

**SOF INTERNATIONAL
MATHEMATICS OLYMPIAD
2025-26**

CLASS
12

**QUESTION
PAPER SET**

A

Total Questions : 50

Time : 1 hr.

Guidelines for the Candidate

- You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
- 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.
- 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)
- 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.
- All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
- There is only ONE correct answer. Choose only ONE option for an answer.
- 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. ● (B) (C) (D)
- Rough work should be done in the blank space provided in the booklet.
- Return the OMR Sheet to the invigilator at the end of the exam.
- Please fill in your personal details in the space provided before attempting the paper.

Name:.....

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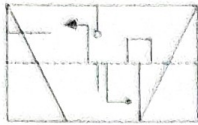
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LOGICAL REASONING

1. A rectangular transparent sheet with a pattern and a dotted line on it is given. Select a figure from the options as to how the pattern would appear when the transparent sheet is folded along the dotted line.

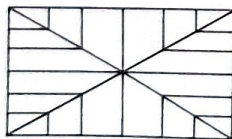


- A.
- B.
- C.
- D.

2. Select the number which will complete the given series.

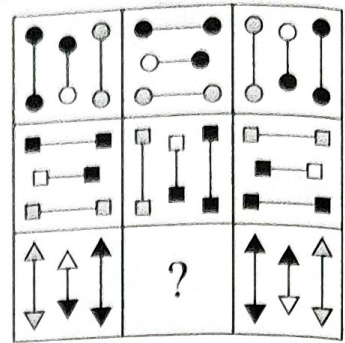
3601, 3602, 1803, 604, ?, 36

- A. 202
 B. 155
 C. 305
 D. 152
3. If the second and third digits of each of the following numbers are interchanged and two is multiplied to each of the first and last digits and then numbers are arranged in descending order, then what is the product of the first digits of the highest number and the smallest number from the left end?
- 4962 3194 4753 3581 4391
- A. 48
 B. 36
 C. 28
 D. 64
4. Find the number of triangles formed in the given figure.



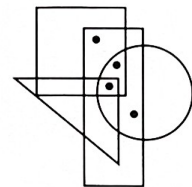
- A. 30
 B. 31
 C. 32
 D. More than 32

5. Which of the following options will complete the given figure matrix?



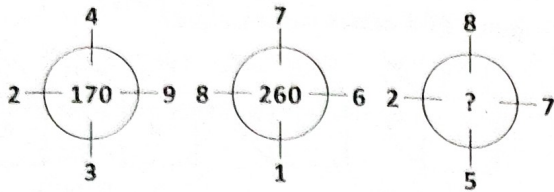
- A.
- B.
- C.
- D.

6. Select a figure from the options which satisfies the same conditions of placement of dots as in the given figure.



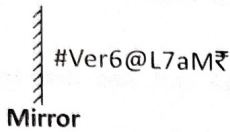
- A.
- B.
- C.
- D.

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



- A. 250
B. 228
C. 190
D. 230

8. Select the correct mirror image of the given combination of letters, symbols and numbers.



- A. řM67J@019V#
B. řW67J@919V#
C. řM67J@619V#
D. #Λ619@Γ79Wř

9. The following digits are to be coded as follows:

Digits	6	4	8	2	5	3	9	1	7
Codes	©	π	κ	∞	λ	÷	T	%	+

While coding the given number, following conditions are also to be observed.

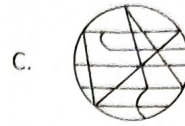
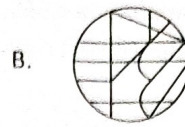
Conditions:

- (i) If the exact middle digit is an odd number, then it is to be coded as =.
(ii) If the first as well as the last digit is a prime number, then both are to be coded as >.
(iii) If the first digit is a prime number and the last digit is a composite number, then both are to be coded as <.
(iv) If the exact middle digit is an even number, then it is to be coded as θ.

Find the code for 5876432.

