

# Barishal Board 2016

Higher Mathematics

Subject Code : 

1	2	6
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Times — 2 hours 10 minutes

Full marks — 40

*[ Read the stems carefully and answer the associated questions. Taking minimum one question from each group answer altogether four questions.]*

## Section A—Algebra

1. ▶  $f(x) = \frac{2x+2}{x-1}$  is a function, where  $x \neq 1$ .

- a. If  $f(p) = k$ , express  $p$  in terms of  $k$ . 2
- b. Find  $f^{-1}(3)$ . 4
- c. Express  $f(x^2)$  as the sum of partial fractions. 4

2. ▶  $\frac{1}{3x-1} + \frac{1}{(3x-1)^2} + \frac{1}{(3x-1)^3} + \dots$  is a series and  $\left(x - \frac{k}{x^2}\right)^8$  is a binomial.

- a. If  $x = 1$ , find the series and find the common ratio. 2
- b. Impose a condition on  $x$  under which the given infinite series will have a sum up to infinity and find the sum. 4
- c. In the expansion of the binomial if the coefficient of  $x^2$  is 252. Find the value of  $k$ . 4

## Section B — Geometry and Vector

3. ▶ In triangle ABC,  $AB = 12$  cm,  $AC = 5$  cm,  $BC = 13$  cm and O is the point of intersection of the three medians.

- a. Find the length of the median from the vertex A on the opposite arm. 2

- b. According to the stimulus, show that, the sum of the squares of the three sides of the triangle is equal to the three times of the sum of the squares of the distances from O to the vertices. 4
- c. Find the difference of the numerical values of the volume and the whole surface areas of the solid which is formed by the complete revolution of the triangle about its smallest side. 4
4. ► A(-5, 0), B(5, 0), C(5, 5) and D(-5, 5) are the vertices of the quadrilateral ABCD turned round of the anti-clockwise.
- a. Find the area of the quadrilateral ABCD. 2
- b. Show that, the quadrilateral ABCD is a rectangle. 4
- c. If S and T are the middle point of the arms AB and AC, prove by the vector method that,  $ST \parallel BC$  and  $ST = \frac{1}{2} BC$ . 4

### Section C—Trigonometry and Probability

5. ► Suppose,  $P = \frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1}$  and  $Q = \sec\theta + \tan\theta$ .
- a. If  $\tan 10x = \cot 5x$ , find the value of x. 2
- b. Show that,  $P = Q$ . 4
- c. If  $Q = \sqrt{3}$  and  $0 < \theta < 2\pi$ , find the value of  $\theta$ . 4
6. ► A coin is tossed three times.
- a. Define sample space with example. 2
- b. Draw the probability tree of the probable incident and write down the sample space. 4
- c. Show that, the sum of the probability of getting three heads and the probability of getting maximum two tails is 1. 4

[N.B — Answer all the questions. Each question carries one mark. Block fully, with a ball-point pen, the circle of the letter that stands for the correct/best answer in the "Answer Sheet" for Multiple Choice Questions Examination.]

1. If  $\cos\theta = -\frac{1}{2}$  and  $\pi < \theta \leq \frac{3\pi}{2}$ , then which one of the value of  $\tan\theta$ ?

(a)  $-\sqrt{3}$                       (b)  $\frac{1}{\sqrt{3}}$   
 (c) 1                                (d)  $\sqrt{3}$

2. If  $\sin^2\theta - \cos^2 = \cos\theta$  (where  $0^\circ \leq \theta \leq \pi$ ) then—

i.  $\theta = \pi$                       ii.  $\theta = \frac{\pi}{3}$   
 iii.  $\theta = \frac{2\pi}{3}$

Which one of the following is correct?

(a) i & ii  
 (b) i & iii  
 (c) ii & iii  
 (d) i, ii & iii

3. If  $\cos\theta = \frac{b}{a}$  and  $a > b > 0$ , then—

i.  $\sin\theta = \frac{\sqrt{a^2 - b^2}}{a}$             ii.  $\cot\theta = \frac{b}{\sqrt{a^2 - b^2}}$   
 iii.  $\cos\theta - \sec\theta = \frac{a^2 - b^2}{ab}$

Which one of the following is correct?

(a) i & ii                      (b) i & iii  
 (c) ii & iii                    (d) i, ii & iii

4. If  $a(x + b) < c$  and  $a < 0$ , then which is correct?

(a)  $x < \frac{c}{a} - b$                 (b)  $x < \frac{c}{a} + b$   
 (c)  $x > \frac{c}{a} - b$                 (d)  $x > \frac{c}{a} + b$

5.  $2x + 3y - 7 < 0$ , the solution of inequalities graph is—

i. all points at the origin side of the line  
 ii. all points at the (3, 3) point side of the line  
 iii. the line passing through the point (-1, 3)

Which one of the following is correct?

