



For CBSE Class 11  
Annual Exams

**MATHEMATICS (041)**

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**INDIRA AWARD WINNER**

**YTS-08**

☑ **General Instructions** : Same as given in YTS-01.

**SECTION A**

(Question numbers 01 to 20 carry 1 mark each.)

Followings are **multiple choice questions**. Select the correct option in each one of them.

01. Standard form of  $\frac{1-i}{1+i}$  equals  
 (a)  $i$  (b)  $-i$  (c)  $2+i$  (d)  $0-i$
02. Two different finite sets have  $m$  and  $n$  elements. The number of subsets of the first set is 112 more than that of the second set. The values of  $m$  and  $n$  are respectively  
 (a) 3, 7 (b) 7, 4 (c) 7, 2 (d) 7, 5
03. Equation of the line passing through the point (3, 4) and parallel to the line  $y = 2x - 5$  is  
 (a)  $y = 2x - 2$  (b)  $y = 2x + 2$  (c)  $y = 2 - 2x$  (d)  $x = 2y - 2$
04. If  $f(x) = \frac{|x-4|}{x-4}$  then,  $\lim_{x \rightarrow 4^+} f(x) =$   
 (a)  $-1$  (b)  $0$  (c)  $1$  (d) Does not exist
05. If  $|x| < 5$ , then  $x \in$   
 (a)  $[-5, 5]$  (b)  $(-5, 5)$  (c)  $x < -5$  or  $x > 5$  (d)  $(-\infty, \infty)$
06. If four digits odd number is to be formed using the digits 0, 1, 2, 3, 4 and 5 (without repetitions) then, the total number of ways this can be done is  
 (a) 192 (b) 256 (c) 540 (d) 144
07. The mean deviation about the median of the observations  $x_i : 1, 2, 3, 4, 5$  is  
 (a) 1.2 (b) 2.1 (c) 3.2 (d) 3
08. For the parabola  $y^2 = -4ax$ , the length of its latus-rectum is  
 (a)  $a$  (b)  $-4a$  (c)  $4a$  (d) 4
09. If  $f(x)$  is a signum function, then its range is  
 (a)  $\{-1, 1\}$  (b)  $(-1, 0, 1)$  (c) any Real number (d)  $\{-1, 0, 1\}$
10. If  $x+1 > -6+2x$ ,  $4-3x \leq -2$ , then  
 (a)  $x \in [2, 7]$  (b)  $x \in [2, 7)$  (c)  $x \in (2, 7)$  (d) No solutions
11. The mean of 10 observations is 4. If each observation is multiplied by 3, then new mean of the resulting observations, is  
 (a) 4 (b) 36 (c) 12 (d) 6
12. Let A and B be two events such that  $P(A) = 0.3$  and  $P(A \cup B) = 0.8$ .  
 If  $P(A \cap B) = P(A) \cdot P(B)$ , then  $P(B)$  is  
 (a)  $\frac{5}{7}$  (b)  $\frac{2}{7}$  (c)  $\frac{1}{7}$  (d)  $\frac{6}{7}$
13. After the expansion of  $(1+x)^9 + (1-x)^9$ , the no. of terms in this expansion will be  
 (a) 10 (b) 5 (c) 11 (d) 20
14. A box contains 1 red and 3 identical black balls. Two balls are drawn at random in succession without replacement. Then, the sample space for this experiment is  
 (a)  $\{RB\}$  (b)  $\{RB, BR\}$  (c)  $\{R, B, B, B\}$  (d)  $\{RB, BR, BB\}$

15.  $\lim_{x \rightarrow 0} \left[ \frac{\sqrt{9+x} - \sqrt{9}}{x} \right]$  is equal to  
 (a) 6 (b)  $\frac{1}{6}$  (c)  $\frac{1}{3}$  (d) 3
16. The minute hand of a clock is 49 cm long. How much distance does its tip move in 30 minutes?  
 (a) 22 cm (b) 1470 cm (c) 154 cm (d) 1078 cm
17. If  ${}^n C_x = {}^n C_y$ , then  
 (a)  $n = x$  (b)  $n = y$  (c)  $x + y = 2n$  (d)  $x = y$  or,  $x + y = n$
18. The distance between the points P(5, 6, 7) and Q(5, 6, 0) is  
 (a) 49 units (b) 7 units (c) 253 units (d) 29 units

Followings are **Assertion-Reason based questions**.

