

1. Dhaka Board 2017

Higher Mathematics

(Creative)

Subject Code

1	2	6
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Full marks — 50

Time — 2 hours 35 minutes

[N.B. — The figures in the right margin indicate full marks. Answer **five** questions taking at least **one** from each Group.]

Group A — Algebra

1. ► The functions $f: \mathbb{V} \rightarrow \mathbb{V}$ and $g: \mathbb{V} \rightarrow \mathbb{V}$ are defined by $f(x) = \frac{2x+2}{x-1}$ and $g(x) = \frac{x-3}{2x+1}$

- Find the domain of f . 2
- Show that g is one-one and onto function. 4
- If $3f^{-1}(x) = x$, then find the value of x . 4

2. ► $P = x^{a-b}$, $Q = x^{b-c}$, $R = x^{c-a}$.

- If $\log\left(\frac{P}{R}\right) = 0$, then show that, $b + c = 2a$. 2

b. Prove that, $\frac{1}{1+Q+P^{-1}} + \frac{1}{1+R+Q^{-1}} + \frac{1}{1+P+R^{-1}} = 1$. 4

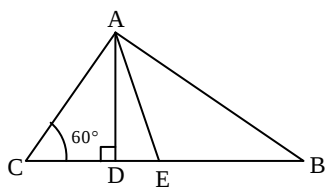
- Prove that, $(c+a) \log(PQ) + (a+b) \log(QR) + (b+c) \log(PR) = 0$. 4

3. ► $A = \left(1 + \frac{x}{2}\right)^8$ and $B = \left(a + \frac{x}{3}\right)^7$; $a \neq 0$.

- Expand A up to 4th term by the help of Pascal's triangle. 2
- In the expansion of B coefficient of a^2 is 672, find the value of x . 4
- Expanding $(2-x)A$ up to x^3 in ascending power of x . Find the value of $1.9 \times (1.05)^8$ by using the result. 4

Group B — Geometry and Vector

4. ►



In $\triangle ABC$, the mid point of BC is E , $AD = 4\text{cm}$ and $BC = 6\text{cm}$.

- Determine the length of the side AC . 2
- Prove that, $AC^2 + AB^2 = 3(AE^2 + CE^2)$. 4
- Construct a triangle whose base is BC , the vertical angle is $\angle C$ and the difference of the

length of the other two sides is 2cm. (The sign of construction and description are essential) 4

5. ► The height of a right circular cone is 8cm and the radius of its base is 6 cm. It is melted and formed into several number of solid sphere with diameter 4cm.

- Find the area of the curved surface of each sphere. 2
- Find the whole surface area of the right circular cone. 4
- Find how many solid spheres can be formed. 4

6. ► The vertices of $\triangle ABC$ are $A(1, 3)$, $B(-1, -1)$, $C(3, -1)$ and the mid points of AB and AC are D and F .

- Determine the slope of AB . 2
- Find the length of each side and the area of the triangle ABC . 4
- Prove with the help of vectors that $DF \parallel BC$ and $DF = \frac{1}{2}BC$. 4

Group C — Trigonometry & Probability

7. ► $\sin A + \cos A = P$ and $Q = \sec \theta - \tan \theta$.

- Express $32'4''$ in radians. 2
- If $P = 1$, then prove that, $\sin A - \cos A = \pm 1$. 4
- Find the value of θ where as $Q = (\sqrt{3})^{-1}$. (Where θ is acute angle) 4

8. ► An unbiased coin and an unbiased dice are tossed and thrown together once.

- If the dice is thrown once rather than the coin determine the probability of getting a prime number on the upper side. 2
- Draw the probability tree and write down the sample space and then determine the probability of getting the head of the coin and an even number of the dice. 4
- If two dice are thrown once together, then draw the probability tree and find the probability of getting same number on the upper side from the sample space. 4

Answers

1. a. $\{x \in \mathbb{V} : x \neq 1\}$ c. $-1, 6$

3. a. $1 + 4x + 7x^2 + 7x^3$ b. 6

4. a. 4.62 cm (approx.)

5. a. 50.27 sq. cm (approx.)

b. 301.59 sq. cm (approx.)

c. 9

6. a. 2 b. 8 sq. unit

7. a. 0.0093 radians c. 30°

8. a. $\frac{1}{2}$

b. $\{H_1, H_2, H_3, H_4, H_5, H_6, T_1, T_2, T_3, T_4, T_5, T_6\}; \frac{1}{4}$

c. $\frac{1}{6}$

2. Rajshahi Board 2017

Higher Mathematics (Creative)

Subject Code 1 2 6
Full marks — 50

Time — 2 hours 35 minutes

[N.B. — The figures in the right margin indicate full marks. Taking at least **one** question from each group answer any **five** questions.]