(a) i & ii                      (b) i & iii  
 (c) ii & iii                    (d) i, ii & iii

6. If  $y^x = 9$ ,  $y^2 = 3^x$ , then (x, y) equal—

(a) (2, 3),  $(-2, \frac{1}{9})$             (b) (2,  $\pm 3$ ),  $(-2, \pm \frac{1}{3})$   
 (c)  $(2, \frac{1}{9})$ , (-2, -3)            (d)  $(-2, -\frac{1}{9})$ , (2, 3)

7. If  $y = 2x + 1$  and  $y = 2x - 1$  are two straight line, then—

i. multiplication of slope is -4  
 ii. point of intersection is  $(\frac{1}{4}, \frac{1}{2})$   
 iii. bisector of y-axis respectively is 1, -1

Which one of the following is correct?

(a) i & ii                      (b) i & iii  
 (c) iii & iii                    (d) i, ii & iii

8.  $2x - y + 7 = 0$  and  $3x + ky - 5 = 0$  are parallel straight line, then the value of k is—

(a) 6                      (b) 2                      (c)  $\frac{2}{3}$                       (d)  $-\frac{3}{2}$

9. If (2, -1), (a + 1, a - 3) and (a + 2, a) three points are collinear, then the value of a is—

(a)  $\frac{1}{3}$                       (b) 2                      (c)  $\frac{1}{2}$                       (d) -1

10. The equation of a straight line passing through origin and the point  $(x_1, y_1)$  is—

(a)  $y = mx$                       (b)  $y = \frac{x_1}{y_1}x$   
 (c)  $y = \frac{y_1}{x_1}x$                       (d)  $y - y_1 = m(x - x_1)$

11. Diameter of a ball is 3 cm, then what is the volume?

(a)  $3\pi \text{ cm}^3$                       (b)  $\frac{9}{2}\pi \text{ cm}^3$   
 (c)  $9\pi \text{ cm}^3$                       (d)  $36\pi \text{ cm}^3$

12. The length, breadth and height of a rectangular parallelopiped are respectively 5 cm, 4 cm and 3 cm, then the area of surfaces is —

(a)  $30 \text{ cm}^2$                       (b)  $47 \text{ cm}^2$   
 (c)  $60 \text{ cm}^2$                       (d)  $94 \text{ cm}^2$

13. If  $\log_{\sqrt{8}}x = 5\frac{1}{3}$ , then value of x is—

(a) 256                      (b)  $\frac{128}{3}$                       (c) 32                      (d) 8

14. If  $9\mathbf{a} - 4\mathbf{b}$  and  $-3\mathbf{a} - \mathbf{b}$  are respectively the position vectors P and Q with respect to a

vector origin. Then  $\mathbf{PQ}$  is—

(a)  $6\mathbf{a} - 5\mathbf{b}$                       (b)  $12\mathbf{a} - 3\mathbf{b}$   
 (c)  $-12\mathbf{a} + 3\mathbf{b}$                       (d)  $\frac{9\mathbf{a} - 4\mathbf{b}}{-3\mathbf{a} - \mathbf{b}}$

15. An unbiased dice and one coin thrown. What is the probability of getting an odd number and only one 7?

(a)  $\frac{1}{2}$                       (b)  $\frac{1}{4}$                       (c)  $\frac{1}{6}$                       (d)  $\frac{1}{12}$

16. How may tangents can be drawn of a circle from a point which is outside that circle?

(a) 1                      (b) 2                      (c) 3                      (d) infinite

17. When  $\cos\theta = \frac{\sqrt{3}}{2}$ , then  $\sin 3\theta = ?$

- (a) 0 (b)  $\frac{\sqrt{3}}{2}$  (c)  $\frac{1}{2}$  (d) 3

18. If a member of the set number  $n$ , then the number of real subset is—

- (a)  $2^n + 2$  (b)  $2^{n+2}$   
(c)  $2^n - 1$  (d)  $2^n - 2$

19. If P and Q two polynomial, then—

- i.  $P - Q$  is a polynomial  
ii.  $PQ$  may not be the polynomial  
iii.  $\frac{P}{Q}$  may or may not be a polynomial

Which one of the following is correct?

- (a) i & ii (b) ii & iii  
(c) i & iii (d) i, ii & iii

20.  $\sqrt{(x-1)(x-2)} + \sqrt{(x-3)(x-4)} = \sqrt{2}$ . The solution is—

- (a) (0, 2) (b) (0, 3)  
(c) (2, 3) (d) (3, 5)

21. Probability tree is used to—

- i. build the sample space  
ii. make the shape of a tree  
iii. find the probability of various event

Which one of the following is correct?

