IMO

SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2023-24

SOF CELEBRATING 25 Years of INSPIRING YOUNG MINDS

CLASS 12

QUESTION PAPER SET A

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

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 one 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: Rahul bought 4 kg 90 g of apples, 2 kg 60 g of grapes and 5 kg 300 g of mangoes. The total weight of all the fruits he bought is_____.
   A. 11.450 kg   B. 11.000 kg   C. 11.350 kg   D. 11.250 kg
   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.:...
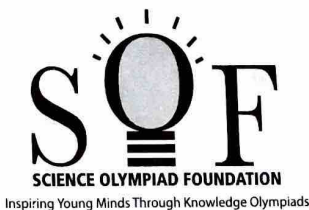
SOF
SCIENCE OLYMPIAD FOUNDATION
Inspiring Young Minds Through Knowledge Olympiads

1. The following letters are coded as follows:

Letters	C	E	N	I	S	M	A	D
Codes	#	<	@	>	*	%	$	©

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

Conditions:

(i) If the first letter is a vowel and the last letter is a consonant, then both are to be coded as ↓.

(ii) If both the first letter and the last letter are consonants, then both are to be coded as ↑.

(iii) If both the second and the second last letters are vowels, then both are to be coded as +.

(iv) If the first letter is a consonant and the last letter is a vowel, then their codes are to be interchanged.

Find the code for MEDICINES.

A. ↑ < © > # @ > + ↑

B. ↑ + © > # > @ + ↑

C. % < © > # > @ < *

D. % + © > # @ + * %

2. Find the missing term in the given series.

F18U, G22Q, I26N, __?__, P34K

A. M30L

B. L28M

C. L30M

D. L30L

3. The given question consists of a set of three figures (i), (ii) and (iii) showing a sequence of folding of a piece of paper. Fig. (iii) shows the manner in which the folded paper has been cut. Select a figure from the options which would most closely resemble the unfolded form of Fig. (iii).

(i)   (ii)   (iii)

A.

B.

C.

D.
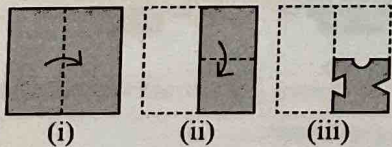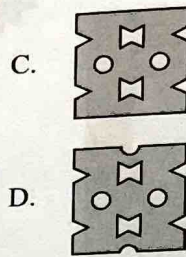
4. A man starts to walk towards the direction of sunrise. He walks for 15 m and then turns right and walks 20 m. He then turns left and walk 3 m and then turns right and walks 4 m. Finally, he turns right again and walks 6 m to reach his home. How far and in which direction is he now from the starting point?

A. $12\sqrt{5}$ m, North-West

B. $12\sqrt{5}$ m, South-East

C. $14\sqrt{5}$ m, East

D. $14\sqrt{5}$ m, South -West

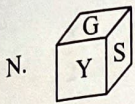5. Select a figure from the options which is exactly embedded in the given figure as one of its parts.
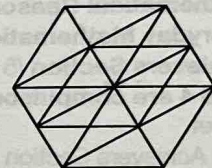
A.

B.

C.

D.

6. Select the box(es) that is/are similar to the box formed, when the given sheet of paper is folded to form a box.

	G	
T	V	
	S	Y
	Q	

L.   M.

N.
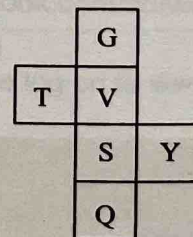
A. L and M only

B. N only

C. L only

D. M and N only

---

7. Read the following information and answer the question that follow:

A dealer sold six cars A, B, C, D, E and F during a period of Monday to Saturday, one car on each day.

(i) The car C was sold at least before three cars.

(ii) The car F was sold on Tuesday.

(iii) Both the cars B and E were sold at least before one car.

(iv) The car D was sold immediately after the car C.

(v) At least four cars were sold after the car E.

How many cars were sold before the car F?

A. 1

B. 2

C. 3

D. None of these

---

8. In the following equation, two signs and two numbers need to be interchanged to make it correct. Select the signs and numbers from the given options.
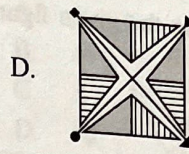
$$4 - 8 \div 4 \times 6 + 3 = 4$$

A. + and ÷; 3 and 6

B. + and –; 6 and 8

C. – and ×; 6 and 8

D. + and –; 3 and 6

---

9. Select the correct mirror image of the given figure.

A.

