es) from the options that is/are similar to the box formed, when the given sheet is folded to form a box.





A. (ii) only
B. (i), (ii) and (iv) only
C. (ii) and (iv) only
D. (iii) only

3. The given question consists of two statements followed by three conclusions numbered I, II and III. Read all the conclusions and find which of the given conclusions logically follows from the given statements, if all statements are assumed to be true.

Statements :

(i) All forests are mountains.

(ii) Some mountains are hills.

Conclusions :

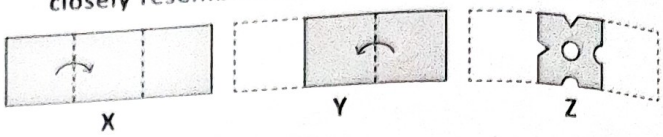
I. Some forests are hills.

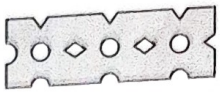
II. Some mountains are forests.

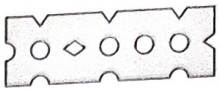
III. All hills are mountains.

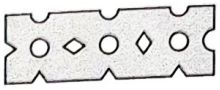
A. Only I and II follows
B. Only II and III follows
C. Only III follows
D. Only II follows

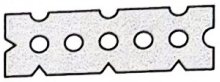
4. There is a set of three figures X, Y and Z showing a sequence of folding of a piece of paper. Fig. Z shows the manner in which the folded paper has been cut. Select a figure from the options which would most closely resembles the unfolded form of fig. Z.



A. 

B. 

C. 

D. 

5. How many such pairs of letters are there in the word DISCREPANCY each of which have as many letters between them in the word as in the English alphabets?

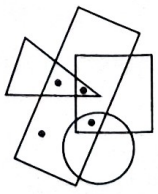
A. Three
B. Four
C. Five
D. More than five

6. There is a certain relationship between the pair of numbers on the either side of : :. Identify the relationship of the given pair and find the missing number.

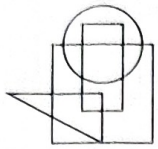
849 : 392 :: 685 : ?

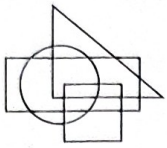
A. 510
B. 280
C. 495
D. 324

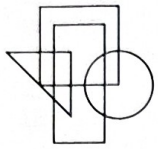
7. Select a figure from the options which does not satisfy the same conditions of placement of dots as in the given figure.



A. 

B. 

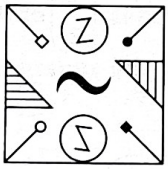
C. 

D. 

8. **Select the correct water image of the given figure.**

A. 

B. 

C. 

D. 

9. **A word arrangement machine when given an input line of words rearranges them by following a particular rule in each step. The following is an illustration of an input line of words and steps of rearrangement.**

Input : so actions speak louder than a word

Step I : a so actions speak louder than word

Step II : a so than actions speak louder word

Step III : a so than word actions speak louder

Step IV : a so than word speak actions louder

Step V : a so than word speak louder actions

Step V is the last step of the given input.

As per the rule followed in the above steps, which of the following will be the last step for the given input?

Input : follow the right path to health

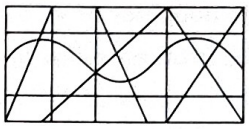
A. to the path right health follow

B. to the path right follow health

C. to the path follow right health

D. the to path right follow health

10. **Which of the following figures is exactly embedded in the given figure as one of its parts?**



A. 

B. 

C. 

D. 

