

Guidelines for CBSE Proficiency Test in Mathematics – 2011

This document provides some general guidelines for the CBSE Proficiency Test in Mathematics to be held in May-June, 2011. It aims to introduce the test to interested students and explains the format of the question paper.

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General information

- The CBSE Proficiency Test in Mathematics aims to test higher level competencies in the subject which include
 - knowledge of concepts/principles and techniques of mathematics,
 - ability to solve problems requiring the application and interconnection of the above knowledge,
 - ability to apply the above knowledge to analyse relevant daily life situations and draw appropriate inferences,
 - ability to solve problems requiring numerical data-interpretation, graphical interpretation, etc., and
 - ability to reason mathematically.
- The content level will be defined by the prescribed CBSE Class IX and Class X syllabus. The recommended textbooks for this content are NCERT Mathematics textbooks for classes IX and X.
- The questions in the test will not be based merely on recall of information given in the textbooks, and several of them may be unconventional.
- The maximum marks for the test will be 100 and the test will have a duration of two and half hours.
- The question paper will be fully objective in nature; answers will be machine-gradable. The paper will consist of multiple choice questions (MCQs), numerical questions and column matching questions as illustrated by the sample questions given below. There will be negative marking for wrong answers to the multiple choice questions only.
- The total number of questions is NOT indicated by the number of questions in the sample given here.
- The distribution of marks among different types of questions is NOT indicated by the number of questions of each type in the sample given here.

PROFICIENCY TEST IN MATHEMATICS (Sample questions)

This is a sample question paper. It illustrates the different types of questions to be expected in the actual Proficiency Test in Mathematics and the methods of indicating the answers on the Answersheet. It DOES NOT reflect the distribution of marks among different types or the total number of questions in the actual test.

General Instructions

- All questions are compulsory.
- The questions are divided into three sections:
 1. **Section I:** Questions 1 to 11 are **Multiple Choice Questions**. Each multiple choice question has four options out of which only ONE option is correct. Each correct answer earns a credit of 3 marks. **A wrong answer carries a penalty of –1 mark.**
 2. **Section II:** Questions 12 to 15 are **Numerical Questions**. Each correct answer earns a credit of 5 marks. There is no negative marking for these questions.
 3. **Section III:** Questions 16 to 17 are **Column-matching Questions**. In these questions, there are 3 items in the left column (Column I) and 5 options in the right column (Column II). You have to match each item in Column I with ALL the correct options in Column II. For each item in Column I, you earn 2 marks if all correct matches in Column II are indicated, and no incorrect matches are indicated. There is no negative marking for these questions.
- For all types, an unanswered question earns no mark.

Instructions for writing on the Answersheet

- Use an HB pencil to fill the Answersheet. DO NOT USE A PEN.
- If you want to change an entry after filling a bubble, erase the filled bubble cleanly and fill in the new bubble of your choice.
- Apart from filling in bubbles for answers and roll number, do not write anything else on the Answersheet. You will be provided extra space in the question paper for rough work.
- Roll Number: The following example illustrates the correct way of writing your Roll Number.

Example:

Suppose your roll number is **2093184**.

Write it out in the box provided at the top of the grid in the Answersheet. Then for every digit in the roll number, fill in the appropriate bubble in the corresponding column, as shown.

Roll Number

2	0	9	3	1	8	4
0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9

Instructions for writing on the Answersheet (contd.)

- Multiple Choice Questions: The following example illustrates the correct way of answering a Multiple Choice Question.

Example:

6. If $2x - 3 = 1$ then x equals
 (A) 1 (B) 2 (C) -1 (D) -2

Answer: The answer to this question is option (B). You have to mark it on the Answersheet as shown.

6. A B C D
 ○ ● ○ ○

- Numerical Questions: The following example illustrates the correct way of answering a Numerical Question.

Example:

14. What is the sum of the first 9 natural numbers?

Answer: The answer is 45. You have to indicate the answer by filling the bubble containing “5” in the right column, and the bubble containing “4” in the left column of the grid in the Answersheet, as shown.

14.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Note: The answer to every Numerical Question is an integer between 0 and 99. If the answer is a single digit, for example, 5, enter it as “05”.

- Column-matching Questions: The following example illustrates the correct way of answering a Column-matching question.

Example:

16. Column I below lists three categories of numbers. Column II lists some numbers. For each item in Column I, match ALL the correct options in Column II.

Column I

- (i) Even number
- (ii) Odd number
- (iii) Square of a natural number

Column II

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) 5

Answer: The correct matches for this question are:

- (i): (B), (D)
- (ii): (A), (C), (E)
- (iii): (A), (D)

You have to indicate the answer as shown.

16.

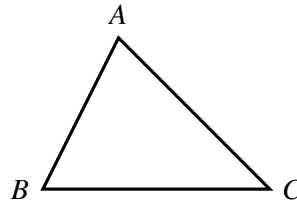
	A	B	C	D	E
i	○	●	○	●	○
ii	●	○	●	○	●
iii	●	○	○	●	○

Section I: Multiple Choice questions

This section contains 11 questions.