B.

C.

D.
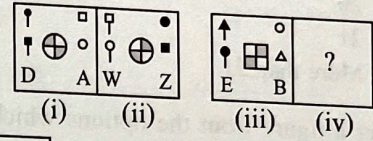

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10. There is a certain relationship between figures (i) and (ii). Establish a similar relationship between figures (iii) and (iv) by selecting a suitable figure from the options that would replace the (?) in figure (iv).


(i)	(ii)	(iii)	(iv)

A.

B.

C.

D.

---

11. How many pairs of letters are there in the word CHOLESTEROL each of which has the same number of letters between them in the word as in the English alphabets?

A. One

B. Two

C. Three

D. More than three

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12. In the given Venn diagram, rectangle represents the families living in a flat, circle represents the families having bikes, square represents the families having cars and triangle represents the families having pets.
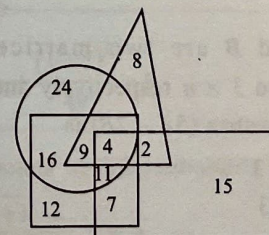
Which of the following numbers represents the families living in a flat having both bike and car but not pet?
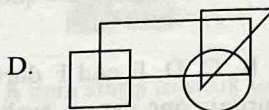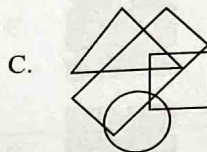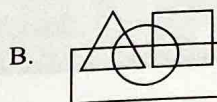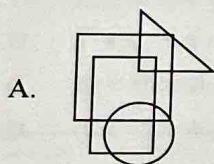
A. 11

B. 4

C. 7

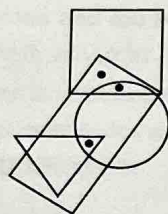D. 16

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13. How many triangles are there in the given figure?
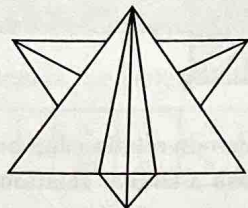
A. 19
B. 20
C. 21
D. More than 21

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

A.

B.

C.

D.

15. Study the given information carefully and answer the following question.

(i) 'A + B' means 'A is the father of B'.

(ii) 'A ÷ B' means 'A is the daughter of B'.

(iii) 'A – B' means 'A is the son of B'.

(iv) 'A × B' means 'A is the wife of B'.

How is S related to P in the expression $T \div P + K \times S$?

A. Son
B. Father-in-law
C. Son-in-law
D. Grandson

MATHEMATICAL REASONING

16. Sum to infinity of a G.P. is 15 and the sum to infinity of their squares is 45. If a is the first term and r is the common ratio, then the sum of first 5 terms of the A.P. whose first term a and common difference $3r$ is

A. 25
B. 35
C. 45
D. 55

17. If A and B are two matrices of the order $3 \times m$ and $3 \times n$ respectively and $m = n$, then the order of matrix $(5A - 2B)$ is

A. $m \times 3$
B. 3×3
C. $m \times n$
D. $3 \times n$

18. The area enclosed between the curve $y^2 = 4x$ and the line $y = x$ is

A. $\dfrac{8}{3}$ sq. units

B. $\dfrac{4}{3}$ sq. units

C. $\dfrac{2}{3}$ sq. units

D. $\dfrac{1}{2}$ sq. units

19. If $A + B + C = 180°$, then $\sin^2 \dfrac{A}{2} + \sin^2 \dfrac{B}{2} + \sin^2 \dfrac{C}{2} =$

A. $1 - 2\cos\dfrac{A}{2}\cos\dfrac{B}{2}\cos\dfrac{C}{2}$

B. $1 - 2\sin\dfrac{A}{2}\sin\dfrac{B}{2}\sin\dfrac{C}{2}$

C. $1 - 4\sin\dfrac{A}{2}\sin\dfrac{B}{2}\sin\dfrac{C}{2}$

D. $1 - 4\cos\dfrac{A}{2}\cos\dfrac{B}{2}\cos\dfrac{C}{2}$

20. Find the principal value of $\operatorname{cosec}^{-1}\left(\operatorname{cosec}\dfrac{13\pi}{4}\right)$.

A. $\frac{\pi}{2}$

B. π

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

D. $-\frac{\pi}{4}$

---

21. A number lock has four rings and each ring has 10 digits, 0, 1, 2, ...,9. Find the maximum number of unsuccessful attempts that can be made by a thief who tries to open the lock without knowing the key code.