- A. <κ+θπ*
B. λκ+©π÷∞
C. >κ+θπ÷>
D. λκ+=π*∞

10. Select a figure from the options in which the given figure is not exactly embedded as one of its parts.

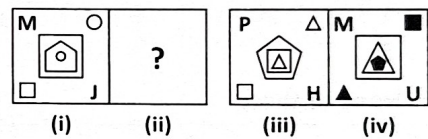


11. Select the correct order of signs from the options which will replace the blanks, so that the given equation becomes correct.

$$14 _ 7 _ 3 _ 4 _ 5 _ 5$$

- A. +, ÷, ×, =, -
B. -, +, =, ÷, +
C. ÷, ×, =, -, +
D. ÷, ×, +, -, =

12. There is a certain relationship between figures (iii) and (iv). Establish a similar relationship between figures (i) and (ii) by selecting a suitable figure from the options that would replace the (?) in figure (ii).



- A.
- B.
- C.
- D.

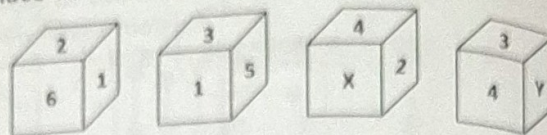
13. If 'P + Q' means 'P is the husband of Q', 'P - Q' means 'P is the mother of Q', 'P × Q' means 'P is the wife of Q' and 'P ÷ Q', means 'P is the father of Q', then which of the following statements is incorrect for the expression L + N - X × Z ÷ T?

- A. Z is the son-in-law of L.
B. N is the paternal grandmother of T.
C. L is the father of X.
D. N is the mother-in-law of Z.

14. Arrange the following words in the order in which they occur in a dictionary and select the correct option.

1. Passport
 2. Pasteurise
 3. Passionate
 4. Password
 5. Passenger
- A. 5, 1, 3, 4, 2
 B. 3, 5, 1, 4, 2
 C. 5, 3, 1, 4, 2
 D. 3, 5, 4, 1, 2

15. Four different positions of a dice are given below. Which of the following numbers will come in the place of X and Y respectively?



- A. 6 and 5
 B. 5 and 6
 C. 3 and 2
 D. 6 and 2

MATHEMATICAL REASONING*

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

16. In a hurdle race, a runner has probability p of jumping over a specific hurdle. Given that in 5 trials, the runner succeeded 3 times, the conditional probability that the runner had succeeded in the first trial, is

- A. $\frac{3}{5}$
 B. $\frac{2}{5}$
 C. $\frac{1}{5}$
 D. None of these

17. The perpendicular bisector of the line segment joining $P(1, 4)$ and $Q(k, 3)$ has y-intercept -4 . Then, a possible value of k is

- A. 4
 B. 1
 C. 2
 D. -2

18. Let R and S be two non-void relations on a set A . Which of the following statements is false?

- A. R and S are transitive $\Rightarrow R \cup S$ is transitive
 B. R and S are transitive $\Rightarrow R \cap S$ is transitive
 C. R and S are symmetric $\Rightarrow R \cup S$ is symmetric
 D. R and S are reflexive $\Rightarrow R \cup S$ is reflexive

19. If $f'(x) = \sin(\log x)$ and $y = f\left(\frac{2x+3}{3-2x}\right)$, then $\frac{dy}{dx}$ at $x = 1$ is equal to

- A. $6\sin \log(5)$
 B. $5\sin \log(6)$
 C. $5\sin \log(12)$
 D. $12\sin \log(5)$

20. If an infinite G.P. has first term as a and sum 5, then

- A. $a < -10$
 B. $-10 < a < 10$
 C. $0 < a < 10$ and $a \neq 5$
 D. $a > 10$

21. The shortest distance between the lines

$$\frac{x}{m_1} = \frac{y}{1} = \frac{z-a}{0}, \quad \frac{x}{m_2} = \frac{y}{1} = \frac{z+a}{0}$$

- A. a
 B. $\frac{a}{|m_1 - m_2|}$
 C. $2|a|$
 D. $\frac{2a}{|m_1 - m_2|}$

22. The region of the complex plane for which $\left|\frac{z-a}{z+a}\right| = 1$ [$\operatorname{Re}(a) \neq 0$], is

- A. x-axis
 B. y-axis
 C. The straight line $x = a$
 D. None of these

23. If A_{ij} denotes the cofactor of the element a_{ij} of the

determinant $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$, then the value of

- $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33}$ is
- A. 0
 B. 5
 C. 10
 D. -5

24. Consider the following statements:

I. $\int_{-\pi/2}^{\pi/2} \sqrt{\cos x - \cos^3 x} dx = \frac{3}{4}$

II. $\int_0^4 (|x-1| + |x-3|) dx = 10$

Which of above statement(s) is/are correct?