- (a) i & ii (b) ii & iii  
(c) i & iii (d) i, ii & iii

22. If  $S = \{x : x \in \mathbb{R}, F(x) = \sqrt{2-x}\}$ , then dom S is—

- (a)  $\{x \in \mathbb{R}, x \geq 2\}$  (b)  $\{x \in \mathbb{R}, x \leq 2\}$   
(c)  $\mathbb{R} - \{2\}$  (d)  $\mathbb{R} + \{2\}$

23. If  $(x-2)$  is a factor of  $p(x) = x^4 - 5x^3 + 7x^2 - a$ , then what is the value of 'a'?

- (a) 2 (b) 4 (c) 5 (d) 6

24.  $-\frac{1}{3}, 1, \frac{1}{5}, \frac{1}{9}, \dots$  which is the  $n$ -th term of the sequence?

- (a)  $\frac{1}{5n-8}$  (b)  $\frac{1}{3n-6}$  (c)  $-\frac{1}{3n}$  (d)  $\frac{1}{4n-7}$

Following information answer the question no. 25 and 26:

$(2x^2 - \frac{1}{2x})^8$  is a binomial expansion.

25. What is the third term of the expansion?

- (a)  $-512x^{13}$  (b)  $-224x^7$   
(c)  $256x^{10}$  (d)  $448x^{10}$

26. Middle term of the expansion is—

- (a)  $70x^4$  (b)  $14x^2$   
(c)  $-70x^4$  (d)  $-224x^7$

27. If  $b^2 - 4ac$  is not a perfect square, then what is the nature of roots?

- (a) Real and rational (b) Real and irrational  
(c) Real and equal (d) Imaginary

28. If  $P(a) = 4a^4 + 12a^3 + 7a^2 - 3a - 2$ , then which is the factor of  $P(a)$ ?

- (a)  $(2a-1)$  (b)  $4a+1$   
(c)  $a-1$  (d)  $4a-1$

29. Any right angle triangle ABC with side  $a, b, c$  median  $d, e, f$  and  $\angle C = 90^\circ$ , then which one is true?

- (a)  $2(d^2 + e^2 + f^2) = 3c^2$   
(b)  $2(d^2 + e^2 + f^2) = 3(a^2 + b^2)$   
(c)  $d^2 + e^2 + f^2 = 3c^2$   
(d)  $4(d^2 + e^2 + f^2) = 3(a^2 + b^2 + c^2)$

30. If  $U = \{x : x \in \mathbb{N}, x \leq 10\}$ ;  $A = \{x : x \in \mathbb{N}, x \leq 8 \text{ and } x \text{ even number}\}$ ,  $B = \{x : x \in \mathbb{N}, x \text{ multiples of } 3\}$ , then  $A \cap B$  is—

- (a)  $\emptyset$  (b)  $\{6\}$   
(c)  $\{6, 8\}$  (d)  $\{2, 3, 4, 6, 8\}$

31. An infinite geometric series whose first term  $\frac{1}{2}$  and sum of infinity  $\frac{3}{4}$ , then the common ratio is—

- (a)  $\frac{3}{4}$  (b)  $\frac{2}{3}$  (c)  $\frac{1}{2}$  (d)  $\frac{1}{3}$

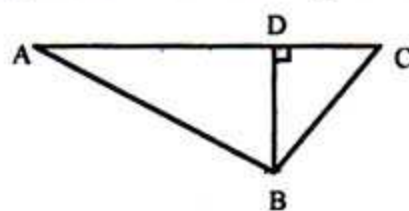
32. If  $f(x) = \frac{4x-9}{x-2}$ , then value of  $f^{-1}(3)$  is—

- (a) 3 (b) 1 (c)  $\frac{3}{5}$  (d) -3

33. The slope of a straight line passing through the point  $A(-5, 4)$ ,  $B(3, 7)$  is—

- (a)  $-\frac{1}{10}$  (b)  $-\frac{2}{11}$  (c)  $\frac{3}{8}$  (d)  $\frac{8}{3}$

Answer to the question no. 34 and 35 according to the information given below:



$AB = 12$  cm,  $BC = 5$  cm and  $AC = 13$  cm.

34. From the triangle ABC

- i. Half of perimeter is 15 cm  
ii. Area is  $30 \text{ cm}^2$   
iii.  $\sin B = \frac{12}{13}$

Which one of the following is correct?

- (a) i & ii (b) i & iii  
(c) ii & iii (d) i, ii & iii

35. What is the length of BD?

- (a) 4.62 cm (b) 9.23 cm  
(c) 10 cm (d) 24 cm

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