A. 10000

B. 9999

C. 10001

D. 9998

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22. The function $f(x) = x + \frac{4}{x}$ has

A. Local maxima at $x = 2$ and local minima at $x = -2$

B. Local minima at $x = 2$ and local maxima at $x = -2$

C. Absolute maxima at $x = 2$ and absolute minima at $x = -2$

D. None of these

---

23. A discrete random variable X has the following probability distribution:

X	$P(X)$
1	c
2	$2c$
3	$2c$
4	$3c$
5	c^2
6	$2c^2$
7	$7c^2 + c$

Find the value of c.

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

B. $\frac{3}{7}$

C. $\frac{2}{5}$

D. $\frac{1}{10}$

---

24. A real value of x satisfies the equation $\left(\frac{3-4ix}{3+4ix}\right) = \alpha - i\beta$ $(\alpha, \beta \in R)$, if $\alpha^2 + \beta^2$ is equal to

---

A. 1

B. -1

C. 2

D. -2

---

25. If α, β, γ, are the roots of $x^3 + ax^2 + b = 0$, then the value of $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$ is

A. $-a^3$

B. $a^3 - 3b$

C. a^3

D. $a^2 - 3b$

---

26. Let Q be the set of rational numbers and R be a relation on Q defined by $R = \{(x, y) : x, y \in Q, x^2 + y^2 = 5\}$. Then the relation is

A. Symmetric only

B. Reflexive and transitive only

C. Transitive only

D. An equivalence relation

---

27. Which of the following functions is bijective?

A. $f : Z \to Z$ defined by $y = x + 2$

B. $f : Z \to Z$ defined by $y = 2x$

C. $f : R \to R^+$ defined by $y = \sqrt{x}$

D. $f : R \to R$ defined by $y = x + |x|$

---

28. Equation of the locus of the point which moves such that the sum of its distances from the points $(3, 9)$ and $(3, 1)$ is 10, is

A. $\frac{(x-5)^2}{9} + \frac{(y-3)^2}{25} = 1$

B. $\frac{(x-3)^2}{9} + \frac{(y-5)^2}{25} = 1$

C. $\frac{x^2}{9} + \frac{y^2}{25} = 1$

D. $\frac{(x-3)^2}{36} + \frac{(y-5)^2}{49} = 1$

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29. The set of points of differentiability of the function $f(x) = \begin{cases} \frac{\sqrt{x+1}-1}{(x)^{3/2}}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ is

A. R

B. $[0, \infty)$

C. $(0, \infty)$

D. $R - \{0\}$

30. If the lines $2x - 3y = 5$ and $3x - 4y = 7$ are the diameters of a circle of area 154 sq. units, then find the equation of the circle.

   A. $x^2 + y^2 - 2x + 2y = 40$

   B. $x^2 + y^2 - 2x - 2y = 47$

   C. $x^2 + y^2 - 2x + 2y = 47$

   D.   None of these

31. Solution of the differential equation

   $\dfrac{dx}{dy} - \dfrac{x \log x}{1 + \log x} = \dfrac{e^y}{1 + \log x}$, if $y(1) = 0$, is

   A. $x^x = e^{ye^y}$

   B. $e^y = x^{e^y}$

   C. $x^x = y e^y$

   D.   None of these

32. $\displaystyle\lim_{x \to \frac{\pi}{2}} \dfrac{\left\{1 - \tan\left(\dfrac{x}{2}\right)\right\}(1 - \sin x)}{\left\{1 + \tan\left(\dfrac{x}{2}\right)\right\}(\pi - 2x)^3}$ is equal to

   A. $\dfrac{1}{8}$

   B. 0

   C. $\dfrac{1}{32}$

   D. ∞

33. Let $\vec{a} = 2\hat{i} - 3\hat{j} + 6\hat{k}$ and $\vec{b} = -2\hat{i} + 2\hat{j} - \hat{k}$, then

   $\dfrac{\text{projection of } \vec{a} \text{ on } \vec{b}}{\text{projection of } \vec{b} \text{ on } \vec{a}} =$

   A. $\dfrac{3}{7}$

   B. $\dfrac{7}{3}$

   C. -4

   D. 3

34. If $\displaystyle\int \dfrac{2x^2 + 3}{(x^2 - 1)(x^2 + 4)} dx = a \log\left(\dfrac{x-1}{x+1}\right) + b \tan^{-1}\dfrac{x}{2} + C$, then the values of a and b respectively are

   A.   1/2, 1/2

   B.   1, 1

   C.   1/2, 1

   D.   None of these

35. Find the equation of line passing through the origin which intersect the line $\dfrac{x-3}{2} = \dfrac{y-3}{1} = \dfrac{z-0}{1}$ at angle $\dfrac{\pi}{3}$.

