



**D.A.V. PUBLIC SCHOOLS, JHARKHAND ZONE - J**  
**HALF-YEARLY EXAMINATION**  
**(SESSION: 2026-2027)**

**Class: XI**

**Max. Marks: 80**

**Subject: MATHEMATICS (041)**

**Time Allowed: 3 Hrs.**

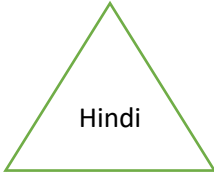
**General Instructions:**

- 1) All questions are compulsory.
- 2) The question paper contains 38 questions divided into FIVE sections – A, B, C, D and E.
- 3) Against each question the weightage of the question has been indicated.
- 4) Section B, C and D comprise of Very Short Answer type, Short Answer type and Long Answer type questions respectively. Section E contains Case – Based questions.
- 5) Section A has 18 MCQs and 2 A-R based questions whose correct answer option is to be written.
- 6) For A-R (Assertion – Reason) based question select the answer from the codes (A), (B), (C) and (D) as given below:
  - (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
  - (B) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion.
  - (C) Assertion is true, but Reason is false.
  - (D) Assertion is false, but Reason is true.
- 7) Use of calculator or any electronic/ digital device is not allowed.

| Q. No. | Section – A (20 x 1 = 20 Marks)                                                                                                                                                                                                                                  | Marks |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1      | If fourth term of a G.P. is 3 then the product of its first seven terms is<br>(A) $3^4$ (B) $3^7$ (C) $7^4$ (D) $4^7$                                                                                                                                            | 1     |
| 2      | If $A \subset B$ then $A - B =$<br>(A) $\phi$ (B) $A$ (C) $B$ (D) $\phi'$                                                                                                                                                                                        | 1     |
| 3      | Two finite sets have $m$ and $n$ elements. The number of elements in the Power set of the first set is 48 more than the total number of elements in Power set of the second set. The values of $m$ and $n$ , respectively are<br>(A) 7,6 (B) 6,3 (C) 6,4 (D) 7,4 | 1     |
| 4      | If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$ then $\tan(2A + B)$ is equal to<br>(A) 1 (B) 2 (C) 3 (D) 4                                                                                                                                                  | 1     |
| 5      | Solution of $\frac{1}{x-2} \leq 1$ is<br>(A) $[3, \infty)$ (B) $(-\infty, 2)$ (C) $(-\infty, 2) \cup [3, \infty)$ (D) $(-\infty, 2) \cup (3, \infty)$                                                                                                            | 1     |
| 6      | $ x - 1  > 5 \Rightarrow$<br>(A) $x \in (-4, 6)$ (B) $x \in [-4, 6]$<br>(C) $x \in (-\infty, -4) \cup (6, \infty)$ (D) $x \in (-\infty, -4) \cup [6, \infty)$                                                                                                    | 1     |
| 7      | If $\{x\} \in A$ , then<br>(A) $\{x\} \subset P(A)$ (B) $\{\{x\}\} \in P(A)$<br>(C) $\{\{x\}\} \subset P(A)$ (D) $\{\{\{x\}\}\} \notin P(A)$                                                                                                                     | 1     |
| 8      | If $A = \{x : x^2 - 5x + 6 = 0\}$ , $B = \{2, 4\}$ , $C = \{4, 5\}$ then $A \times (B \cap C)$ is<br>(A) $\{(2, 4), (3, 4)\}$ (B) $\{(4, 2), (4, 3)\}$<br>(C) $\{(2, 4), (3, 4), (4, 4)\}$ (D) $\{(2, 2), (3, 3), (4, 4), (5, 5)\}$                              | 1     |
| 9      | The domain and range of the real function $f$ defined as $f(x) = \frac{4-x}{x-4}$ are respectively<br>(A) $R$ and $\{-1, 1\}$ (B) $R - \{4\}$ and $R$<br>(C) $R - \{-4\}$ and $R$ (D) $R - \{4\}$ and $\{-1\}$                                                   | 1     |