11. **If 6@4 = 1.5, 6#4 = 24 and 6%4 = 2, then what will be the value of (23#5%10) % (272@17) % (132@12)?**

A. 78

B. 112

C. 96

D. 81

12. **From a point X, Sridhar walks 50 m towards East and then turns left and walks 60 m to reach point Y. Also from point X, Garvit walks 40 m towards West and then turns left and walks 70 m to reach point Z. How far and in which direction is point Y with respect to point Z?**

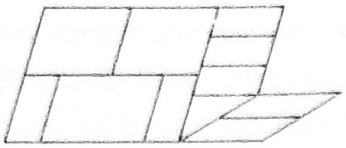
A. $10\sqrt{50}$ m, South-West

B. $50\sqrt{10}$ m, South-East

C. $50\sqrt{10}$ m, North-East

D. $10\sqrt{50}$ m, North-East

13. Find the number of parallelograms formed in the given figure.



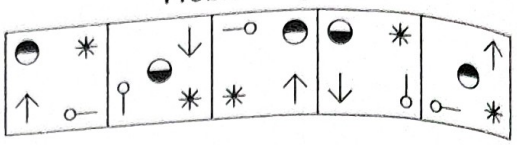
A. 19
B. 20
C. 21
D. More than 21

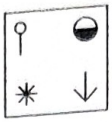
14. In a family, M is the mother of K, who is the husband of J. T is the son of V, who is the husband of S. J is the sister of T. R is the daughter of K. Which of the following statements is incorrect?

A. K is the son-in-law of S.
B. J is the daughter of V.
C. T is the brother-in-law of K.
D. R is the nephew of T.

15. Select a figure from the options which will continue the same series as established by the Problem Figures.

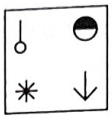
Problem Figures



A. 

B. 

C. 

D. 

MATHEMATICAL REASONING*

*This section is to be attempted by science stream students.

16. If A and B are finite sets and $n(A) = n(B)$, then

A. $n(A - B) = n(A)$
B. $n(A - B) = n(B)$
C. $n(A - B) = n(B - A)$
D. $n(A \cup B) = n(A \cap B)$

17. If the number of elements in set A is p, the number of elements in set B is q and the number of elements in $A \times B$ is 7, then $p^2 + q^2 =$

A. 42
B. 49
C. 50
D. 51

18. If p and q are zeroes of the quadratic polynomial $2x^2 + 2(m + n)x + m^2 + n^2$, then find the quadratic polynomial whose zeroes are $(p + q)^2$ and $(p - q)^2$.

A. $x^2 + 2mnx + (m^2 + n^2)^2$
B. $x^2 - 4mnx - (m^2 - n^2)^2$
C. $x^2 - 2mnx - (m^2 - n^2)^2$
D. $x^2 + 4mnx - (m^2 - n^2)^2$

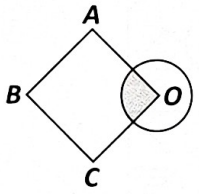
19. If ${}^nC_{r-1} = 36$, ${}^nC_r = 84$, ${}^nC_{r+1} = 126$, then the value of r is

A. 1
B. 2
C. 3
D. None of these

20. If z_1, z_2, z_3 are complex numbers such that $|z_1| = |z_2| = |z_3| = 1$, then $|z_1 - z_2|^2 + |z_2 - z_3|^2 + |z_3 - z_1|^2$ cannot exceed

A. 6
B. 9
C. 12
D. None of these

21. O is the centre of a circle of diameter 4 cm and $OABC$ is a square. If the shaded area is $\left(\frac{1}{3}\right)$ of the area of the square, then the side of the square is



A. $(\sqrt{3}\pi)$ cm
B. $(\sqrt{3\pi})$ cm
C. $(3\sqrt{\pi})$ cm
D. (3π) cm

22. Three positive numbers form an increasing G.P. If the middle term in this G.P. is doubled, the new numbers are in A.P., then the common ratio of the G.P. is

A. $2-\sqrt{3}$

B. $2+\sqrt{3}$

C. $\sqrt{2}+\sqrt{3}$

D. $3+\sqrt{2}$

23. The value of

$$\lim_{x\to 0}\frac{8}{\sin^8 x}\left(1-\cos\frac{x^2}{2}-\cos\frac{x^2}{4}+\cos\frac{x^2}{2}\cos\frac{x^2}{4}\right)=$$

A. $\frac{1}{16}$

B. $\frac{1}{32}$

C. $\frac{1}{64}$

D. $\frac{1}{8}$

24. The angle of depression of a car moving with uniform speed towards the building as observed from the top of the building is found to be 30°. The angle of depression changes to 60° after 12 seconds. After what time, will it reach the base of the building?

