

[ Taking at least one from each group answer any four questions. Each question carries 10 marks.]

### Group-A: Algebra

1. ►  $f(x) = 3x + 1, 0 \leq x \leq 2$ .

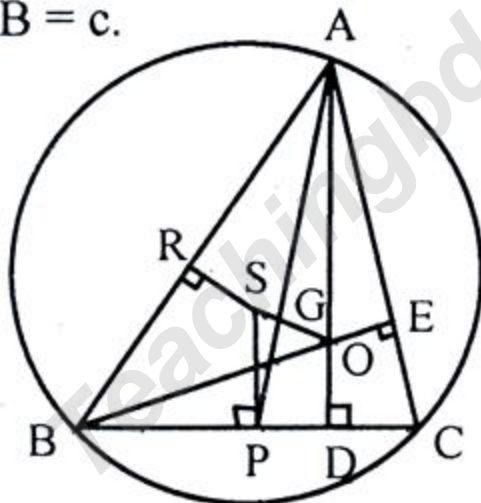
- Find range of  $f$ . 2
- Show that,  $f$  is one-one function. 4
- Determine  $f^{-1}$  and draw the graph of  $f^{-1}$ . 4

2. ► Given that,  $\frac{1}{x+1} + \frac{1}{(x+1)^2} + \frac{1}{(x+1)^3} + \dots$

- For  $x = 1$ , find the series. What is common ratio of the obtained series? 2
- If  $x = 2$ , find the sum of first 10 terms of the series. 4
- Impose a condition on  $x$  under which the given infinity series will have a sum and find the sum. 4

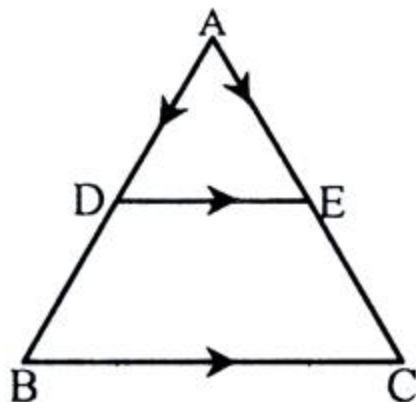
### Group-B: Geometry and Vector

3. ► O is the orthocenter, S is the circumcenter, G is the centroid and AP is the median of the triangle ABC,  $BC = a$ ,  $AC = b$  and  $AB = c$ .



- What is the relation between OA and SP. 2
- Show that, S, G, O are collinear. 4
- If C is an acute angle, show that,  $a \cdot CD = b \cdot CE$ . 4

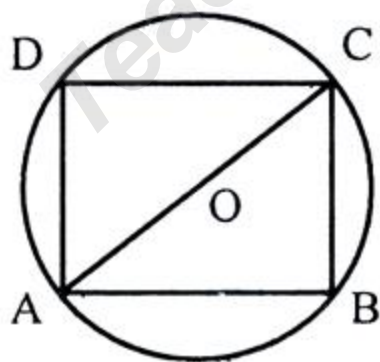
4. ► D and E are respectively the middle points of the sides AB and AC of the triangle  $\triangle ABC$ .



- Express  $(\vec{AD} + \vec{DE})$  in terms of the vector  $\vec{AC}$ . 2
- Prove with the help of vectors that,  
 $DE \parallel BC$  and  $DE = \frac{1}{2} BC$ . 4
- If M and N are the middle points of the diagonals of the trapezium BCED, then prove with the help of vectors that  
 $MN \parallel DE \parallel BC$  and  $MN = \frac{1}{2} (BC - DE)$  4

### Group-C: Trigonometry and Probability

- The length, breadth and height of a rectangular solid are in the ratio 4 : 3 : 2 and its area of the whole surface is 468 square meters.
  - What is the length of rectangular solid? 2
  - One side of a square is equal to the length of that rectangular solid. Find the circumference of a circle which area is equal to the area of this square. 4
  - The height of a cone is 3.52 meters more than the diagonal of the rectangular solid and the radius of its base is 8 meters, find the area of the whole surface and the volume. 4
- ABCD quadrilateral inscribed in a circle with center O and diameter BD = 10 cm.