Group A — Algebra

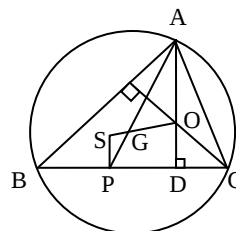
1. ▶ $f(x) = \frac{2}{x-3}$
 - a. Find the domain of $f(x)$ 2
 - b. Determine $f^{-1}(5)$. 4
 - c. Draw the graph of the given function. 4
2. ▶ i) $2 + \sqrt{2} + 1 + \frac{1}{\sqrt{2}} + \frac{1}{2} + \frac{1}{2\sqrt{2}} + \dots$ 4
 ii) $\sqrt[3]{1+x} + \sqrt[3]{1-x} = \sqrt[3]{2}$ 2
 - a. Express 0.12 as a rational fraction. 2
 - b. Find the 7th term and the sum of the given series (i) (up to infinity) if exist. 4
 - c. Solve the equation (ii). 4
3. ▶ $\left(2x^2 - \frac{1}{2x^3}\right)^{10}$ and $\left(x^2 + \frac{y}{x}\right)^6$ are two binomial expression. 4
 - a. Find the middle term of first binomial. 2
 - b. Find x free term and its value of the expansion of the first binomial. 4
 - c. In the expansion of second binomial coefficients of x^3 is 540, then find the value of y. 4

Group B — Geometry and Vector

4. ▶ The height h, the median on the base d and an angle $\angle x$ adjoining to the base of the triangle ABC are given. 4
 - a. Draw figures by the stem. 2
 - b. The triangle needs to be constructed with description. 4
 - c. If three medians AE, BF and CD of $\triangle ABC$ meet at O, prove that $AB^2 + BC^2 + CA^2 = 3(AO^2 + BO^2 + CO^2)$. 4
5. ▶ A(p, 3p), B(p², 2p), C(p - 2, p) and D(1, 1) are the four different points. 4
 - a. Find the value of p if the line joining the points B and C has slope $\frac{1}{2}$. 2
 - b. If the lines AB and CD are parallel, find the admissible value of p. 4
 - c. With negative value of p from (b) the straight line joining the middle points of the non-parallel side R and S of a trapezium ABCD. Prove with

the help of vectors that $RS \parallel AB \parallel CD$ and $RS = \frac{1}{2}(AB + CD)$. 4

6. ▶



In the picture follow S is the circumcenter, O is orthocentre and G is the centroid of the triangle ABC. AP is the median.

- a. What is nine point circle? 2
- b. Prove that, $AG : GP = 2 : 1$. 4
- c. If $\triangle ABC$ the median AP is extended the point of circle F, prove that $AF \cdot BC = AB \cdot CF + AC \cdot BF$ 4

Group C — Trigonometry & Probability

7. ▶ Musa Ebrahim saw that a hill subtends an angle of $7'$ at a point 540 kilometre from the foot of hill and write an equation is $x = \tan \theta + \sec \theta$. 4
 - a. Find the height of the hill. 2
 - b. From the equation find the value of $\sin \theta = \frac{x^2 - 1}{x^2 + 1}$ 4
 - c. From the equation if $x = 1$; find the value of θ ; where $0^\circ \leq \theta < 90^\circ$. 4
8. ▶ Out of 90 days and 90 students in the class IX, the absent result in the class shown in the table below :

Number of absent days	Number of students
0	10
2	15
3	25
5	20
5 More	20

- a. What is the probability that below 2 days absent? 2
- b. What is the probability that less than 3 days? 4
- c. Find the probability of getting 5 or a number greater than 5 days absent. 4

Answers

1. a. $\nabla - \{3\}$ b. $\frac{17}{5}$
2. a. $\frac{4}{33}$ b. $\frac{1}{4}; 4 + 2\sqrt{2}$
- c. $x = \pm 1$
3. a. $\frac{-252}{x^5}$ b. 5 th; 840 c. 3

5. a. 1, 2 b. -1, 2
7. a. 1.1 km (approx.) c. 0°
8. a. $\frac{1}{9}$ b. $\frac{5}{18}$
- c. $\frac{4}{9}$

3. Dinajpur Board 2017

Higher Mathematics (Creative)

Subject Code

1	2	6
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Time — 2 hours 35 minutes

Full marks — 50

[N.B. — The figures in the right margin indicate full marks. Taking at least **one** from each group answer any **five** questions.]