In the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**.

Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.  
 (b) Both A and R are true and R is not the correct explanation of A.  
 (c) A is true but R is false.  
 (d) A is false but R is true.
19. **Assertion (A)** : If  $\tan x = \frac{1}{2}$ ,  $x \in \left(0, \frac{\pi}{4}\right)$ , then  $\sin 2x = \frac{4}{5}$ .

**Reason (R)** :  $\sin 2x = \frac{2 \tan x}{1 - \tan^2 x}$ .

20. **Assertion (A)** : For 2, 8, 32, ..., the 9<sup>th</sup> term is  $2^{17}$ .  
**Reason (R)** : In a geometric progression, its  $n^{\text{th}}$  term is  $a_n = a r^{n-1}$ .

### SECTION B

(Question numbers 21 to 25 carry 2 marks each.)

21. For following sets, write set-builder form :

- (a)  $A = \{1, 7\}$   
 (b)  $B = \{2, 3, 5, 7, 11, 13\}$ .

Hence, write  $A \cap B$  and  $A - B$ .

**OR**

Given  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{2, 4, 6\}$  and  $C = \{3, 5, 7\}$ .

Let the set  $U = \{1, 2, 3, \dots, 9\}$  represents the corresponding universal set.

Find  $A' - (B \cup C)$ .

22. If the coefficients of  $(2n+1)^{\text{th}}$  and  $(4n+5)^{\text{th}}$  terms in the expansion of  $(1+x)^{10}$  are equal, then find the value of  $n$ .
23. Prove that the points A(0, -1, -7), B(2, 1, -9) and C(6, 5, -13) are collinear.
24. If  $n \in \mathbb{R}$ , then find the minimum value of the expression  $3^n + 3^{1-n}$ .

**OR**

Insert three numbers between 1 and 25 such that the resulting sequence forms an arithmetic progression.

25. Let  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 4\}$  and  $C = \{4, 5\}$ . Verify that  $A \times (B \cap C) = (A \times B) \cap (A \times C)$ .

### SECTION C

(Question numbers 26 to 31 carry 3 marks each.)

26. Let  $f(x) = x^2$  and  $g(x) = 2x + 1$  be two given real functions.

Find  $(f + g)(x)$ ,  $(f - g)(x)$ ,  $(f \cdot g)(x)$  and  $\left(\frac{f}{g}\right)(x)$ . Also write the condition on  $x$ , for which  $\left(\frac{f}{g}\right)(x)$  is defined.

27. Find the derivative of  $y = \frac{1 + \sin x}{1 + \cos x}$  with respect to  $x$ .

28. Find the image of the point  $(-8, 12)$  with respect to the line mirror  $4x + 7y + 13 = 0$ .

**OR**

Find the equation of the line (s) which passes through the point  $(3, 4)$  and cuts off intercepts on the coordinates axes such that their sum is 14.

29. Find the variance and standard deviation for the following data :  
45, 60, 62, 60, 50, 65, 58, 68, 44, 48.

30. Evaluate :  $\lim_{x \rightarrow 0} \frac{10^x - 5^x - 2^x + 1}{x \tan x}$ .

**OR**

Evaluate :  $\lim_{n \rightarrow \infty} \frac{1 + 2 + 3 + \dots + n}{n^2}$ .

31. Prove that  $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8} = \frac{3}{2}$ .

**OR**

If  $\cot \alpha \cot \beta = 2$ , then show that  $\frac{\cos(\alpha + \beta)}{\cos(\alpha - \beta)} = \frac{1}{3}$ .

## SECTION D

(Question numbers 32 to 35 carry 5 marks each.)

32. In how many ways can the letters of the word PERMUTATIONS be arranged if

(i) the words starts with P and end with S

(ii) the vowels are all together

(iii) there are always 4 letters between P and S?

33. Find the sum :  $7 + 77 + 777 + \dots$  to  $n$  terms.

**OR**

If  $a$  and  $b$  are the roots of  $x^2 - 3x + p = 0$  and  $c, d$  are roots of  $x^2 - 12x + q = 0$ , where  $a, b, c, d$  form a geometric progression. Prove that  $(q + p) : (q - p) = 17 : 15$ .

34. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10.

The probability that both will qualify the examination is 0.02.