- A. Only I
- B. Only II
- C. Both I and II
- D. Neither I nor II

25. If $f(x) = ax^2 + bx + c$ and $f(-1) \geq -4$, $f(1) \leq 0$ and $f(3) \geq 5$, then the least value of a is

- A. $\frac{1}{4}$
- B. $\frac{1}{8}$
- C. $\frac{1}{3}$
- D. $-\frac{1}{3}$

26. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ and $A^6 = KA - 205I$, then the value of $K =$

- A. 11
- B. 22
- C. 33
- D. 44

27. The value of $\lim_{x \rightarrow 0} \left(\frac{\sin 2x}{3x} + \frac{x \sin x^2}{\sin x^3} \right)$ is:

- A. $\frac{2}{3}$
- B. 1
- C. $\frac{4}{3}$
- D. $\frac{5}{3}$

28. Let $f(x)$ be differentiable on the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \rightarrow x} \frac{t^2 f(x) - x^2 f(t)}{t-x} = 1$, then $f(x) =$

- A. $\frac{1}{3x} + \frac{2}{3}x^2$
- B. $\frac{1}{2x} - \frac{1}{3}x^2$
- C. $\frac{1}{x} + \frac{2}{3}x^2$
- D. $\frac{1}{3x} + \frac{4}{9}x^2$

29. The area (in sq. units) bounded by the curves $y^2 = 20x$ and $x^2 = 16y$ is

- A. 80π
- B. $\frac{320}{3}$
- C. $\frac{160}{3}$
- D. 100

30. If α, β, γ and δ are four solutions of the equations

$\tan\left(\theta + \frac{\pi}{4}\right) = 3 \tan 3\theta$, then $\tan \alpha \tan \beta \tan \gamma \tan \delta$ equals

- A. 3
- B. $\frac{1}{3}$
- C. $-\frac{1}{3}$
- D. None of these

31. If $x \in \left(\frac{\pi}{2}, \pi\right)$ then the value of the expression

$\sin^{-1}(\cos(\cos^{-1}(\cos x) + \sin^{-1}(\sin x)))$, is equal to

- A. $\frac{\pi}{2}$
- B. $-\pi$
- C. π
- D. $-\frac{\pi}{2}$

32. Let $f(x) = \begin{cases} xe^{ax} & , x \leq 0 \\ x + ax^2 - x^3 & , x > 0 \end{cases}$, where a is a positive constant. Then, the interval in which $f(x)$ is strictly increasing, is

- A. $\left(0, \frac{a}{3}\right)$
- B. $\left(-\frac{2}{a}, 0\right)$
- C. $\left(-\frac{2}{a}, \frac{a}{3}\right)$
- D. None of these

33. An equilateral triangle has its centroid at the origin and one side is $x + y = 1$. The other sides are

- A. $y = (2 \pm \sqrt{3})(x + 1)$
- B. $y + 1 = (\sqrt{3} \pm 1)(x + 1)$
- C. $y - 1 = (2 \pm \sqrt{3})(x - 1)$
- D. $y + 1 = (2 \pm \sqrt{3})(x + 1)$

34. Let $ABCD$ be the parallelogram whose sides AB and AD are represented by the vector $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$ respectively. If \vec{a} is a unit vector parallel to \overline{AC} , then \vec{a} is equal to

- A. $\frac{1}{3}(3\hat{i} - 6\hat{j} - 2\hat{k})$
 B. $\frac{1}{3}(3\hat{i} + 6\hat{j} + 2\hat{k})$

- C. $\frac{1}{7}(3\hat{i} - 6\hat{j} - 3\hat{k})$
 D. $\frac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$