A. 6 seconds

B. 8 seconds

C. 4 seconds

D. 12 seconds

25. If $(2x^2 - x - 1)^5 = a_0 + a_1x + a_2x^2 + \ldots + a_{10}x^{10}$, then $a_2 + a_4 + a_6 + a_8 + a_{10} =$

A. 15

B. 30

C. 16

D. 17

26. If three distinct numbers are chosen randomly from the first 100 natural numbers, then the probability that all three of them are divisible by both 2 and 3 is

A. $\frac{4}{25}$

B. $\frac{4}{1155}$

C. $\frac{4}{33}$

D. $\frac{4}{35}$

27. A triangle ABC, right angled at A, has points A and B as $(2, 3)$ and $(0, -1)$ respectively. If $BC = 5$ units, then the point C is

A. $(-4, 2)$

B. $(4, 2)$

C. $(3, -3)$

D. $(0, -4)$

28. Let L be the line passing through the point $P(1, 2)$ such that its intercepted segment between the co-ordinate axes is bisected at P. If L_1 is the line perpendicular to L and passing through the point $(-2, 1)$, then the point of intersection of L and L_1 is

A. $\left(\frac{4}{5}, \frac{12}{5}\right)$

B. $\left(\frac{11}{20}, \frac{29}{10}\right)$

C. $\left(\frac{3}{10}, \frac{17}{5}\right)$

D. $\left(\frac{3}{5}, \frac{23}{10}\right)$

29. If the roots of the quadratic equation $x^2 - 4x - \log_3 a = 0$ are real, then what is the least value of a ?

A. 64

B. $\frac{1}{81}$

C. $\frac{1}{64}$

D. 81

30. The eccentricity of an ellipse with centre at the origin and axes along the coordinate axes, is 1/2. If one of the directrices is $x = 4$, then the equation of the ellipse is

A. $4x^2 + 3y^2 = 1$

B. $3x^2 + 4y^2 = 12$

C. $4x^2 + 3y^2 = 12$

D. $3x^2 + 4y^2 = 1$

31. If $2 \sin A \cos A + (\cos A + \sin A)^2 - (2 \cos A + \sin A)^2 = p \sin^2 A + q$, then

A. $p = 3, q = -3$

B. $p = -3, q = 3$

C. $p = 1, q = -1$

D. $p = -1, q = 1$

32. The scores of batsman *A* in 10 different test matches were 38, 70, 48, 34, 42, 55, 63, 46, 54 and 44. Find the mean deviation about median.

A. 8.6
B. 10.61
C. 6.8
D. 9.61

33. The pair of equations $3^{x+y} = 243$, $243^{x-y} = 3$ has

A. No solution
B. Infinitely many solutions
C. Unique solution, $x = 2\frac{3}{5}$ and $y = 2\frac{2}{5}$
D. None of these

34. The solution set of $|3 - 4x| > 2$ is

A. $\left(\frac{7}{4}, \infty\right)$
B. $\left(-\frac{1}{4}, \frac{7}{4}\right)$
C. $\left(-\infty, -\frac{1}{4}\right) \cup \left(\frac{7}{4}, \infty\right)$
D. $\left(-\infty, \frac{1}{4}\right) \cup \left(\frac{5}{4}, \infty\right)$

35. Select the incorrect option.

A. $\cos^2\theta + \frac{1}{1+\cot^2\theta} = 1$
B. $(1 + \tan^2\theta)(1 + \sin\theta)(1 - \sin\theta) = 1$
C. $\frac{\tan\theta + \sin\theta}{\tan\theta - \sin\theta} = \frac{\sec\theta - 1}{\sec\theta + 1}$
D. $\frac{\sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta\cos\theta = 1$

OR

APPLIED MATHEMATICS*

*This section is to be attempted by commerce stream students.