Group A — Algebra

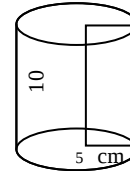
1. ▶ $\frac{1}{2x-5} + \frac{1}{(2x-5)^2} + \frac{1}{(2x-5)^3} + \dots$ is a series.
 - a. Find the series if $x = 4$. What is common ratio of the obtained series? 2
 - b. Find the 9th term and the sum of first 10 terms of the series when $x = 5$. 4
 - c. Find the condition which should be imposed on x , so that the given series will have a sum up to infinity and find the sum. 4
2. ▶ $ax^2 + bx + c = 0$ (i)
 $5 - 8x - x^2 = 0$ (ii)
 are two quadratic equations with one variable.
 - a. Find the value of y , when $5^{y+2} = 625$. 2
 - b. Find the roots of the equation (i). 4
 - c. Solve the equation (ii) and determine the characteristic of roots. 4
3. ▶ $P = \left(x + \frac{3}{x}\right)^5$ and $Q = (1 + ax)^6$ are two binomial expression, where $a \neq 0$.
 - a. Find the value of middle term of Q . 2
 - b. Find the expansion of P by the help of Pascal's triangle. 4
 - c. In then expansion of Q , if coefficients of x^2 and x^4 are equal then find the value of a . 4

Group B — Geometry and Vector

4. ▶ In ΔPQR , the side QR is trisected at the point M and N .
 - a. Draw a picture based on the above information with sign. 2
 - b. Prove that, $PQ^2 + PR^2 = PM^2 + PN^2 + 4MN^2$ 4
 - c. If $PQ = PR$ and M is any point on QR then show that $PQ^2 - PM^2 = QM \cdot MR$ 4

5. ▶ The coordinates of the four points are respectively $A(0, 1)$, $B(-1, -2)$, $C(2, -3)$, $D(3, 0)$.
 - a. Find the slope of the line AB . 2
 - b. Find the area of the quadrilateral $ABCD$. 4
 - c. Find the coordinate of the point of intersection of the line AC and BD . 4

6. ▶



- a. Find the area of the base of the cylinder. 2
- b. Find the area of the curved surface and whole surface of the cylinder. 4
- c. A spherical ball exactly fits into the cylinder. Find the volume of the unoccupied portion of the cylinder. 4

Group C — Trigonometry & Probability

7. ▶ The wheel of a car moving from Dhaka to Khulna revolves 720 times in a minute. The radius of the wheel is 0.25 meter.
 - a. Find the circumference of the wheel. 2
 - b. Find the speed of the car. 4
 - c. If the distance of Dhaka and Khulna subtends 2° angle at the centre of the earth, find the time required to go from Dhaka to Khulna. (The radius of the earth is 6440 km.) 4
8. ▶ An unbiased coin is tossed thrice.
 - a. What do you mean by sample space and sample point? 2
 - b. Draw the probability tree and write down the sample space. 4
 - c. Show that in n times tossing of the coin the sample space will consist of 2^n sample points. 4

Answers

1. a. $\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots$; $\frac{1}{3}$
 b. $\frac{1}{5^9}, \frac{1}{4 \times 5^{10}}$
 c. $x < 2$ or $x > 3; \frac{1}{2x-6}$

2. a. 2
 b. $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
 c. Real, unequal and irrational

3. a. $20a^3x^3$
 b. $x^5 + 15x^3 + 90x + \frac{270}{x} + \frac{405}{x^3} + \frac{243}{x^5}$
 c. ± 1
5. a. 3 b. 10 sq. unit c. $(1, -1)$
6. a. 78.54 sq. cm (approx.)
 b. 314.16 sq. cm (approx.)
 471.24 sq. cm (approx.)
 c. 261.8 cubic cm (approx.)
7. a. 1.57m (approx.) b. 67.86 km/hour
 c. 3.31 hours
8. b. {HHH, HHT, HTH, THH, TTT, TTH, THT, HTT}