35. The domain of the function f given by $f(x) = \frac{x^2 + 2x + 1}{x^2 - x - 6}$ is _____.

- A. $R - \{3, -2\}$
 B. $R - \{-3, 2\}$
 C. $R - \{3, -2\}$
 D. None of these

OR

APPLIED MATHEMATICS*

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

16. If α and β are the roots of the equation $x^2 - 3x + a = 0$, γ and δ are the roots of the equation $x^2 - 12x + b = 0$ and $\alpha, \beta, \gamma, \delta$ form an increasing GP, then the values of a and b are respectively

- A. 2, 32
 B. 4, 8
 C. 2, 16
 D. 3, 10

17. Why is the optimal value of the objective function in an LPP always found at a corner point of the feasible region?

- A. Because objective function is linear and feasible region is convex.
 B. Because all constraints are inequalities.
 C. Because feasible region has only one solution.
 D. None of these

18. Let $f(x) = \begin{cases} -x^3 + \frac{b^3 - b^2 + b - 1}{b^2 + 3b + 2}, & 0 \leq x < 1 \\ 2x - 3, & 1 \leq x \leq 3 \end{cases}$

If $f(x)$ attains minimum at $x = 1$, then $b \in$

- A. $(-2, -1) \cup [1, \infty)$
 B. R
 C. $(0, \infty)$
 D. None of these

19. Which of the following is disadvantage of using the linear method of depreciation?

- A. Technological advancements can render an asset obsolete before the end of its estimated useful life.
 B. An asset used heavily might depreciate faster than one used lightly.

- C. Doesn't reflect higher loss in value during initial years.
 D. All of these

20. A die is thrown three times. Events A and B are defined as below:

A : '4 on the third throw' and B : '6 on the first and 5 on the second throw'. Find the probability of A given that B has already occurred.

- A. $\frac{2}{3}$
 B. $\frac{1}{7}$
 C. $\frac{1}{6}$
 D. $\frac{2}{7}$

21. Calculate the covariance of the following bivariate data.

X	Y
3	16
4	9
5	4
6	1
7	1
8	4
9	9
10	16

- A. 2.5
 B. 3.5
 C. 0
 D. 0.5

22. If $y = (x + \sqrt{1+x^2})^n$, then $(1+x^2) \frac{d^2y}{dx^2} + x \frac{dy}{dx} =$

- A. $-n^2y$
- B. n^2y
- C. $-y$
- D. $2x^2y$

23. An investor puts ₹50,000 in a mutual fund. The fund grows to ₹80,000 in 4 years. The next year, due to a market crash, it drops to ₹70,000. What is the CAGR for the 5-year period? [Use : $(1.4)^{1/5} = 1.0696$]

- A. 6.96%
- B. 9.29%
- C. 8%
- D. 7.2%

24. If $x(x-1) \frac{dy}{dx} - y = x^2(x-1)^2$, then $4y(2) - y(-1) =$

- A. 0
- B. 6
- C. 4
- D. 2

25. Suppose that the demand and supply functions for a product are $p = D(q) = 120 - 0.5q$ and $p = S(q) = 4.5q$. Find the producer surplus at the equilibrium point.

- A. 1395
- B. 1296
- C. 1185
- D. None of these

26. If the x -intercept of the line $y = mx + 2$ is greater than $\frac{1}{2}$, then the gradient of the line lies in the interval

- A. $(-1, 0)$
- B. $(\frac{-1}{4}, 0)$
- C. $(-\infty, -4)$
- D. $(-4, 0)$

27. A man divided ₹ 32799 between his two sons such that the amount received by the elder after 3 years is equal to the amount received by the younger after 5 years, the rate of compound interest being 5% per annum. Find the two shares.