16. Find the largest possible positive integer that divides 125, 162 and 259 leaving remainder 5, 6 and 7 respectively.

A. 14
B. 18
C. 12
D. 16

17. If the line $x - 1 = 0$ is the directrix of the parabola $y^2 - kx + 8 = 0$, then one of the values of k is

A. 1/8
B. 8
C. 4
D. 1/4

18. The x-coordinate of a point P is thrice its y-coordinate. If P is equidistant from $Q(3, -5)$ and $R(2, 5)$, then the coordinates of P are

A. (1, 3)
B. $\left(\frac{-15}{14}, \frac{-5}{14}\right)$
C. $\left(\frac{3}{2}, \frac{1}{2}\right)$
D. $\left(\frac{1}{2}, \frac{3}{2}\right)$

19. Why are fixed charges used by service providers in India?

A. To promote more usage
B. To penalize low users
C. To recover basic operational costs
D. To collect tax on behalf of government

20. Radheshyam is a dealer of footwear in Moradabad (UP). He purchased footwear worth ₹ 2,00,000. He sold 50% of these footwear to a dealer in Agra (UP) for ₹ 1,30,000 and the rest of the stock remains in his godown. If the rate of GST is 12%, find the excess credit of CGST to be carried forward.

A. ₹ 1200
B. ₹ 1800
C. ₹ 3600
D. None of these

21. Two numbers are selected at random from the integers 1 through 9. If the sum is even, then find the probability that both numbers are odd.

A. $\frac{3}{8}$
B. $\frac{5}{8}$

C. $\frac{3}{10}$

D. None of these

22. One diagonal of a square is $3x - 4y + 8 = 0$ and one vertex is $(-1, 1)$. The area of square is

A. $\frac{1}{50}$ sq. unit

B. $\frac{2}{25}$ sq. unit

C. $\frac{3}{50}$ sq. unit

D. $\frac{1}{25}$ sq. unit

23. If α and β are the zeroes of the polynomial $3t^2 - 6t + 4$, then find the value of $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}+2\left(\frac{1}{\alpha}+\frac{1}{\beta}\right)+3\alpha\beta$.

A. 5

B. 8

C. $\frac{10}{3}$

D. $\frac{1}{2}$

24. Which of the following statements is true about capital gains?

A. Capital gains are taxed at a different rate than salary income.

B. Capital gains can be included under the deduction of 80C.

C. Long term capital gains are fully taxable.

D. Capital gains are never taxable.

25. Find the Karl Pearson's coefficient of skewness.

Marks	Number of students
Above 5	100
Above 15	80
Above 25	75
Above 35	60
Above 45	55
Above 55	20
Above 65	0

A. −0.59

B. 0.88

C. 0.78

D. −0.69

26. If mode for the following distribution is 22 and $10 > y > x$, then find the value of y.

Class-intervals	Frequency
0 - 10	5
10 - 20	8
20 - 30	10
30 - 40	x
40 - 50	y
Total	30

A. 6

B. 5

C. 3

D. None of these

27. The domain of the function $f(x) = \log_4 (\log_5 (\log_3(18x - x^2 - 77)))$ is

A. $x \in (4, 5)$

B. $x \in (8, 10)$

C. $x \in (0, 10)$

D. $x \in (8, 10]$

28. If m and n are the roots of $x^2 - px + q = 0$, then the value of $p^3 - 3pq$ is

A. $m^3 + n^3$

B. $m^3 - n^3$

C. $m^2 + n^3 + mn$

D. $m^3 - n^3 + mn$

29. In a class of 8 students, the rank difference between two subjects are 0, 2, 1, −3, −3, 2, 1, 0.

What is the value of spearman's rank correlation?

A. 0.51

B. 0.67

C. 0.78

D. None of these

30. A man borrows ₹ 7000 at 12% p.a. compounded semi-annually. He pays ₹ 2000 at the end of every six months. Calculate the amount outstanding at the end of the third payment.