4. Comilla Board 2017

Higher Mathematics
(Creative)Subject Code

1	2	6
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Full marks — 50

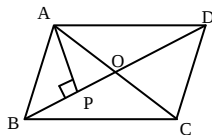
Time — 2 hours 35 minutes

[N.B. — The figures in the right margin indicate full marks. Answer **five** questions taking at least **one** from each Group.]**Group A — Algebra**

1. ► $f(x) = \frac{2x+3}{x-3}$; $x \neq 3$ is a function.
- Find the value of $f(a-1)$. 2
 - Find the inverse function of given function. 4
 - Show that the given function is one-one and onto. 4
2. ► $P(x) = 18x^3 + 15x^2 - x + a$, $Q(x) = x^3 + x^2 - 6x$ are two algebraic equation.
- Resolve into factors of $Q(x)$. 2
 - Find the value of a if $(3x + 2)$ is a factor of the polynomial $P(x)$. 4
 - Express the partial fractions of $\frac{x^2 + x - 1}{Q(x)}$. 4
3. ► Consider the following infinite series :
- $$1 + \frac{1}{1+3x} + \frac{1}{(1+3x)^2} + \frac{1}{(1+3x)^3} + \dots$$
- Find the common ratio of the obtained series when $x = 1$. 2
 - Find the sum of first 10 terms of the series obtained in $x = \frac{1}{3}$. 4
 - Find the condition which should be imposed on x , so that the given series with have a sum up to infinity. 4

Group B — Geometry and Vector

4. ►



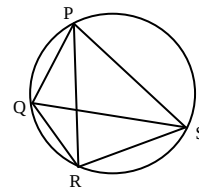
In figure, ABCD is a parallelogram.

- Find the orthogonal projection of AB and AD. 2
- Prove that, $AB^2 + AD^2 = 2(AO^2 + BO^2)$. 4
- Prove that, $AO = OC$ and $BO = OD$ with the help of vectors. 4

5. ► A(3, -6), B(-6, -2), C(-2, 6) and D(8, 4) are four points, their position on the same plane.

- Find the distance between B and C. 2
- If the distance of x-axis and the point A are equal from P(x, y), show that, $x^2 - 6x + 12y + 45 = 0$. 4
- Find the area of the quadrilateral ABCD taking the vertices in anti-clockwise order and find the perimeter of ABCD. 4

6. ►

In figure $PR = 10\text{cm}$ and $QS = 8\text{cm}$.

- Which theorem does support the given figure? Write that theorem. 2
- Prove that $PR \cdot QS = PQ \cdot RS + PS \cdot QR$. 4
- If PR and QS are the edges of two cubes, then find the ratio of the area of two cubes. 4

Group C — Trigonometry & Probability

7. ► $A = \sec\theta + \tan\theta$ and $B = \cos\left(-\frac{25\pi}{6}\right)$

- Find the value of B . 2
- If $A = x$, then show that, $\sin\theta = \frac{x^2 - 1}{x^2 + 1}$. 4
- Find the value of θ when $A = \sqrt{3}$ and $0 < \theta < 2\pi$. 4

8. ► A coin is tossed four times by Shoishab.

- What is the probability of getting an odd number or a number divisible by 2 in a single throw of a dice? 2
- Draw the probability tree and write down the sample space. 4
- What is the probability contains at least two heads and one tail? 4

Answers

1. a. $\frac{2a+1}{a-4}$ b. $\frac{3x+3}{x-2}$
 2. a. $\frac{x(x+3)(x-2)}{6x}$ b. -2
 c. $\frac{1}{2(x-2)} + \frac{1}{3(x+3)}$
 3. a. $\frac{1}{4}$ b. $\frac{1025}{512}$
 c. $x < \frac{-2}{3}$ or $x > 0$

4. a. BP; DP
 5. a. $4\sqrt{5}$ unit
 c. 99 sq. unit;
 40.17 unit (approx.)
 6. c. $25 : 16$
 7. a. $\frac{\sqrt{3}}{2}$ c. $\frac{\pi}{6}$
 8. a. 1 c. $\frac{5}{8}$

5. Chittagong Board 2017

Higher Mathematics (Creative)

Subject Code 1 2 6

Time — 2 hours 35 minutes

Full marks — 50

[N.B. — The figures in the right margin indicate full marks. Read the stems carefully and answer the associated questions. Answer any five questions taking at least one from each group.]