|                                                                                                    |                                                                                                                                                                                                                                                                               |   |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 10                                                                                                 | A relation $R$ is defined from $\{2,3,4,5\}$ to $\{3,6,7,10\}$ by $xRy \Leftrightarrow x$ is relatively prime to $y$ . The domain of $R$ is<br>(A) $\{2,3,5\}$ (B) $\{3,5\}$ (C) $\{2,3,4\}$ (D) $\{2,3,4,5\}$                                                                | 1 |
| 11                                                                                                 | The value of $3i^{34} + 5i^{27} - 2i^{38} + 5i^{41}$ is<br>(A) 1 (B) $-1$ (C) $-4i$ (D) $10i$                                                                                                                                                                                 | 1 |
| 12                                                                                                 | If $z = (3i - 1)^2$ then $ z  =$<br>(A) 8 (B) 10 (C) 4 (D) $\sqrt{10}$                                                                                                                                                                                                        | 1 |
| 13                                                                                                 | The multiplicative inverse of $(-2 + 5i)$<br>(A) $\frac{-2}{29} + \frac{5}{29}i$ (B) $\frac{2}{29} - \frac{5}{29}i$ (C) $\frac{-2}{29} - \frac{5}{29}i$ (D) $\frac{2}{29} + \frac{5}{29}i$                                                                                    | 1 |
| 14                                                                                                 | If $a, b, c$ are in G.P. ; $x$ and $y$ are A.M. between $a, b$ and $b, c$ respectively, then<br>(A) $\frac{1}{x} + \frac{1}{y} = 2$ (B) $\frac{1}{x} + \frac{1}{y} = \frac{1}{2}$ (C) $\frac{1}{x} + \frac{1}{y} = \frac{2}{a}$ (D) $\frac{1}{x} + \frac{1}{y} = \frac{2}{b}$ | 1 |
| 15                                                                                                 | In a G.P. if the $(m + n)^{th}$ term is $p$ and $(m - n)^{th}$ term is $q$ , then its $m^{th}$ term is<br>(A) 0 (B) $pq$ (C) $\sqrt{pq}$ (D) $\frac{1}{2}(p + q)$                                                                                                             | 1 |
| 16                                                                                                 | If $\cos^2\left(x + \frac{\pi}{3}\right) - \sin^2\left(\frac{\pi}{3} - x\right) = k \cos 2x$ then the value of $k$ is<br>(A) $\frac{1}{2}$ (B) $\frac{-1}{2}$ (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{-\sqrt{3}}{2}$                                                              | 1 |
| 17                                                                                                 | If $\frac{\sin x}{1 + \cos x} =$<br>(A) $\tan \frac{x}{2}$ (B) $\cot \frac{x}{2}$ (C) $\tan\left(\frac{\pi}{4}\right)$ (D) $\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)$                                                                                                     | 1 |
| 18                                                                                                 | The value of $\cot 1305^\circ$ is equal to<br>(A) 1 (B) $-1$ (C) $\sqrt{3}$ (D) $\frac{1}{\sqrt{3}}$                                                                                                                                                                          | 1 |
| 19                                                                                                 | <b>Assertion:</b> Let $R$ be a relation from a set $A$ to the set $B$ . Then domain of the relation $R$ is equal to the set $A$<br><b>Reason:</b> Domain of a relation from $A$ to $B$ is the set containing all elements of $A$ .                                            | 1 |
| 20                                                                                                 | <b>Assertion:</b> The sequence 4,12,36,108, ..... is a G.P.<br><b>Reason:</b> The sequence $a_1, a_2, a_3, a_4, \dots$ is a G.P. if and only if<br>$\frac{a_1}{a_2} = \frac{a_2}{a_3} = \frac{a_3}{a_4}$                                                                      | 1 |
| <b>Section – B (<math>5 \times 2 = 10</math> Marks)</b><br><b>Very Short Answer type questions</b> |                                                                                                                                                                                                                                                                               |   |
| 21                                                                                                 | For two sets $A$ and $B$ , assume that $P(A) = P(B)$ . Prove that $A = B$<br><b>OR</b><br>Show that if $A \subset B$ then $(C - B) \subset (C - A)$                                                                                                                           | 2 |
| 22                                                                                                 | Solve: $\frac{x-2}{x-3} \geq 2$                                                                                                                                                                                                                                               | 2 |
| 23                                                                                                 | Evaluate: $\cos^2 \frac{\pi}{8} + \cos^2 \frac{3\pi}{8} + \cos^2 \frac{5\pi}{8} + \cos^2 \frac{7\pi}{8}$<br><b>OR</b><br>Prove that: $\frac{\sin x - \sin 3x}{\sin^2 x - \cos^2 x} = 2 \sin x$                                                                                | 2 |
| 24                                                                                                 | A train is moving on a circular curve of radius 1500 metre at the rate of 66 km / hr. Through what angle it turned in 10 seconds.                                                                                                                                             | 2 |