- A. ₹ 17100 and ₹ 15699
- B. ₹ 17300 and ₹ 15499

- C. ₹ 17238 and ₹ 15561
- D. ₹ 17199 and ₹ 15600

28. If $A + 2B = \begin{bmatrix} 2 & -4 \\ 1 & 6 \end{bmatrix}$ and $A' + B' = \begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix}$, then A is equal to

- A. $\begin{bmatrix} 0 & 4 \\ 3 & -8 \end{bmatrix}$
- B. $\begin{bmatrix} 1 & -4 \\ -1 & 7 \end{bmatrix}$
- C. $\begin{bmatrix} 0 & -4 \\ 3 & 8 \end{bmatrix}$
- D. $\begin{bmatrix} 1 & 4 \\ 1 & -7 \end{bmatrix}$

29. What is the null hypothesis (H_0)?

- A. A claim we want to prove
- B. A claim of no effect or difference
- C. A biased assumption
- D. All of these

30. The integral $\int \left(1 + x - \frac{1}{x}\right) e^{x+\frac{1}{x}} dx$ is equal to

- A. $-xe^{x+\frac{1}{x}} + c$
- B. $(x+1)e^{x+\frac{1}{x}} + c$
- C. $xe^{x+\frac{1}{x}} + c$
- D. $-x^2e^{x+\frac{1}{x}} + c$

31. Find the quartile deviation of the given data set.

Marks obtained	No. of students
30-40	22
40-50	38
50-60	46
60-70	35
70-80	20

- A. 9.305
- B. 9.55
- C. 9.434
- D. 9.705

32. If the matrix M_r is given by $M_r = \begin{bmatrix} r & r-1 \\ r-1 & r \end{bmatrix}$, $r = 1, 2, 3, \dots$, then the value of $\det(M_1) + \det(M_2) + \dots + \det(M_{2008})$ is
- 2007
 - 2008
 - $(2008)^2$
 - $(2007)^2$

33. The main purpose of applying a moving average in time series is:
- To exaggerate fluctuations
 - To remove the trend
 - To predict exact future values
 - To smoothen short-term irregularities and highlight the trend

34. If the lines $3x - 4y - 7 = 0$ and $2x - 3y - 5 = 0$ are two diameters of a circle of area 49π sq. units, then the equation of the circle is

- $x^2 + y^2 + 2x - 2y - 62 = 0$
- $x^2 + y^2 - 2x + 2y - 62 = 0$
- $x^2 + y^2 + 2x - 2y - 47 = 0$
- $x^2 + y^2 - 2x + 2y - 47 = 0$

35. What is the largest positive integer n for which $(n + 12)$ divides $n^2 + 144$?

- 276
- 282
- 285
- 265

EVERYDAY MATHEMATICS

36. The expenses on wheat, meat and vegetables of a family are in the ratio $12 : 17 : 3$. The prices of these articles are increased by 20%, 30% and 50% respectively. The total expenses of the family on these articles are increased by

- $23\frac{1}{3}\%$
- $28\frac{1}{8}\%$
- $27\frac{1}{8}\%$
- $25\frac{1}{7}\%$

37. The average age of family of five members is 24 years. If the present age of the youngest member is 8 years, then what was the average age of the rest of the family 8 years ago?

- 16 years
- 18 years
- 20 years
- None of these

38. Rajesh and Ramesh started business with investment in the ratio of $12 : 11$ and their annual profits were in the ratio $3 : 1$. If Rajesh invested the money for 11 months; then for what time Ramesh invested the money?

- 4 months
- 3 months
- 6 months
- 8 months

39. Rohit calculates his profit percentage on the selling price whereas Rahul calculates his profit on the cost price. They find that the difference of their profit is ₹ 275. If the selling price of both of them are the same and Rohit gets 25% profit and Rahul gets 15% profit, then find their selling price.

- ₹ 2100
- ₹ 2300
- ₹ 2350
- ₹ 2250

40. Prabhu purchased 30 kg of rice at the rate of ₹ 17.50 per kg and another 30 kg rice at a certain rate. He mixed the variety of two rice and sold the entire quantity at the rate of ₹ 18 per kg and made 20% overall profit. At what price per kg did he purchase the lot of another 30 kg rice?

- ₹ 14.50
- ₹ 12.50
- ₹ 15.50
- ₹ 13.50

41. A petrol distributor mixed leaded and unleaded petrol in such a way that the mixture consists 25% of unleaded petrol. How much quantity of leaded petrol should be added in 3 litres mixture so that the percentage of unleaded petrol becomes 15%?