- Determine  $\sin \frac{1}{2} (A + C)$ . 2
- Prove that,  $\cos A + \cos B + \cos C + \cos D = \tan A + \tan B + \tan C + \tan D$ . 4
- A solid sphere is formed by revolving the circle around BD. Find the area of the surface and volume. 4

<b>Answers</b> 1. (a) Range = [1, 7] (c) $f^{-1}(x) = \frac{1}{3}(x - 1)$ 2. (a) $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots; \frac{1}{2}$ (b) $\frac{29524}{59049}$ (c) $x > 0$ or, $x < -2; \frac{1}{x}$ 3. (a) $OA = 2SP$	4. (a) $\vec{AD} + \vec{DE} = \frac{1}{2} \vec{AC}$ 5. (a) 12m (b) 42.54m (approx.) (c) 734.86m <sup>2</sup> (approx.) and 1318.63m <sup>3</sup> (approx.) 6. (a) 1 (c) 314.16cm <sup>2</sup> (approx.) and 523.6 cm <sup>3</sup> (approx.)
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## Multiple Choice Questions

Time — 35 Minute Full Marks— 35

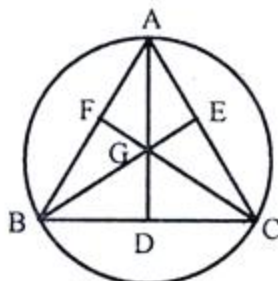
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[Find out the best/correct answer and fill the circles with ballpoint pen. Each question is worth 1 mark.]

1. Which is the probability of getting 3 in the throw of a dice?  
(a)  $\frac{1}{6}$  (b)  $\frac{1}{3}$  (c)  $\frac{2}{3}$  (d)  $\frac{1}{2}$
2. For any set A –
  - i. will be an infinite set if and only if A is equivalent to its proper subset.
  - ii. If the number of the elements are n, then  $n(P(A)) = 2n$ .
  - iii. is a subset of itself.Which of the following is correct?  
(a) i and ii (b) ii and iii  
(c) i and iii (d) i, ii and iii
3. If  $f(x) = 3x + 1$ ,  $0 \leq x \leq 2$ , then range of f is  
(a)  $0 \leq y \leq 2$  (b)  $1 \leq y \leq 2$   
(c)  $0 \leq y \leq 7$  (d)  $1 \leq y \leq 7$
4. Which of the following is correct?  
(a)  $[a, b] \Rightarrow a < x < b$   
(b)  $[a, b] \Rightarrow a \leq x \leq b$   
(c)  $(a, b) \Rightarrow a \leq x \leq b$   
(d)  $]a, b[ \Rightarrow a \leq x \leq b$
5. If  $f(x) = x^3 + 5$  then what is the value of  $f^{-1}(5)$ ?  
(a) 0 (b) 2 (c) 3 (d) 5
6. What is the distance between  $(-3, 2)$  and  $(1, -1)$ ?  
(a) 2 (b) 4 (c) 5 (d) 9
7. Lengths of other two sides except the hypotenuse of a right-angled triangle are 4 cm. and 3 cm. If triangle is revolved about the larger side, the evolved solid will be a
  - i. right circular cone
  - ii. right circular cylinder
  - iii. the area of the base of the evolved solid is  $9\pi$  square centimetres.Which of the following is correct?  
(a) i (b) ii  
(c) i and iii (d) ii and iii
8. What will be the remainder if the polynomial  $P(x) = 36x^2 - 8x + 5$  is divided by  $(2x - 1)$ ?  
(a) 10 (b) 8 (c) 5 (d) 2
9. A quadrilateral where two sides are parallel but other two sides are not parallel then it is called—  
(a) Parallelogram (b) Trapezium  
(c) Rhombus (d) Square
10. The point of intersection of the perpendiculars drawn at the mid points of three sides of a triangle is known as—  
(a) Circumcentre (b) Incentre  
(c) Orthocentre (d) Centroid
11. If  $AB \parallel DC$  then
  - i.  $\overrightarrow{AB} = m \overrightarrow{DC}$ , where m is a scalar quantity.
  - ii.  $\overrightarrow{AB} = \overrightarrow{DC}$
  - iii.  $\overrightarrow{AB} = \overrightarrow{CD}$Which one of the above sentences is true?  
(a) i (b) ii  
(c) i and ii (d) i, ii and iii
12. The height of the pyramid with a square base of side 10 cm is 12 cm. What is the area of all surfaces of the pyramid?  
(a) 400 sq.cm (b) 300 sq.cm  
(c) 340 sq.cm (d) 360 sq.cm
13. Which are the correct solutions of the equation  $2x + y = 3$ ?  
(a)  $(1, -1), (2, -1)$  (b)  $(1, 1), (2, -1)$   
(c)  $(1, 1), (-2, 1)$  (d)  $(-1, 1), (2, -1)$
14. In which quadrant the angle  $300^\circ$  lie?  
(a) First (b) Second  
(c) Third (d) Fourth.
15. If the points  $(a, 0)$ ,  $(0, b)$  and  $(1, 1)$  are collinear, then which one is correct?  
(a)  $a + b = 1$  (b)  $a + b = -1$   
(c)  $a + b = ab$  (d)  $a + b = -ab$
16. The coordinates  $(2, -3)$ ,  $(3, 0)$ ,  $(0, 1)$  and  $(-1, -2)$  are the vertices of a –  
(a) Square (b) Rectangle  
(c) Parallelogram (d) Rhombus





In the above picture D, E, F are respectively the middle points of BC, AC and AB. In the light of this picture answer the questions No. 17 and 18.