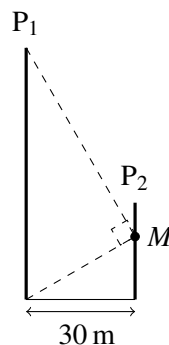
For questions 1 to 11 only one of the four options is correct. You have to indicate your answer by filling the appropriate bubble in the Answersheet. A correct answer will earn 3 marks, a wrong answer will earn (-1) mark, and an unattempted question will earn 0 mark.

1. Three villages A , B and C form a scalene triangle on flat land (see figure below). A well needs to be constructed on the same flat land in such a way that it is equidistant from the three villages.



The well should be built at

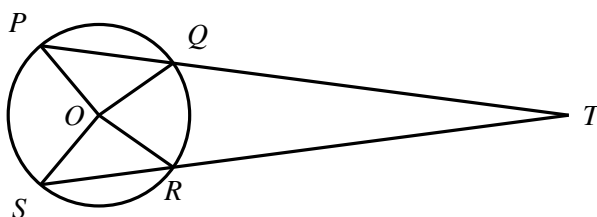
- (A) the incentre of $\triangle ABC$.
(B) the centroid of $\triangle ABC$.
(C) the circumcentre of $\triangle ABC$.
(D) the orthocentre of $\triangle ABC$.
2. In a game, a number is chosen at random from the set $\{1, 2, 3, \dots, 28, 29, 30\}$. What is the probability that the number chosen is a product of exactly two different prime numbers?
(A) $\frac{7}{30}$ (B) $\frac{1}{6}$ (C) $\frac{4}{15}$ (D) $\frac{1}{5}$
3. Two vertical poles P_1 and P_2 stand 30 metres apart on the ground (see figure below). M is a point on pole P_2 such that the two ends of pole P_1 subtend a right angle at the point M and the angle of elevation of the top of pole P_1 from the point M is 60° .



The height of the pole P_1 , in metres, is

- (A) $20\sqrt{3}$ (B) $40\sqrt{3}$ (C) $60\sqrt{3}$ (D) $120\sqrt{3}$
4. In the coordinate plane, $\triangle ABC$ has vertices $A(0, 0)$, $B(8, -2)$ and $C(8, 10)$. Point D lies on BC , such that $BD : DC = 5 : 7$. What is the area of $\triangle ADC$?
(A) 28 (B) 32 (C) 36 (D) 40

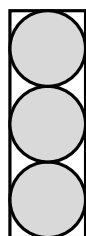
5. P, Q, R and S are four points on a circle with centre O (see figure below). PQ and SR intersect at the point T outside the circle.



If $\angle POS = 100^\circ$ and $\angle ROQ = 70^\circ$ then $\angle PTS$ is equal to

- (A) 20° (B) 25° (C) 15° (D) 18°

6. A cylindrical tennis ball container contains three balls stacked on one another, such that they touch the wall of the container (see figure below). The top and bottom balls also touch the lid and the base of the container respectively.



If the volume of a tennis ball is 160 cm^3 , then what is the volume of the container?

- (A) 720 cm^3 (B) 840 cm^3 (C) 1440 cm^3 (D) 480 cm^3

7. The sum of all the numbers between 1 and 1000, which are divisible by 5 but not by 2 is

- (A) 101100 (B) 50000 (C) 50050 (D) 10100

8. In $\triangle ABC$, $\angle A = 25^\circ$, $\angle B = 35^\circ$, and $AB = 16$ units. In $\triangle PQR$, $\angle P = 35^\circ$, $\angle Q = 120^\circ$, and $PR = 4$ units. Which of the following is true?

- (A) $\text{Area}(\triangle ABC) = 2 \text{ Area}(\triangle PQR)$
 (B) $\text{Area}(\triangle ABC) = 4 \text{ Area}(\triangle PQR)$
 (C) $\text{Area}(\triangle ABC) = 8 \text{ Area}(\triangle PQR)$
 (D) $\text{Area}(\triangle ABC) = 16 \text{ Area}(\triangle PQR)$

9. A quadratic polynomial, $f(x)$, is such that:

$$f(x) > 0, \text{ for } -3 < x < 2$$

$$\leq 0, \text{ otherwise}$$

Which of the following can be the polynomial $f(x)$?