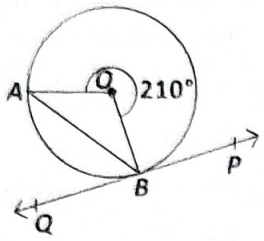
A. ₹ 3970

B. ₹ 1970

C. ₹ 2088

D. ₹ 2970

31. If AB is a chord of a circle with centre O and PQ is a tangent to the circle at B with reflex $\angle AOB = 210°$, then $\angle ABQ =$ _____ .



A. 75°
B. 150°
C. 210°
D. 105°

32. Let $f(x) = \dfrac{|x^3 - 6x^2 + 11x - 6|}{x^3 - 6x^2 + 11x - 6}$, then the set of points 'a', where $\lim\limits_{x \to a} f(x)$ does not exist, are

A. {1, 2, 3}
B. {1, 2, 0}
C. {−1, 1}
D. {0, 1}

33. Which of the following is an example of an annuity due in real life?

A. Receiving a pension at year end.
B. Buying a mutual fund once.
C. Paying rent at the start of the month.
D. All of these

34. In an A.P., if $S_5 + S_7 = 167$ and $S_{10} = 235$, then the A.P., where S_n denotes the sum of its first n terms, is

A. 2, 5, 8, 11, 14,...
B. 1, 5, 9, 13, 17,...
C. 2, 8, 14, 20, 26,...
D. 1, 6, 11, 16, 21,...

35. A financial plan offers 10% interest compounded quarterly. What is Annual Equivalent Rate (AER)? [Use : $(1.025)^4 = 1.1038$]

A. 10.02%
B. 10.25%
C. 10.38%
D. 10.5%

EVERYDAY MATHEMATICS

36. A, B, C can do a piece of work individually in 8, 12 and 15 days respectively. A and B start working but A quit after working 2 days. After this C join B till the work to be completed. In how many more days the work will be completed?

A. $3\frac{3}{4}$ days
B. $4\frac{6}{7}$ days
C. $6\frac{7}{13}$ days
D. $3\frac{8}{9}$ days

37. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that only one of them will qualify the examination.

A. 0.11
B. 0.10
C. 0.12
D. 0.13

38. A and B together start a business and invest the capital in the ratio 23 : 24. If 6% of the total profit paid to the public dominated association for charity and A's share is ₹ 1656, then what was the total profit?

A. ₹ 7050
B. ₹ 3450
C. ₹ 3600
D. ₹ 1800

39. A man bought two goats for ₹ 1008. He sold one at a loss of 20% and other at a profit of 44%. If each goat was sold for the same price, then the cost price of the goat which was sold at loss, was

A. ₹ 648
B. ₹ 360
C. ₹ 568
D. ₹ 440

40. In an interschool chess championship, every student had to play a game with every other student. It was observed that in 28 matches both players were boys and in 66 matches both were girls. What is the number of matches in which opposite sex were against each other?

A. 528
B. 462
C. 196
D. 96

41. The average age of 4 boys, five years ago was 9 years. On including a new boy, the present average age of all the five boys is 15 years. The present age of the new boy is

A. 14 years
B. 18 years
C. 15 years
D. 19 years

42. A mixture contains 80% acid and rest water. Part of the mixture that should be removed and replaced by the same amount of water to make the ratio of acid and water 4 : 3 is

A. $\left(\frac{1}{3}\right)^{rd}$
B. $\left(\frac{2}{7}\right)^{th}$
C. $\left(\frac{2}{3}\right)^{rd}$
D. $\left(\frac{3}{7}\right)^{th}$

43. A person is to count 4500 currency notes. Let a_n denote the number of notes he counts in the n^{th} minute. If $a_1 = a_2 = ... = a_{10} = 150$ and $a_{10}, a_{11}, ...$ are in A.P. with common difference –2, then the time taken by him to count all notes is

A. 24 minutes
B. 34 minutes
C. 125 minutes
D. None of these

44. Water flows at the rate of 10 metre per minute from a cylindrical pipe 5 mm in diameter. How long will it take to fill up a conical vessel whose diameter at the base is 40 cm and depth 24 cm?