17. What is the name of the point G?  
 (a) Orthocentre (b) Incentre  
 (c) Centroid (d) Circumcentre
18. What is the name of the circle drawn through the vertices of ABC?  
 (a) Circumcircle (b) Incircle  
 (c) Excircle (d) Nine point circle
19. What is the 10th term in the expansion of  $(1+x)^{20}$ ?  
 (a)  ${}^{20}C_{10}x^{10}$  (b)  ${}^{20}C_{11}x^9$   
 (c)  ${}^{20}C_{10}x^9$  (d)  ${}^{20}C_9x^9$
20. If  $x = 60^\circ$ , what is the measurement of the half of the supplementary angle of  $\angle x$ ?



- (a)  $30^\circ$  (b)  $60^\circ$  (c)  $120^\circ$  (d)  $180^\circ$

21. What is the area of triangle with vertices A (2, 3), B (5, 6) and C(-1, 4).  
 (a) 12 sq.unit (b) 8 sq.unit  
 (c) 6 sq.unit (d) 3 sq.unit
22. A(1, 1) ——— B(3, -3) Slope of AB  
 (a) 6 (b) 2 (c) -2 (d) 0
23. The nine point circle passes through the...  
 (a) Centroid (b) Orthocentre  
 (c) Circumcentre  
 (d) Middle points of the sides
24. In  $\sqrt{s(s-a)(s-b)(s-c)}$ , Here s means  
 (a) Area of triangle  
 (b) Area of circle  
 (c) Half perimeter of triangle  
 (d) Half perimeter of circle
25. What is the angle between the hour hand and minute hand at time 9:25 am?

- (a)  $120^\circ$  (b)  $107.5^\circ$  (c)  $132.5^\circ$  (d)  $127.5^\circ$

A ball is drawn at random from a bag containing 12 blue, 16 white and 20 black balls. Answer the questions 26 and 27 considering the given information.

26. What is the probability that the ball is blue?  
 (a)  $\frac{1}{16}$  (b)  $\frac{1}{12}$  (c)  $\frac{1}{8}$  (d)  $\frac{1}{4}$
27. What is the probability that the ball is not white?  
 (a)  $\frac{1}{3}$  (b)  $\frac{2}{3}$  (c)  $\frac{1}{16}$  (d)  $\frac{1}{48}$
28. If  $\log_{\sqrt{8}} x = 3\frac{1}{3}$ , then the value of x is...  
 (a) 64 (b) 32 (c) 16 (d) 8
29. If  $(2a)^{2x-3} = 1$ , what the value of x?  
 (a) 0 (b) 1 (c)  $\frac{2}{3}$  (d)  $\frac{3}{2}$

Answer the questions No 30 and 31 on the basis of the following information. A spherical ball of diameter 2cm. exactly fits in a cylindrical box.

30. What is the volume of the cylinder?  
 (a)  $2\pi$  cc. (b)  $4\pi$  cc. (c)  $6\pi$  cc. (d)  $8\pi$  cc.
31. What is the volume of the unoccupied portion of the cylinder?  
 (a)  $\frac{\pi}{3}$  cc (b)  $\frac{2\pi}{3}$  cc  
 (c)  $\frac{3\pi}{3}$  cc (d)  $\frac{4\pi}{3}$  cc
32. If  $b^2 - 4ac$  is a perfect square, then the roots are—  
 (a) Real and rational  
 (b) Real and irrational  
 (c) Real and equal  
 (d) Imaginary
33.  $\log_{\sqrt{a}} b \times \log_{\sqrt{b}} c \times \log_{\sqrt{c}} a = \dots$ ?  
 (a) 8 (b) 4 (c) 2 (d) 1
34. Which is the general term in the expansion of  $(a+b)^n$ ?  
 (a)  ${}^nC_r a^{n-r} b^r$  (b)  ${}^nC_r a^r b^{n-r}$   
 (c)  ${}^nC_r a^{n+r} b^r$  (d)  ${}^nC_r a^r b^{n+r}$
35. The intersecting point of  $y = x - 3$  and  $y = -x + 3$   
 (a) (0, 0) (b) (0, 3) (c) (3, 0) (d) (-3, 3)

1	(a)	2	(c)	3	(d)	4	(b)	5	(a)	6	(c)	7	(c)	8	(a)	9	(b)	10	(a)	11	(a)	12	(d)	13	(b)	14	(d)	15	(c)	16	(a)	17	(c)	18	(a)	19	(d)	20	(b)
21	(c)	22	(c)	23	(d)	24	(c)	25	(c)	26	(d)	27	(b)	28	(b)	29	(d)	30	(a)	31	(b)	32	(a)	33	(a)	34	(a)	35	(c)										