Determine the probability that

(a) both Anil and Ashima will not qualify the examination.

(b) at least one of them will not qualify the examination.

(c) only one of them will qualify the examination.

**OR**

A fair coin is tossed four times. Write the sample space for this experiment.

If a person wins ₹1 for each head and lose ₹1.50 for each tail that turns up. From the sample space, calculate how many different amounts of money you can have after four tosses and the probability of having each of these amounts.

35. If  $\cos x = -\frac{1}{3}$  and  $x$  lies in III quadrant, then find the values of  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$ .

**SECTION E**

(Question numbers 36 to 38 carry 4 marks each.)

This section contains **three Case-study / Passage based questions.**

First two questions have **three sub-parts (i), (ii) and (iii) of marks 1, 1 and 2 respectively.**

Third question has **two sub-parts of 2 marks each.**

36. **CASE STUDY I :** Read the following passage and answer the questions given below.

A number in the form of  $x + iy$ , where  $x$  and  $y$  are real numbers, is defined to be a complex number. Here  $x$  and  $y$  are called the Real part and Imaginary part of the complex number  $x + iy$  respectively.

Additive inverse of the complex number  $x + iy$  is given by  $-x - iy$ ; whereas the conjugate of this complex number  $x + iy$  is given by  $x - iy$ . Further the modulus of complex number  $x + iy$  is  $\sqrt{x^2 + y^2}$ .

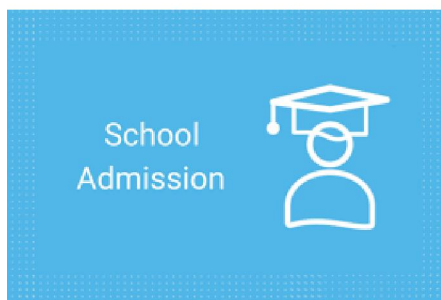
Also the multiplicative inverse of complex number  $x + iy$  is  $\frac{x - iy}{\sqrt{x^2 + y^2}}$ .

- (i) For  $z = -\sqrt{3} + 4\sqrt{3}i$ , write the Real and Imaginary parts.
- (ii) Find additive inverse of  $z$ , given in (i).
- (iii) Write the multiplicative inverse of the complex number  $z = -\sqrt{3} + 4\sqrt{3}i$ .

**OR**

- (iii) Determine the conjugate of complex number  $z = 4\sqrt{3} + 3i$  and its modulus.

37. **CASE STUDY II :** Read the following passage and answer the questions given below.



In a city school during the admission to class XI, 18 students took English, 23 students took Hindi and 24 students took Sanskrit.

Of these, 13 took both Hindi and Sanskrit, 12 took both English and Hindi and 11 took both English and Sanskrit.

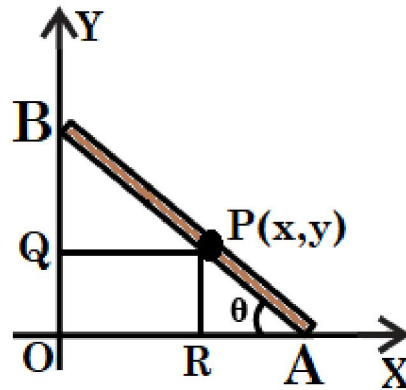
Due to the request made by some students, the school authorities decided that 6 students will be offered all the three languages.

- (i) Let A, B and C denote the set of students who took English, Hindi and Sanskrit respectively. Using venn diagram, find the total number of students who have only Hindi but neither English nor Sanskrit.
- (ii) Find the total number of students who took admission in class XI.
- (iii) How many students took Sanskrit but not Hindi? How many students took exactly one of the three subjects?

**OR**

- (iii) How many students took exactly two of the three subjects? How many students took Hindi but not Sanskrit?

38. CASE STUDY III : Read the following passage and answer the questions given below.



A rod AB of length 15 cm rests in between two walls (represented by the coordinate axes in the above diagram) in such a way that the end point A lies on x-axis and end point B lies on y-axis. A point P(x, y) is taken on the rod in such a way that AP = 6 cm . Also  $\angle OAB = \theta$  .

- (i) If  $PQ \perp OY$  and  $PR \perp OX$ , then find the value of  $\cos \theta$  in  $\Delta PBQ$  and  $\sin \theta$  in  $\Delta PRA$  .
- (ii) Determine the equation of the locus of the point P on the rod. Write the name of the curve obtained.