   A. $\dfrac{x}{1} = \dfrac{y}{2} = \dfrac{z}{-1}$

   B. $\dfrac{x}{-1} = \dfrac{y}{1} = \dfrac{z}{-2}$

   C. $\dfrac{x}{1} = \dfrac{y}{3} = \dfrac{z}{2}$

   D.   Both A and B

OR

APPLIED MATHEMATICS

16. Mrs. Garg borrowed ₹ 800000 from a bank to purchase a car and decided to repay by monthly installments in 5 years. The bank charges interest at 8% p.a. compounded monthly. Calculate the EMI. (Given $(1.0067)^{60} = 1.4928$)

   A.   ₹ 17256

   B.   ₹ 18151

   C.   ₹ 15138

   D.   None of these

17. If m and n are positive integers such that $^{m+n}P_2 = 90$ and $^{m-n}P_2 = 30$, then the number of ordered pairs (m, n) of such integers is

   A.   4

   B.   3

   C.   2

   D.   1

18. The total number of students in a school is 600. If 150 students drink apple juice, 250 students drink pineapple juice and 100 students drink both apple juice and pineapple juice, then find the number of students who drink neither apple juice nor pineapple juice.

   A.   300

   B.   350

   C.   272

   D.   290

19. The first two terms of an infinitely decreasing G.P. are $\sqrt{3}$ and $2/(\sqrt{3}+1)$. Then which of the following is correct?

A. Common ratio is $(\sqrt{3}-1)/\sqrt{3}$

B. Sum to infinity of the G.P. is $3\sqrt{3}$

C. Common ratio is $1/\sqrt{3}$

D. Sum to infinity of the G.P. is 3

20. If $A = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$, then which one of the following statements is not correct?

A. $A^4 - I = A^2 + I$

B. $A^3 - I = A(A - I)$

C. $A^2 + I = A(A^2 - I)$

D. $A^3 + I = A(A^3 - I)$

21. Obtain the three year moving averages for first three years of the following series of observations.

Years	Annual Sales (in 0000 ₹)
2011	3.6
2012	2.4
2013	4.2
2014	5.4
2015	5.4
2016	5.4
2017	3.4
2018	2.4

A. 5.4

B. 4.4

C. 3.4

D. 2.4

22. If $\int x^{-3} \cdot 5^{1/x^2} \, dx = k.5^{1/x^2} + C$, then find the value of k.

A. $2 \log 5$

B. $-\dfrac{1}{2 \log 5}$

C. $3 \log 3$

D. None of these

23. If $7^{2004} = x \bmod 41$, then find the value of x.

A. 40

B. 33

C. 20

D. None of these

24. The domain of $f(x) = \log_{10} \dfrac{x-5}{x^2-10x+24} - \sqrt[3]{x+5}$ is

A. $(4, 5)$

B. $(6, \infty)$

C. $(4, 5) \cup (6, \infty)$

D. $(4, 5] \cup (6, \infty)$

25. The total cost associated with production of x heaters is given by $C(x) = 0.8x^3 - 0.9x^2 - 150x + 1800$. Find the marginal cost when 10 heaters are produced.

A. ₹ 72

B. ₹ 1872

C. ₹ 135

D. ₹ 1935

26. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at $P(-2, 0)$ and cuts the y-axis at the point Q, where its gradient is 3. Find the equation of the curve.