|                                                                              |                                                                                                                                                                                                                                                                                                                                                                                       |   |
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| 25                                                                           | Using geometric series convert $0.\overline{235}$ into proper fraction.                                                                                                                                                                                                                                                                                                               | 2 |
| <b>Section – C ( 6 × 3 = 18 Marks)</b><br><b>Short Answer type questions</b> |                                                                                                                                                                                                                                                                                                                                                                                       |   |
| 26                                                                           | Prove that: $\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$                                                                                                                                                                                                                                                                                           | 3 |
| 27                                                                           | Sum the following series up to $n$ terms<br>$0 \cdot 3 + 0 \cdot 33 + 0 \cdot 333 + 0 \cdot 3333 + \dots$<br><b>OR</b><br>If $a, b, c$ are in G.P. then show that $a^2 + b^2$ , $ab + bc$ , $b^2 + c^2$ is also in G.P.                                                                                                                                                               | 3 |
| 28                                                                           | Draw the graph of $f(x) = \operatorname{cosec} x$ in the interval $(-\pi, \pi)$                                                                                                                                                                                                                                                                                                       | 3 |
| 29                                                                           | A man wants to cut three lengths from a single piece of plyboard of length 91 cm. The second length is to be 3 cm. longer than the shortest length of the pieces and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest board if the third piece is to be at least 5 cm. longer than the second.                                  | 3 |
| 30                                                                           | Let $f = \{(1,1), (2,3), (0,-1), (-1,-3)\}$ be a function from $Z$ to $Z$ defined by $f(x) = b - ax$ , for some integers $a$ and $b$ . Determine values of $a$ and $b$ .<br><b>OR</b><br>Let $R$ be a relation on $N$ defined by $R = \{(x, y): x + 3y = 12; x, y \in N\}$ .<br>(i) Write $R$ in the roster form.<br>(ii) Write the domain of $R$ .<br>(iii) Write the range of $R$ . | 3 |
| 31                                                                           | Using properties of sets, for any non – empty sets $A, B$ and $C$ prove that<br>$A - (B - C) = (A - B) \cup (A \cap C)$                                                                                                                                                                                                                                                               | 3 |
| <b>Section – D ( 4 × 5 = 20 Marks)</b><br><b>Long Answer type questions</b>  |                                                                                                                                                                                                                                                                                                                                                                                       |   |
| 32                                                                           | Three numbers are in G.P. whose sum is 70. If extremes be each multiplied by 4 and the means by 5, they will be in A.P. Find the numbers.                                                                                                                                                                                                                                             | 5 |
| 33                                                                           | If $a + ib = \frac{(x+1)^2}{2x^2+1}$ , prove that $a^2 + b^2 = \frac{(x^2+1)^2}{(2x^2+1)^2}$<br><b>OR</b><br>If $\alpha$ and $\beta$ are different complex numbers with $ \beta  = 1$ , then find $\left  \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right $                                                                                                                       | 5 |
| 34                                                                           | Find the domain and range of $f(x) = \sqrt{9 - x^2}$                                                                                                                                                                                                                                                                                                                                  | 5 |
| 35                                                                           | Prove that $\sin 10^\circ \sin 50^\circ \sin 60^\circ \sin 70^\circ = \frac{\sqrt{3}}{16}$<br><b>OR</b><br>If $\cos x = \frac{-3}{5}$ , $\frac{\pi}{2} < x < \pi$ , find the values of $\sin \frac{x}{2}$ and $\tan \frac{x}{2}$ .                                                                                                                                                    | 3 |

|    | <p align="center"><b>Section – E (<math>3 \times 4 = 12</math> Marks)</b></p> <p align="center"><b>Case – Based Questions</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |
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| 36 | <p>In a simulation, a computer virus spreads that each infected computer infects 4 more computers every hour. If only one computer is initially infected and the infection is tracked for 6 hours then</p> <p>(i) Write the sequence in which the number of computers are infected in the first four hours.<br/>Also mention what type of sequence is it?</p> <p>(ii) How many computers will be infected at the end of 6 hours?</p> <p>(iii) What is the total number of infected computers after 6 hours?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>1</p> <p>1</p> <p>2</p> |
| 37 | <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>English</p> </div> <div style="text-align: center;">  <p>Hindi</p> </div> <div style="text-align: center;">  <p>Sanskrit</p> </div> </div> <p>In a school there are students who have opted English and Sanskrit but not Hindi; some have opted English and Hindi but not Sanskrit. If the circle represents set of those students who have opted English; the triangle for set of students who have opted Hindi and the rectangle for Sanskrit then</p> <p>(i) Represent the above situation by a diagram to represent relation between the mentioned sets. The diagram to be draw using circle, triangle and square.</p> <p>(ii) If all students who have opted Hindi also have opted English then write the relation between the sets alongwith the diagram ; considering the number of students opting for English is more than those of Hindi.</p> <p>(iii) Out of 150 students in the school if 65 have opted for French, 80 have opted for English and 26 opted both French and English, find how many students opted neither French nor English.</p> | <p>1</p> <p>1</p> <p>2</p> |
| 38 | <div style="display: flex; justify-content: space-around;">   </div> <p>Students of a class went to a park for an educational trip. There they found a rope tied to the top of a pole with the ground. The teacher asked students to measure the angle the rope is making with the ground and also to measure the length of the rope and height of the pole. The distance between the pole and the rope tied at the point on the ground is <math>5\sqrt{2}</math> m.</p> <p>(i) If the angle between the rope and the ground is <math>75^\circ</math>, find the value of <math>\tan 75^\circ</math></p> <p>(ii) Find the length of the rope.    <b>OR</b>    Find the height of the pole.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>2</p> <p>2</p>          |