

# Sylhet 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.]*

## Group A—Algebra

1. ▶  $x - 1$  is a factor of the polynomial  $g(x) = px^3 + qx^2 + rx + s$  and all coefficients of the polynomial are integers and  $p \neq 0$ ,  $s$

$\neq 0$  another expression  $Q(x) = \frac{x^3}{x^2 - 16}$ .

a. Show that,  $p + q + r + s = 0$ . 2

b. If  $p = 1$ ,  $q = 5$ ,  $r = 6$  and  $s = 8$  and  $g(x)$  yields the same remainder upon division by  $x - k$  and  $x - l$  where  $k \neq l$  then show that,  $k^2 + l^2 + kl + 5k + 5l + 6 = 0$ . 4

c. Express  $Q(x)$  as partial fraction. 4

2. ▶  $a = xy^{p-1}$ ,  $b = xy^{q-1}$ ,  $c = xy^{r-1}$  and  $f(x) = \ln \frac{4+x}{4-x}$ .

a. If  $(16)^{2x} = 4^{x+1}$  then  $x = ?$  2

b. By the stem prove that,  $(q - r) \log_k a + (r - p) \log_k b + (p - q) \log_k c = 0$ . 4

c. Determine the domain and range of the function

$f(x) = \ln \frac{4+x}{4-x}$ . 4

## Group B—Geometry and Vector

3. ▶ A line with slope 5 passes through the point  $A(2, -5)$  and intersects  $x$ -axis at the point  $B$ . Another line passing through the point  $A$  intersect  $x$ -axis at the point  $C(-1, 0)$ .

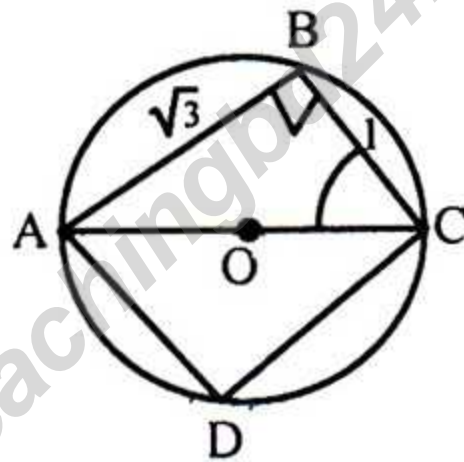
a. Find the equations of the straight line passes through  $A$ . 2

b. Find the equation of the straight line  $AB$  and its length. 4

- c. Determine the area of the triangle ABC by plotting its vertices on the graph paper. 4
4. ► PQRS is a cyclic quadrilateral and PQ, QS are two diagonals.
- a. What is the position of the centre of a circle of nine point circle and find its radius? 2
- b. Prove that,  $PR \cdot QS = PQ \cdot RS + QR \cdot PS$ . 4
- c. Prove with the help of vectors that, the straight lines joining the middle points of the adjacent sides of a quadrilateral PQRS form of a parallelogram. 4

### Group C—Trigonometry and Probability

5. ►



ABCD is a cyclic quadrilateral with centre O of the circle.

- a. Find the value of  $\theta$  in circular system. 2
- b. In  $\Delta ABC$ , show that,  $\cos(B + C) = \cos B \cos C - \sin B \sin C$ . 4
- c. What is the speed of the wheel if ABCD is a circular wheel and it revolve ten times in a second? 4
6. ► A dice and two coins are thrown together.
- a. What is sample space and sample point? 2
- b. Draw the probability tree and write down the sample space. 4
- c. What is the probability of getting at least one T of a coin and multiple of 2 and 3 of a dice? 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. How many elements of power set of the set  $A = \{1, 2, 3, 4, 5\}$ ?

- (a) 5    (b) 10    (c) 25    (d) 32

2. Among a certain group of students, 60 like cricket, 40 like football and 25 like both the game. How many students like at least one of the games?

- (a) 25    (b) 75    (c) 100    (d) 125

3. Algebraic expression—

i.  $x^2y + yz^2 + xyz$  is a homogeneous polynomial

ii.  $6x^2 + 5xy + 2y^2$  is a symmetric expression

iii.  $z^2x + x^2y + yz^2$  is a cyclic expression

Which one of the following is correct?