Group A — Algebra

1. ► $S = \{(x, y) : x^2 + y^2 + 6x + 8y + 9 = 0\}$ be a relation and
 $A = \{x : x \in \mathbb{N}, x \text{ is prime number and } x < 7\}$, $B = \{x : x \text{ is positive integer and } \sqrt{x} < 2\}$ are two sets.
 a. Express the set B in tabular method. 2
 b. Show that, $P(A) \cap P(B) = P(A \cap B)$ 4
 c. Draw the graph of the relation "S" and ascertain from the graph whether 'S' is a function or not. 4

2. ► $\frac{1}{3x+2} + \frac{1}{(3x+2)^2} + \frac{1}{(3x+2)^3} + \dots$ be a infinite geometric series and $px^2 + qx + r = 0$ be a quadratic equation in one variable, here p, q, r are the real numbers; $p \neq 0$
 a. Find the series when $x = 1$ and what is the common ratio of the obtain series? 2
 b. Impose a condition on 'x' under which the given series will have a sum up to infinity and find the sum. 4
 c. If 'a' and 'b' be the roots of this given equation, then show that $a + b = \frac{-q}{p}$ and $ab = \frac{r}{p}$ 4

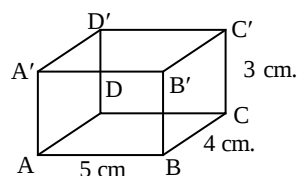
3. ► $a = \log_p(qr)$, $b = \log_q(rp)$, $c = \log_r(pq)$ and $F(x) = x^3 + 6x^2 + 11x + 6$.
 a. When $C = 2$, then show that, $r = \sqrt{pq}$ 2
 b. If $F(x)$ yields the same remainder upon division by $x - u$ and $x - v$ where $u \neq v$, show that, $u^2 + v^2 + uv + 6u + 6v + 11 = 0$. 4
 c. Prove that, $\frac{1}{a+1} + \frac{1}{b+1} + \frac{1}{c+1} = 1$. 4

Group B — Geometry and Vector

4. ► The perpendiculars AD, BE and CF from the vertices to the opposite sides of the acute angled triangle ABC meet at the point O.
 a. If $AC = 5$ cm, $CD = 3$ cm, then find the length of AD. 2
 b. Prove that, $AO \cdot OD = BO \cdot OE = CO \cdot OF$. 4
 c. Show that, $BC \cdot CD = AC \cdot CE$. 4
 5. ► P (8, 3), Q (3, 8) and R (-2, 3) are the three vertices of a triangle 'S' and 'T' be the middle points of the sides PQ and PR respectively.

- a. Find the slope of QR. 2
 b. Show that, ΔPQR is an isosceles triangle and its area is 25 square units. 4
 c. Prove with the help of vectors that, $ST \parallel QR$ and $ST = \frac{1}{2} QR$. 4

6. ►



- a. Find the volume of the solid mentioned in the diagram. 2
 b. The radii of three metal solid sphere is AB, BC and CC' respectively. A new solid sphere is formed by melting the three spheres. Determine the radius and whole surface area of new sphere. 4
 c. A rectangle of size of ABCD surface of the solid is revolved about the greater side. Find the volume and the total surface area of the solid formed. 4

Group C — Trigonometry & Probability

7. ► $\cot \theta + \operatorname{cosec} \theta = m$.
 a. Find the value of $\operatorname{cosec} \theta - \cot \theta$. 2
 b. If $m = 2$, then show that, $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1 + \sin \theta}{\cos \theta}$. 4
 c. If $m = \sqrt{3}$, then find the value of θ where $0 \leq \theta \leq 2\pi$ 4
 8. ► A bag contains 10 red (R), 5 black (B), 8 white (W) and 6 yellow (Y) marbles. A marble is chosen at random from the bag.
 a. What is random experiment? 2
 b. What is probability that the marble will be yellow or black? 4
 c. Show that the probability that the marble will be red or white or black is equal to the probability that the marble will not be yellow. 4

Answers	1. a. {1, 2, 3} c. not a function	6. a. 60 cubic cm b. 6 cm, 452.39 sq. cm (approx.)
	2. a. $\frac{1}{5} + \frac{1}{5^2} + \frac{1}{5^3} + \dots$; $\frac{1}{5}$ b. $x < -1$ or $x > \frac{-1}{3}$; $\frac{1}{3x+1}$	c. 226.1952 sq. cm (approx.); 251.328 cubic cm (approx.)
	4. a. 4cm	7. a. $\frac{1}{m}$ c. $\frac{\pi}{3}$
	5. a. 1	8. b. $\frac{11}{25}$