A. 48 minutes 15 secs
B. 51 minutes 12 secs
C. 52 minutes 1 sec
D. 55 minutes

45. If a train runs at 40 km/hr, it reaches its destination late by 11 minutes, but if it runs at 50 km/hr, it is late by 5 minutes only. Find the correct time for the train to complete its journey.

A. 19 minutes
B. 20 minutes
C. 21 minutes
D. 18 minutes

ACHIEVERS SECTION

46. Fill in the blanks and select the correct option.

(i) If $af(x) + bf\left(\frac{1}{x}\right) = x - 1$, $x \neq 0$, $a \neq b$, then $f(2) =$ _____.

(ii) The domain of the function $f(x) = \sqrt{3 - 2^x - 2^{1-x}}$ is _____.

	(i)	(ii)
A.	$\frac{2a+b}{2(a^2-b^2)}$	[0, 1]
B.	$\frac{a+2b}{2(a^2-b^2)}$	[1, 2]
C.	$\frac{2a+b}{2(a^2+b^2)}$	[0, 1)
D.	$\frac{2a+b}{2(a^2+b^2)}$	(1, 2]

47. Read the given statements carefully and state 'T' for true and 'F' for false.

(i) If 61 and 60 are respectively AM and GM of two numbers, then ratio of square roots of the two numbers is 6:5.

(ii) The value of n for which $\frac{x^{n+1}+y^{n+1}}{x^n+y^n}$ is the geometric mean of x and y is $\frac{1}{2}$.

(iii) The sum of the 3rd and the 4th terms of a G.P. is 60 and the product of its first three terms is 1000. If the first term of this G.P. is positive, then its 7th term is 640.

	(i)	(ii)	(iii)
A.	T	T	T
B.	T	T	F
C.	T	F	T
D.	T	F	F

48. Evaluate the following and select the correct option:

(i) $\lim\limits_{x\to 3} \dfrac{\sqrt{3x-3}}{\sqrt{2x-4}-\sqrt{2}}$

(ii) $\lim\limits_{x\to 1} \dfrac{x+x^2+\ldots+x^n-n}{x-1}$

	(i)	(ii)
A.	$\frac{1}{\sqrt{2}}$	$\frac{n+1}{2}$
B.	$\frac{1}{\sqrt{2}}$	$\frac{n(n+1)}{2}$
C.	$\frac{1}{2}$	$\frac{n(n+1)}{2}$
D.	$\frac{1}{2}$	$\frac{n+1}{2}$

49. Read the given statements carefully and select the correct option.

Statement-I : If all the words (with or without meaning) having five letters are formed using the letters of the word SMALL and are arranged as in a dictionary, then the position of the word SMALL is 58^{th}.

Statement-II : The number of arrangements that can be formed from the letters a, b, c, d, e, f taken 3 at a time without repetition and each arrangement containing at least one vowel is 96.

A. Both Statement-I and Statement-II are true.

B. Both Statement-I and Statement-II are false.

C. Statement-I is true but Statement-II is false.

D. Statement-I is false but Statement-II is true.

50. Which of the following options is correct?

A. If one vertex of an equilateral triangle is at $(2, -1)$ and the base is $x + y - 2 = 0$, then the length of each side is $\frac{2}{\sqrt{3}}$.

B. If the points (1, 3) and (5, 1) are two opposite vertices of a rectangle and the other two vertices lie on the line $y = 2x + c$, then the value of c is 4.

C. A ray of light along $x + \sqrt{3}y = \sqrt{3}$ gets reflected upon reaching x-axis, the equation of the reflected ray is $\sqrt{3}y = x - \sqrt{3}$.

D. None of these

SPACE FOR ROUGH WORK