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

4. Which one is the factor of  $x^3 + 2x^2 - 5x - 6$ ?

- (a)  $x - 4$     (b)  $x - 1$     (c)  $x + 2$     (d)  $x + 3$

5. In nine-point circle—

i. the centroid divides the medians in the ratio 2 : 1

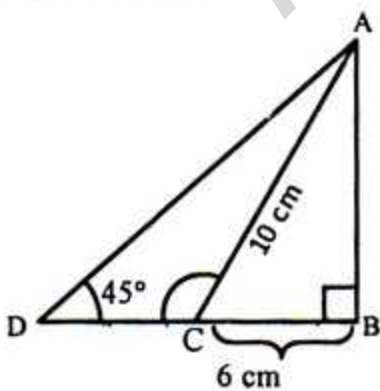
ii. the centre of the nine-point circle is the middle point of the line segment joining the orthocenter and the circumcenter

iii. the radius of the nine-point circle is half of radius of the circumcircle

Which one of the following is correct?

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

Answer the questions 6 and 7 based on the following information:



6. Which one is the orthogonal projection of the line segment AC on BD?

- (a) BD    (b) CD    (c) AB    (d) BC

7.  $DC =$  what?

- (a) 2 cm    (b) 4 cm    (c) 6 cm    (d) 8 cm

8. The area of a piece of paper is 48 sq. cm. A rectangular piece  $x$  cm long and 6 cm wide is cut off from it. What is the possible value of  $x$ ?

- (a)  $8 < x < 6$     (b)  $-6 < x < 8$   
(c)  $6 < x < 8$     (d)  $6 < x < -8$

9. A straight line passes through the points (2, 2) and (4, t) and its slope is 3. What

is the value of t?

- (a) 8    (b)  $\frac{8}{3}$   
(c)  $-\frac{8}{3}$     (d) -8

10. If two tangents of a circle meet at a point outside the circle formed  $60^\circ$  angle, then what will be the measure of the angle that is formed at the centre with the points of contacts?

- (a)  $30^\circ$     (b)  $60^\circ$   
(c)  $120^\circ$     (d)  $360^\circ$

Answer the questions 11 and 12 on the basis of the following information:

" $4x - 2 - x^2 = 0$  is a quadratic equation."

11. What is the discriminant of it?

- (a) 20    (b) 8  
(c)  $2\sqrt{5}$     (d)  $2\sqrt{2}$

12. What are the nature of the roots?

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

13.  $16^x = 64^y$ , then  $\frac{y}{x} =$  what?

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

14. 4 times of a positive number is not less than the sum of the number with 18. Which one is correct?

- (a)  $x = 6$     (b)  $x > 6$   
(c)  $x \geq 6$     (d)  $x < 6$

15. The  $n^{\text{th}}$  term of a sequence is  $U_n = \frac{1}{n}$  and

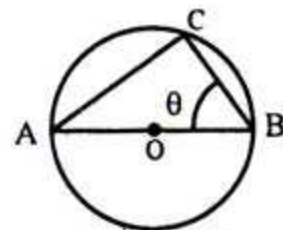
$U_n < \frac{1}{5^3}$ . Which one is correct?

- (a)  $n > \frac{1}{125}$     (b)  $n < \frac{1}{125}$   
(c)  $n > 5^3$     (d)  $n < 5^3$

16. What is the rational fraction of 5.783?

- (a)  $\frac{5783}{1000}$     (b)  $\frac{5783}{99}$     (c)  $\frac{5726}{99}$     (d)  $\frac{5726}{990}$

17.



In the figure  $\sin\theta = \frac{\sqrt{3}}{2}$  and O is the centre of the circle, then—

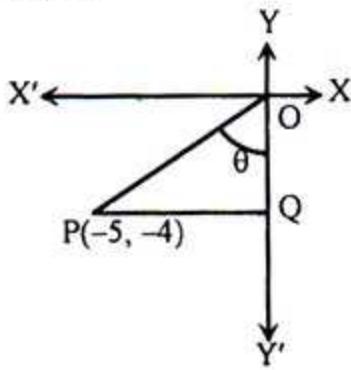
- i. circumference of the circle is  $2\pi$   
ii. area of the circle is  $\pi$   
iii. value of  $\theta$  is  $\frac{\pi}{6}$

Which one of the following is correct?