6. Sylhet Board 2017

Higher Mathematics
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Full marks — 50

Time — 2 hours 35 minutes

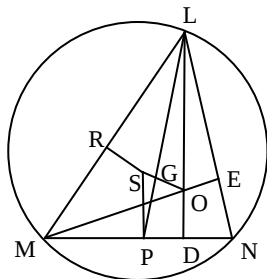
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Group A — Algebra

1. ► $f(x) = \sqrt{2x-3}$ is a function.
- If $f(x) = 1$, then determine the value of x . 2
 - Determine the Domain of $f(x)$ and show the function is one-one. 4
 - Determine the range of $f^{-1}(x)$. 4
2. ► $\frac{1}{3x-1} + \frac{1}{(3x-1)^2} + \frac{1}{(3x-1)^3} + \dots$
- If $x = 2$, then determine the common ratio of the series. 2
 - Determine the 7th term of the series and summation of first ten terms of the series when $x=1$. 4
 - Impose the condition on x so that the series will have an infinite sum and find that sum. 4
3. ► $A = p^2 - \frac{2}{33} - \frac{-2}{33} + 2$ and $f(x) = \ln(1+x)$; $x \geq 0$.
- Find $x : y$ when $(25)^x = (125)^y$. 2
 - If $A = 0$, then show that $3p^3 + 9p = 8$. 4
 - Draw the graph of $f(x)$ with description. 4

Group B — Geometry and Vector

4. ►



In the figure O is the orthocenter, S is the circumcenter, G is the centroid and LP is the median of the triangle LMN.

MN = a, LN = b, LM = c.

- If OL = 9 cm then determine the value of SP. 2
- Show that S, G, O are collinear. 4
- If $\angle N$ is an acute angle, prove that a. ND = b. NE 4

5. ► D, E and F are the middle points of BC, AB and AC respectively of $\triangle ABC$.

- Express vector $\overrightarrow{AB}$ in terms of $\overrightarrow{BF}$ and $\overrightarrow{CE}$. 2
 - Prove that, $EF \parallel BC$ and $EF = \frac{1}{2} BC$ by vector method. 4
 - If the vertices of triangle ABC are A (10,6), B (4,0), C (14,0) then by determining the area of $\triangle ABC$ and $\triangle AEF$ prove that $\triangle ABC : \triangle AEF = 4 : 1$. 4
6. ► The hypotenuse, $a = 5$ cm and the difference of another two sides is $d = 1$ cm of a right angled triangle.

- Determine the length of another two sides of the triangle. 2
- Draw the triangle with sign and description. 4
- Draw a circle whose diameter is equal to the hypotenuse and which passes through two fixed points. (Sign and description of construction should be given.) 4

Group C — Trigonometry & Probability

7. ► $f(x) = \sin x$
- Find the length of the arc which subtends an angle 60° at the centre of a circle with radius 5 cm. 2
 - If $a f(\theta) + b f\left(\frac{\pi}{2} - \theta\right) = c$, then prove that.

$$a f\left(\frac{\pi}{2} - \theta\right) - b f(\theta) = \pm \sqrt{a^2 + b^2 - c^2}.$$
 4
 - Solve : $f(x) + f\left(\frac{\pi}{2} - x\right) = \sqrt{2}$, where $0 \leq x \leq 2\pi$. 4
8. ► An unbiased dice and two unbiased coins are tossed at once.
- What do you mean by sample space and sample point? 2
 - Draw the probability tree of possible events and write down the sample space. 4
 - Determine, P (even number and 2H) + P (prime number and 2T). 4

Answers

1. a. 2 b. $\{x \in \mathbb{R} : x \geq \frac{3}{2}\}$; one - one
 c. $\{x \in \mathbb{R} : x \geq \frac{3}{2}\}$
2. a. $\frac{1}{5}$ b. $\frac{1}{2^7}, \frac{1023}{1024}$
 c. $x < 0$ or $x > \frac{2}{3}$; $\frac{1}{3x-2}$
3. a. 3 : 2

4. a. 4.5 cm
 5. a. $-\frac{4}{3} \overrightarrow{BF} - \frac{2}{3} \overrightarrow{CE}$
 6. a. 4 cm, 3 cm
 7. a. 5.236 cm (approx.) c. $\frac{\pi}{4}$
 8. c. $\frac{1}{4}$

7. Jessore Board 2017

Higher Mathematics (Creative)

Subject Code

1	2	6
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Time — 2 hours 35 minutes

Full marks — 50

[N.B. — The figures in the right margin indicate full marks of the questions. Read the stems carefully and answer the associated questions. Taking minimum one question from each group answer altogether five questions.]