A. $y = -\dfrac{1}{2}x^3 - \dfrac{3}{4}x^2 + 3x + 5$

B. $y = \dfrac{1}{2}x^3 - \dfrac{3}{4}x^2 + 3x + 5$

C. $y = -\dfrac{3}{2}x^3 - \dfrac{3}{4}x^2 + 3x + 5$

D. None of these

27. The quartile deviation for the following data is

x	2	3	4	5	6
f	3	4	8	4	1

A. 0

B. $\dfrac{1}{4}$

C. $\dfrac{1}{2}$

D. None of these

28. If we have various data points represented by Mean(M), Median (M_d), Mode (M_q) and quartile points (Q_1, Q_2, Q_3), then skewness is considered negative when:

A. $Q_3 + Q_1 < 2M_d$

B. $M + M_d < M_q$

C. $Q_3 + Q_1 > M_d$

D. $M > M_d$

29. What will be the amount of ₹ 10800 in 6 years 3 months at 7% annual rate of interest, if the interest accumulates half-yearly? (Given : $\log 108 = 2.033$, $\log 1.035 = 0.0149$ and $\log 1.6565 = 0.2192$)

A. ₹ 14426

B. ₹ 15565

C. ₹ 16565

D. ₹ 16885

30. The term recession is related to which of the following component of time series?

 A. Trend
 B. Cyclical
 C. Seasonal
 D. Both A and C

31. A dealer sells a sofa-set for ₹ 12544 inclusive of GST. For a particular customer, he reduced the price of the sofa-set in such a way that its reduced price plus GST on it becomes the marked price of the sofa-set. If the rate of GST is 12%, then calculate the amount of reduction allowed by the dealer.

 A. ₹ 200
 B. ₹ 1000
 C. ₹ 1120
 D. ₹ 1200

32. If $A = \{1, 2, 3\}$, $B = \{3, 8\}$, then $(A \cup B) \times (A \cap B)$ is equal to

 A. $\{(8, 3), (8, 2), (8, 1), (8, 8)\}$
 B. $\{(1, 2), (2, 2), (3, 3), (8, 8)\}$
 C. $\{(3, 1), (3, 2), (3, 3), (3, 8)\}$
 D. $\{(1, 3), (2, 3), (3, 3), (8, 3)\}$

33. If $Z = 7x + y$, subject to $5x + y \geq 5$, $x + y \geq 3$, $x \geq 0$, $y \geq 0$, then the minimum value of Z occurs at

 A. $(3, 0)$
 B. $\left(\dfrac{1}{2}, \dfrac{5}{2}\right)$
 C. $(7, 0)$
 D. $(0, 5)$

34. If the focus and vertex of a parabola are the points $(0, 2)$ and $(0, 4)$ respectively, then its equation is

 A. $y^2 = 8x + 32$
 B. $y^2 = -8x + 32$
 C. $x^2 + 8y = 32$
 D. $x^2 - 8y = 32$

35. For the data : 18, 22, 26, 18, 26, 28, 26, 32, 29, 30, find percentile rank of 26.

 A. 9
 B. 36
 C. 40
 D. 45

EVERYDAY MATHEMATICS

36. The number of words between DANGER and GARDEN when all letters are used and different words are formed and arranged alphabetically, is

 A. 378
 B. 243
 C. 135
 D. 376

37. A tea merchant buys two kinds of tea, the price of the first kind being twice that of the second. He sells the mixture at ₹ 14/kg thereby making a profit of 40%. If the ratio of the first to second kind of tea in the mixture is 2 : 3, then find the cost price of each kind of tea.

 A. ₹ $7\dfrac{1}{7}$/kg , ₹ $14\dfrac{2}{7}$/kg
 B. ₹ $7\dfrac{3}{7}$/kg , ₹ $14\dfrac{1}{7}$/kg
 C. ₹ 7/kg, ₹ 14/kg
 D. ₹ 4/kg, ₹ 6/kg

38. While returning from Dubai festival, Mr. Sanjay Singh purchased a number of articles, all at a discount of $33\dfrac{1}{3}$% of the list price. However he is required to pay a duty of 20% on the cost of goods. If he realizes a profit of 25% on his outlay, then what must he charge for an article price ₹ 228 as the list price?

 A. ₹ 228
 B. ₹ 322
 C. Neither A and nor B
 D. Data insufficient

39. The average age of a group of men is increased by 5 years when a person aged 18 years is replaced by a new person of aged 38 years. How many men are there in the group?

 A. 3
 B. 4
 C. 5
 D. 6

40. ₹ 5783 is divided among Sherry, Berry and Cherry in such a way that if ₹ 28, ₹ 37 and ₹ 18 be deducted from their respectively shares, they have money in the ratio 4 : 6 : 9. Find Sherry's share.