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



Answer the questions 18 and 19 based on the information:



18. What is the value of  $\tan\theta$ ?

- (a)  $-\frac{\sqrt{41}}{5}$  (b)  $-\frac{4}{\sqrt{41}}$   
 (c)  $\frac{4}{5}$  (d)  $\frac{5}{4}$

19. If PQ is the diameter of a circle, what will be the length of circumference of that circle?

- (a) 7.58 (b) 15.71  
 (c) 19.64 (d) 31.42

20. If  $a, b, x > 0$  and  $a \neq 1, b \neq 1$  then—

- i.  $\log_{\sqrt{a}} a + \log_{\sqrt{b}} b = 4$   
 ii.  $\log \frac{ab}{x} = \log a + \log b - \log x$   
 iii.  $a^x = \sqrt[3]{a^2}$  when  $x = \frac{2}{3}$

Which one of the following is correct?

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

21. The lengths of the three sides of a triangle are 3cm, 4cm and 5cm. What is the sum of the areas of the squares on the three medians?

- (a)  $\frac{200}{3}$  (b)  $\frac{75}{2}$   
 (c)  $\frac{75}{4}$  (d)  $\frac{25}{2}$

22. What is the value of  ${}^{10}C_3$ ?

- (a) 7 (b) 30  
 (c) 120 (d) 240

Answer the questions 23 and 24 based on the following information:

$(1 - 2x + x^2)^2$  is a binomial expression.

23. How many terms are there in the expansion of this binomial?

- (a) 2 (b) 3  
 (c) 4 (d) 5

24. What are the co-efficients in the expansion of the binomial?

- (a) 1, 2, 3, 2, 1 (b) 1, 5, 6, 5, 1  
 (c) 1, 4, 6, 4, 1 (d) 1, 5, 10, 5, 1

25. What is the slope of a line passing through the points A(3, 4) and B(1, 2)?

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

26. What will be the area of the triangle with the vertices A(5, 6) B(3, -1), C(1, 4)?

- (a)  $\frac{19}{2}$  sq. unit (b) 19 sq. unit  
 (c) 31 sq. unit (d) 38 sq. unit

27. The area of a triangle is 36 sq. cm. The length of the base twice the length of its height. What is the length of the base?

- (a) 6cm (b)  $6\sqrt{2}$  cm  
 (c) 12cm (d)  $12\sqrt{2}$  cm

28.  $\underline{a}, \underline{b}$  are the position vectors respectively

of the points A and B, then  $\overrightarrow{AB} =$  what?

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

Answer the questions 29 and 30 based on the following information:

A metallic solid sphere of radius 2 cm is melted and a right circular cylinder of base of 2 cm is formed.

29. What will be area of the surface of the sphere?

- (a) 50.27  $\text{cm}^2$  (b) 33.51  $\text{cm}^2$   
 (c) 16.76  $\text{cm}^2$  (d) 12.57  $\text{cm}^2$

30. What will be height of the right circular cylinder?

- (a) 0.7 cm (b) 2 cm  
 (c) 2.67 cm (d) 8 cm

31. If  $\cos\alpha = -\frac{\sqrt{3}}{2}$  while  $\frac{\pi}{2} < \alpha < \pi$ , what is the value of  $\alpha$ ?

- (a)  $\frac{5\pi}{6}$  (b)  $\frac{2\pi}{3}$  (c)  $\frac{7\pi}{6}$  (d)  $\frac{4\pi}{3}$

32. In February 2000 A.D it rained on's days. What is the probability that it was rain on 12th February on that year?

- (a)  $\frac{5}{29}$  (b)  $\frac{5}{28}$  (c)  $\frac{1}{28}$  (d)  $\frac{1}{29}$

33. What will be the area of the base of a regular hexagonal prism having side of 2 cm?

- (a)  $12\sqrt{3}$   $\text{cm}^2$  (b)  $6\sqrt{3}$   $\text{cm}^2$   
 (c)  $2\sqrt{3}$   $\text{cm}^2$  (d)  $\sqrt{3}$   $\text{cm}^2$

34. In a bag there are 4 red, 5 white and 2 black balls. A ball is chosen at random. What is the probability that the ball will be red?

- (a)  $\frac{1}{4}$  (b)  $\frac{2}{11}$  (c)  $\frac{4}{11}$  (d)  $\frac{5}{11}$

35. What is the domain of the function  $F(x) = \frac{1}{x-5}$ ?

- (a)  $\{x : x \in \mathbb{R} \text{ and } x \neq 5\}$   
 (b)  $\{x : x \in \mathbb{R}\}$   
 (c)  $\{x : x \in \mathbb{R} \text{ and } x \geq 5\}$   
 (d)  $\{x : x \in \mathbb{R} \text{ and } x > 5\}$

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