Group A — Algebra

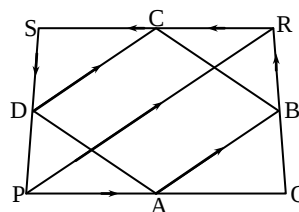
1. ▶ $f(x) = \frac{4x+3}{2x+5}$
 - a. Find the domain of $f(x)$. 2
 - b. Show that, $f(x)$ is one-one function. 4
 - c. If $f^{-1}(-2) = p \cdot f^{-1}(-3)$, find the value of p . 4
2. ▶ $P(x) = x^3 - 6x^2 + 11x - 6$.
 - a. Determine the ratio of degree and leading co-efficient of $P(x)$. 2
 - b. If the remainders of $P(x)$ upon division by $x - m$ and $x - n$ are same where $m \neq n$, then show that,
 $m^2 + mn + n^2 - 6m - 6n + 11 = 0$. 4
 - c. Express $\frac{x^3}{P(x)}$ as partial fractions. 4
3. ▶ $\frac{1}{2x+1} + \frac{1}{(2x+1)^2} + \frac{1}{(2x+1)^3} + \dots$
 - a. If $x = 3$, find the common ratio of the series. 2
 - b. If $x = -2$, find the 10th term of the series and sum of first 10 terms. 4
 - c. Impose a condition on x under which the series will have a sum up to infinity and find the sum. 4

Group B — Geometry and Vector

4. ▶ Three medians AD, BE and CF of $\triangle ABC$ intersect each other at G.
 - a. If $GD = 2\text{cm}$, find the length of AD. 2
 - b. Prove that, $AB^2 + BC^2 = 2(AE^2 + BE^2)$ 4
 - c. Prove that, $3(AB^2 + BC^2 + AC^2) = 4(AD^2 + BE^2 + CF^2)$. 4
5. ▶ Three vertices of the $\triangle ABC$ are respectively A (2, -4), B (-4, 4) and C (3, 3)
 - a. Find the equation of the straight line AB. 2
 - b. Show that, $\triangle ABC$ is a right angled and isosceles triangle. 4

- c. Find the radius of a circle whose area is equal to the area of $\triangle ABC$. 4

6. ▶



In the figure, A, B, C and D are the middle points of quadrilateral PQRS.

- a. Express $\vec{AB}$ in terms of $\vec{PQ}$ and $\vec{QR}$. 2
- b. Prove with the help of vectors that, the quadrilateral ABCD is a parallelogram. 4
- c. Prove with the help of vectors that, $AB \parallel PR$ and $AB = \frac{1}{2} PR$. 4

Group C — Trigonometry & Probability

7. ▶ $7\sin^2\theta + 3\cos^2\theta = P$.
 - a. If $\theta = \frac{\pi}{4}$, find the value of P . 2
 - b. If $P = 4$, prove that, $\cot\theta = \pm\sqrt{3}$ 4
 - c. If $P = 6$ and $0 < \theta < 2\pi$, find the possible value of θ . 4
8. ▶ 20 tickets are numbered serially from 11 to 30. The tickets are mixed thoroughly and one ticket is drawn at random.
 - a. What do you mean by mutually exclusive events? 2
 - b. Find the probability that the drawn is multiple of 2 and divisible by 3. 4
 - c. Show that, the probability of the drawn that is prime number or multiple of 7 is less than that of odd or divisible by 4. 4

Answers	1. a. $\nabla - \left\{ \frac{5}{2} \right\}$ c. $\frac{65}{72}$	4. a. 6cm
	2. a. 3 : 2 c. $1 + \frac{27}{2(x-3)} - \frac{8}{x-2} + \frac{1}{2(x-1)}$	5. a. $4x + 3y + 4 = 0$ c. 2.82 unit (approx.)
	3. a. $\frac{1}{7}$ b. $\frac{1}{3^{10}}, \frac{1-3^8}{4 \times 3^8}$	6. a. $\frac{1}{2}(\vec{PQ} + \vec{QR})$
	c. $x < -1$ or, $x > 0; \frac{1}{2x}$	7. a. 5 c. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$
		8. b. $\frac{1}{5}$

8. Barisal Board 2017

Higher Mathematics (Creative)

Subject Code

1	2	6
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Time — 2 hours 35 minutes