- (A) $-x^2 - x - 6$
 (B) $-x^2 + x + 6$
 (C) $-x^2 + x - 6$
 (D) $-x^2 - x + 6$

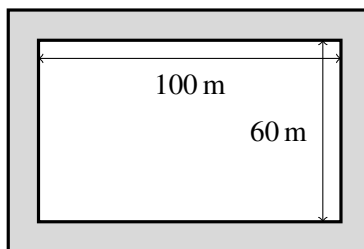
10. An arithmetic progression is such that the sum of the first 8 numbers is -100 and the common difference is 1. For which n would the sum of the first n numbers be -100 again?
 (A) 24 (B) 25 (C) 30 (D) There is no such $n \neq 8$
11. The sum to 100 terms of $(1 - 2 + 3 - 4 + 5 - \dots)$ is:
 (A) -50 (B) -500 (C) -100 (D) -1000

Section II: Numerical questions

This section contains 4 questions.

For questions 12 to 15 the answer is an integer between 0 and 99. You have to indicate the answer by filling bubbles in the appropriate grid provided in the Answersheet. Each question carries 5 marks.

12. A rectangular plot of land is 100 m by 60 m (see figure below). It has a grass-bed of equal width all around it on the boundary (shaded area in the figure). The area of the grass-bed is $\frac{3}{5}$ th of the area of the plot. What is the width of the grass-bed in metres?



13. A shoe shop keeps a record of the number of pairs of shoes sold daily. The record of actual sales for a week (Monday to Sunday) was lost. The manager could only get the following table which showed how much the sale had increased or decreased over the previous day's sale:

Mon	Tue	Wed	Thu	Fri	Sat	Sun
+1	+1	+2	-11	+7	-7	0

If a is the mean of daily sale for the week and b is the mode of daily sale for the week, then what is the value of $a - b$?

14. The annual salary of Mr. Nair for the year 2010 is Rs. 40,000. Every year his salary increases by Rs. 4,000. At the beginning of the year 2010 he had borrowed a sum of Rs. 44,000 from a bank. Given the following information determine the number of years he will take to repay the principal and the interest to the bank.
 (a) The interest due for payment is Rs. 3,600 at the end of the year 2010 and increases by Rs. 800 every year thereafter
and
 (b) each year he is going to pay the bank 20% of his annual income towards loan repayment.
15. From a point A on a straight road the angle of elevation of the top of a vertical tower situated on the roof of a vertical building on the same road is θ . The angle of elevation of the bottom of the tower from a point B on the road is again θ . The height of the building is 50 metres. If $AB : BY$ is 2 : 5, where Y is the base of the building, what is the height of the tower?

Section III: Column-matching questions

This section contains 2 questions.

*For questions 16 to 17 you have to match the options in Column II for each item in Column I. You have to indicate the matches by filling bubbles in the appropriate grid provided in the Answersheet. If **all correct options are matched, and no incorrect option is matched**, each item in Column I earns 2 marks.*

- 16.** Column I lists certain geometric shapes and Column II describes certain properties of geometric shapes. For each item in Column I, choose ALL the correct options in Column II.

Column I

- (i) Parallelogram
- (ii) Rhombus
- (iii) Rectangle

Column II

- (A) Diagonals bisect each other.
- (B) Diagonals are perpendicular to each other.
- (C) The figure includes at least one pair of equal sides.
- (D) A circle drawn through any three vertices always passes through the fourth vertex.
- (E) the pair of lines obtained by joining the mid-points of the opposite sides are always perpendicular to each other.

- 17.** Consider the equation $3(a_1x + b_1y - c_1)^2 + 2(a_2x + b_2y - c_2)^2 = 0$ in real variables x and y , where $a_1, a_2, b_1, b_2, c_1, c_2$ are non-zero real numbers. For each item in Column I, choose ALL the correct options in Column II.

Column I

- (i) Unique solution
- (ii) No solution
- (iii) Infinitely many solutions

Column II

- (A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.
- (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.
- (C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$.
- (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2}$.
- (E) $a_2^2b_1^2 + a_1^2b_2^2 > 2a_1a_2b_1b_2$.

END OF QUESTIONS

PROFICIENCY TEST IN MATHEMATICS

ANSWER SHEET (for sample questions)

This is a sample Answersheet designed for marking the answers to the sample questions given earlier in this document. The actual Answersheet provided in the Proficiency Test may look different.

Instructions:

1. Use an HB pencil to fill this sheet. **DO NOT USE A PEN.**
2. Refer to the instructions on the question paper for filling in your roll number and the answers to the questions.
3. If you want to change an answer after filling a bubble, erase the filled bubble cleanly and fill in the new bubble of your choice.
4. Apart from filling in bubbles for answers and roll number, do not write anything else on the Answersheet.
5. Take extra care to ensure that your Roll Number is correctly filled out in the grid.

Roll Number

0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9

A B C D

1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

13.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

14.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

15.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

16.

	A	B	C	D	E
i	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ii	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
iii	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17.

	A	B	C	D	E
i	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ii	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
iii	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Solutions to sample questions

1. C
2. A
3. B
4. A
5. C
6. A
7. B
8. D
9. D
10. B
11. A
12. 10
13. 5
14. 10
15. 20
16.
 - i. A C
 - ii. A B C
 - iii. A C D E
17.
 - i. A E
 - ii. C
 - iii. B