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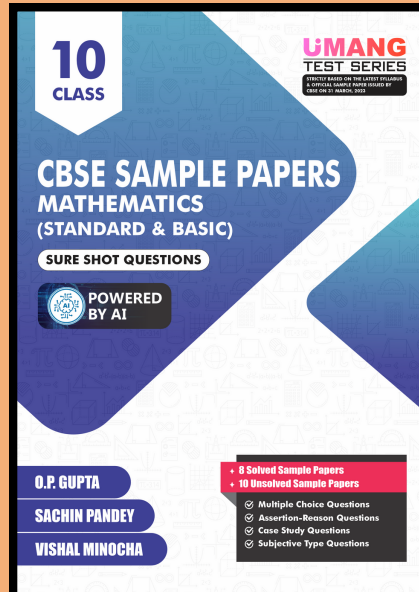
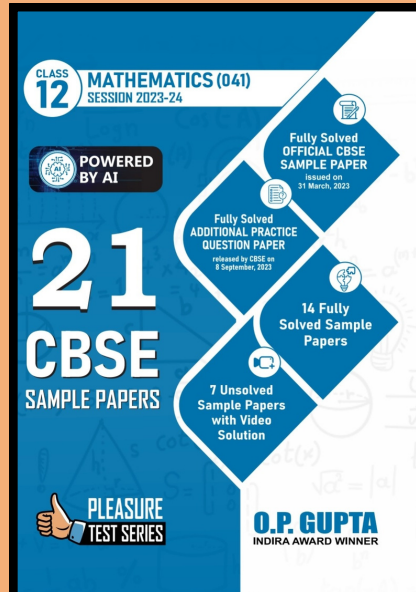
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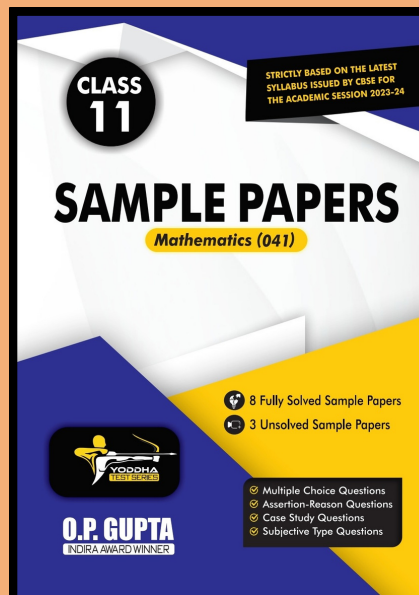
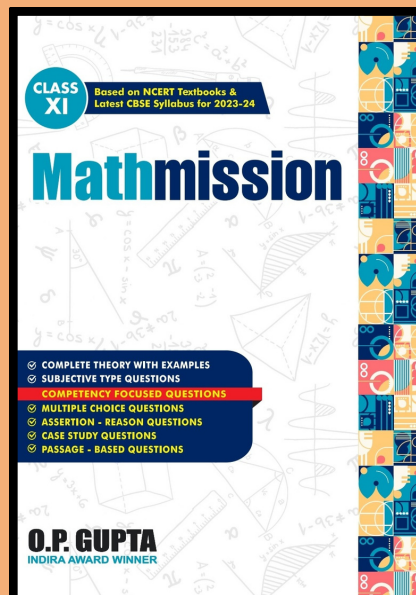
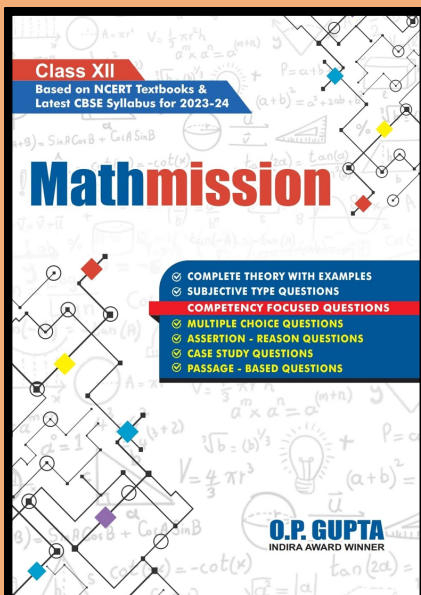
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