 A. ₹ 1256

B. ₹ 1228
C. ₹ 1456
D. ₹ 1084

41. A, B and C are assigned a piece of work which they can complete by working together in 15 days. Their efficiencies (measured in terms of rate of doing work) are in the ratio of 1:2:3. After $\frac{1}{3}$rd of the work is completed, one of them has to be withdrawn due to budget constraint. Their wages per day are in the ratio of 3:5:6. The number of days in which the remaining two persons can complete the work (at optimal cost) is

A. 18
B. 20
C. 15
D. 12

42. Ten years later, A will be twice as old as B and five years ago, A was three times as old as B. What are the present ages of A and B respectively (in years)?

A. 20, 30
B. 50, 20
C. 20, 50
D. Cannot be determined

43. There are 500 students in an examination. 150 students passed the first paper, 350 students passed the second paper and 50 students passed both the papers. Find the probability that a student selected at random has failed in both the papers.

A. 1/5
B. 1/10
C. 3/10
D. 3/5

44. Let train A speeding at 120 km/h crosses another train B, running in the same direction in 2 mins 24 secs. If the length of the trains A and B are 200 m and 160 m respectively, then find the speed of train B (in km/hr).

A. 111 km/hr
B. 121 km/hr
C. 131 km/hr
D. 110 km/hr

45. A sum of ₹ 11000 was taken as loan. This loan is to be returned in two equal annual installments. If the rate of interest be 20% compounded annually, then value of each installment will be

A. ₹ 7500
B. ₹ 7100
C. ₹ 7000
D. ₹ 7200

ACHIEVERS SECTION

46. Evaluate :

(i) $\int_{-1}^{2}|x^3 - x|\,dx$

(ii) $\int_{2}^{3}\left(\frac{x^2+1}{x^2}\right)\log\sqrt{\frac{x^2-1}{x}}\,dx$

	(i)	(ii)
A.	$\frac{5}{3}$	$\log 2^{37} - \log 3^{18} + 11$
B.	$\frac{3}{4}$	$\log 2^{28} - \log 5^{18} - 5$
C.	$\frac{11}{4}$	$\log 2^{57} - \log 3^{25} - 5$
D.	None of these	

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

Statement-I : The absolute maximum and absolute minimum values of the function $f(x) = 3x^4 - 8x^3 + 12x^2 - 48x + 25$ on [0, 3] are 16 and -39 respectively.

Statement-II : The intervals on which the function $f(x) = 2x^3 - 9x^2 + 12x + 15$ are increasing and decreasing, are $(-\infty, \infty)$ and $(-3, 0)$ respectively.

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

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

48. Read the given statements carefully and state T for true and F for false.

(i) The solution of differential equation
$\frac{dy}{dx} + y = e^{e^x}$ is $ye^x = e^{e^x} + c$.

(ii) The order and degree of the differential equation
$1 - \left(\frac{dy}{dx}\right)^2 = \left(a\frac{d^2y}{dx^2}\right)^{1/3}$ are 3 and 2 respectively.

(iii) $x^2 = 2y^2 \log y$ is a solution of differential equation
$(x^2 + y^2)\frac{dy}{dx} - xy = 0$.

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

49. A random variable X has the following probability distribution :

X	0	1	2	3	4	5	6	7
P(X)	a	4a	3a	7a	8a	10a	6a	9a

Find $P(X < 3)$, $P(X \geq 4)$, $P(0 < X < 5)$ respectively.

A. $\dfrac{1}{6}, \dfrac{11}{24}, \dfrac{11}{16}$

B. $\dfrac{1}{6}, \dfrac{11}{16}, \dfrac{11}{24}$

C. $\dfrac{1}{4}, \dfrac{11}{26}, \dfrac{21}{44}$

D. $\dfrac{11}{26}, \dfrac{1}{4}, \dfrac{21}{44}$

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50. Solve the following and select the correct option.

(i) If $P = \begin{bmatrix} \sqrt{3}/2 & 1/2 \\ -1/2 & \sqrt{3}/2 \end{bmatrix}$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$, then $P^T Q^{2005} P$ is

(ii) Let $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$.

If B is the inverse of matrix A, then α is

	(i)	(ii)
A.	$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	8
B.	$\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$	5
C.	$\begin{bmatrix} -1 & 0 \\ 0 & 2005 \end{bmatrix}$	8
D.	$\begin{bmatrix} 2010 & 0 \\ -1 & 1 \end{bmatrix}$	5