- 2000 mL
- 1800 mL
- 1200 mL
- None of these

42. Two cities A and B are 130 km apart. A car starts from A to B at 7:20 a.m. at a speed of 40 km/h. Another car starts from B to A at 8:20 a.m. at a speed of 50 km/h. The time of their meeting is
- 9:00 a.m.
 - 9:20 a.m.
 - 10:20 a.m.
 - None of these

43. Nishtha and Tina do a piece of work in 35 days and 25 days respectively. They began the work together but Nishtha leave the work after some days and the rest work be completed by Tina in 13 days. After how many days did Nishtha leave the work?
- 7 days
 - 10 days
 - 12 days
 - 15 days

44. From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged in a row on the shelf so that the dictionary is always in the middle. Then, the number of such arrangements is

- At least 500 but less than 750
- At least 750 but less than 1000
- At least 1000
- Less than 500

45. Shreya is 4 years older than her sister, while her brother who is the youngest among them is 7 years younger to Shreya. Her father is three times the age of her brother. Her sister is 18 years of age and her father is 3 years older than her mother. What is the age of her mother?

- 40 years
- 45 years
- 42 years
- 50 years

ACHIEVERS SECTION

46. Read the following statements carefully and state 'T' for true and 'F' for false.

- (i) On the interval $[0, 1]$, the function

$$f(x) = x^{25} (1 - x)^{75} \text{ takes its maximum value at } x = \frac{1}{4}.$$

- (ii) The value of 'a' for which the function $(a + 2)x^3 - 3ax^2 + 9ax - 1$ decreases monotonically throughout for all real x are $-3 < a < 0$.

- (iii) If $y = a \ln x + bx^2 + x$ has its extreme values at $x = -1, 2$, then $a + b = \frac{3}{2}$.

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

47. Solve the following and select the correct option.

- (i) For positive numbers x, y and z , the numerical

$$\text{value of the determinant } \begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$$

is

- (ii) The value of λ such that the system

$$x - 2y + z = -4, 2x - y + 2z = 2, x + y + \lambda z = 4$$

has no solution is

- | | (i) | (ii) |
|----|-----|------|
| A. | 1 | 1 |
| B. | 0 | 1 |
| C. | -1 | -1 |
| D. | 0 | -2 |

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

Statement I : The solution of $\frac{dy}{dx} = \frac{ax+h}{by+k}$ represents a parabola, if $a = -2, b = 2$.

Statement II : Let the functions $x(t)$ and $y(t)$ satisfy the differential equations $\frac{dx}{dt} + ax = 0, \frac{dy}{dt} + by = 0$.

If $x(0) = 2, y(0) = 1$ and $\frac{x(1)}{y(1)} = \frac{3}{2}$, then $x(t) = y(t)$ for $t = \log_{(4/3)} 2$.

- Statement-I is true but Statement-II is false.
- Statement-I is false but Statement-II is true.
- Both Statement-I and Statement-II are true.
- Both Statement-I and Statement-II are false.

49. If $\int \frac{\log_x e \cdot \log_{ex} e \cdot \log_{e^2 x} e}{x} dx$
 $= A \log_e \log_e x + B \log_e (1 + \log_e x) + C \log_e (2 + \log_e x) + \lambda,$
 then

- A. $A + B = 0$
- B. $A + B = -1/2$
- C. $A + C = 0$
- D. $B + C = 1/2$

50. Solve the following and select the correct option.
 (i) The minimum value of $Z = 4x + 3y$ subject

to constraints $3x + 2y \geq 160, 5x + 2y \geq 200,$
 $x + 2y \geq 80; x, y \geq 0$ is

(ii) The minimum value of $z = x - 5y$ subject to
 constraints $x - y \geq 0, -x + 2y \geq 2, x \geq 3, y \leq 4,$
 $x, y \geq 0$ is

- | | | |
|----|---------------|------|
| | (i) | (ii) |
| A. | 220 | -16 |
| B. | 300 | -11 |
| C. | 230 | -12 |
| D. | None of these | |

SPACE FOR ROUGH WORK