Full marks — 50

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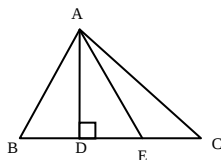
Group A — Algebra

1. ► $E = \{x : x \in \mathbb{V} \text{ and } x^2 - (a+b)x + ab = 0, a, b \in \mathbb{V}\}$,
 $F = \{3, 4\}$ and $G = \{4, 5, 6\}$
 a. Find the elements of the set E. 2
 b. Prove that, $P(F \cap G) = P(F) \cap P(G)$. 4
 c. Show that, $E \times (F \cup G) = (E \times F) \cup (E \times G)$. 4
 2. ► $f(x) = 18x^3 + 15x^2 - x + c$, $g(x) = x^2 - 4x - 7$
 and $h(x) = x^3 - x^2 - 10x - 8$ are three
 polynomials of variable x.
 a. Resolve $h(x)$ into factors. 2
 b. If $(3x + 2)$ is a factor of $f(x)$, find the value of c. 4
 c. Express $\frac{g(x)}{h(x)}$ as partial fractions. 4

3. ► $\sqrt[n]{a} = \sqrt[n]{b} = \sqrt[n]{c}$
 a. If $a = c$, show that, $x = z$. 2
 b. If $x = \frac{1}{2}$, $y = \frac{1}{3}$, show that, $\left(\frac{a}{b}\right)^{\frac{3}{2}} + \left(\frac{b}{a}\right)^{\frac{2}{3}} = a^{\frac{1}{2}} + b^{\frac{1}{3}}$. 4
 c. If $abc = 1$ prove that, $\frac{1}{p^{-x} + p^y + 1} + \frac{1}{p^{-y} + p^z + 1} + \frac{1}{p^{-z} + p^x + 1} = 1$. 4

Group B — Geometry and Vector

4. ►



- In the figure, $BD = ED = CE$ and $AD \perp BC$.
 a. If $DE = 2\text{cm}$. and $AD = 3\text{cm}$, find the length of AC. 2
 b. Prove that, $AB^2 + AC^2 = AD^2 + AE^2 + 4DE^2$. 4
 c. Prove that, $AC^2 = AB^2 + BC^2 - 2BC \cdot BD$. 4

5. ► A solid sphere of radius 9cm formed by melting three spherical balls of radii 6cm, 8cm and r cm exactly fits into a cylindrical box.

- a. Find the area of surface of the sphere of radius 6cm. 2
 b. Find the value of r. 4
 c. Find the volume of the unoccupied portion of the box. 4
 6. ► A (7, 2), B (-4, 2), C (-4, -3) and D (7, -3) are the four vertices of the quadrilateral ABCD.
 a. Find the equation of the line AB. 2
 b. If P (t, 2t) is equidistant from the points A and B, find the value of t. 4
 c. Show that, the quadrilateral ABCD is a rectangle. 4

Group C — Trigonometry & Probability

7. ► $A = x \cos \theta$ and $B = y \sin \theta$, where $0 < \theta < 2\pi$.
 a. Find the value of $\frac{A^2}{x^2} + \frac{B^2}{y^2}$. 2
 b. If $\frac{A}{x} + \frac{B}{y} = Z$, Prove that, $x \sin \theta - y \cos \theta = \pm \sqrt{x^2 + y^2 - z^2}$. 4
 c. If $x^2 = 3$, $y^2 = 7$ and $A^2 + B^2 = 4$, find the value of θ . 4
 8. ► The number of examinee answered the different number of questions in an examination are as follows :

Number of answered question	Number of examinee
1	5
2	45
3	150
4	500
5	800
6 or more	500

- A student is selected at random.
 a. What do you mean by sample space? 2
 b. What is the probability that the student answered at most questions? 4
 c. Show that, the probability of the student answered at most 5 questions is more than that of at least 6 questions. 4

Answers	1. a. a, b	
	2. a. $(x-4)(x+1)(x+2)$ b. -2	
	c. $\frac{5}{6(x+2)} + \frac{2}{5(x+1)} - \frac{7}{30(x-4)}$	
	4. a. 5 cm	
	5. a. 452.39 sq. cm. (approx.) b. 1 cm	
	c. 1526.818 cubic cm (approx.)	
	6. a. $y - 2 = 0$ b. $\frac{3}{2}$	
	7. a. 1 c. $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$	
	8. b. $\frac{7}{20}$	