रोल नं.
Roll No.

| नोट | | NOTE | |
|---|---|---|---|
| (I) | कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं । | (I) | Please check that this question paper contains **11** printed pages. |
| (II) | प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें । | (II) | Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate. |
| (III) | कृपया जाँच कर लें कि इस प्रश्न-पत्र में **14** प्रश्न हैं । | (III) | Please check that this question paper contains **14** questions. |
| (IV) | कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें । | (IV) | **Please write down the serial number of the question in the answer-book before attempting it.** |
| (V) | इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे । | (V) | 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period. |

# गणित (मानक)
# MATHEMATICS (STANDARD)

निर्धारित समय : 2 घण्टे
Time allowed : 2 hours

अधिकतम अंक : 40
Maximum Marks : 40

*सामान्य निर्देश :*

*निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :*

(i) इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । सभी प्रश्न अनिवार्य हैं ।

(ii) यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – **खण्ड क, ख** तथा **ग** ।

(iii) **खण्ड क** में **6** प्रश्न (प्र.सं. **1** से **6**) हैं, जिनमें प्रत्येक प्रश्न **2** अंक का है । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।

(iv) **खण्ड ख** में **4** प्रश्न (प्र.सं. **7** से **10**) हैं, जिनमें प्रत्येक प्रश्न **3** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।

(v) **खण्ड ग** में **4** प्रश्न (प्र.सं. **11** से **14**) हैं, जिनमें प्रत्येक प्रश्न **4** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में दो प्रकरण अध्ययन आधारित प्रश्न भी शामिल हैं ।

(vi) कैल्कुलेटर के उपयोग की अनुमति **नहीं** है ।

### खण्ड क

*प्रश्न संख्या* **1** *से* **6** *तक प्रत्येक प्रश्न के* **2** *अंक हैं ।*

**1.** (क) समांतर श्रेढ़ी : – 30, – 24, – 18, ..... के प्रथम 30 पदों का योगफल ज्ञात कीजिए । *2*

**अथवा**

(ख) एक समांतर श्रेढ़ी में यदि $S_n = n \ (4n + 1)$ है, तो समांतर श्रेढ़ी ज्ञात कीजिए । *2*

**2.** 10·5 सेमी त्रिज्या वाले धातु के एक ठोस गोले को पिघलाकर, 3·5 सेमी त्रिज्या और 3 सेमी ऊँचाई के कुछ छोटे-छोटे शंकु बनाए जाते हैं । इस प्रकार बनाए गए शंकुओं की संख्या ज्ञात कीजिए । *2*

**3.** (क) m के किस मान के लिए द्विघात समीकरण

$$(m - 1) \ x^2 + 2 \ (m - 1) \ x + 1 = 0$$

के दो बराबर और वास्तविक मूल होंगे ? *2*

**अथवा**

(ख) निम्न द्विघात समीकरण को, x के लिए हल कीजिए : *2*

$$\sqrt{3} \ x^2 + 10x + 7\sqrt{3} = 0$$

**4.** निम्न बारंबारता बंटन का बहुलक ज्ञात कीजिए : *2*

| वर्ग | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 |
|------|---------|---------|---------|---------|---------|
| बारंबारता | 15 | 10 | 12 | 17 | 4 |

## General Instructions :

*Read the following instructions very carefully and strictly follow them :*

*(i)* *This question paper contains **14** questions. **All** questions are compulsory.*

*(ii)* *This question paper is divided into **three** sections – **Sections A, B** and **C**.*

*(iii)* ***Section A** comprises of **6** questions (Q.no. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

*(iv)* ***Section B** comprises of **4** questions (Q.no. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

*(v)* ***Section C** comprises of **4** questions (Q.no. **11** to **14**) of **4** marks each. Internal choice has been provided in **one** question. It also contains two case study based questions.*

*(vi)* *Use of calculator is **not** permitted.*

## SECTION A

*Question numbers **1** to **6** carry **2** marks each.*

1. (a) Find the sum of first 30 terms of AP : $-30, -24, -18, \ldots$ .      2

               **OR**

   (b) In an AP if $S_n = n(4n + 1)$, then find the AP.      2

2. A solid metallic sphere of radius 10·5 cm is melted and recast into a number of smaller cones, each of radius 3·5 cm and height 3 cm. Find the number of cones so formed.      2

3. (a) Find the value of m for which the quadratic equation

         $(m - 1) x^2 + 2(m - 1) x + 1 = 0$

     has two real and equal roots.      2

               **OR**

   (b) Solve the following quadratic equation for x :      2

         $\sqrt{3}\, x^2 + 10x + 7\sqrt{3} = 0$

4. Find the mode of the following frequency distribution :      2

| Class | 10 − 20 | 20 − 30 | 30 − 40 | 40 − 50 | 50 − 60 |
|---|---|---|---|---|---|
| Frequency | 15 | 10 | 12 | 17 | 4 |

**5.** रेहान की 5 वर्ष पूर्व आयु (वर्षों में) तथा अब से 7 वर्ष उपरान्त उसकी आयु का गुणनफल उसकी वर्तमान आयु के दो गुने से एक अधिक है । उसकी वर्तमान आयु ज्ञात कीजिए ।　　　2

**6.** दो संकेंद्रीय वृत्तों की त्रिज्याएँ 4 सेमी तथा 3 सेमी हैं । बड़े वृत्त की उस जीवा की लम्बाई ज्ञात कीजिए जो छोटे वृत्त को स्पर्श करती हो ।　　　2

### खण्ड ख

*प्रश्न संख्या 7 से 10 तक प्रत्येक प्रश्न के 3 अंक हैं ।*

**7.** $x$ के किस मान के लिए निम्नलिखित बारंबारता बंटन का माध्यक 34·5 है ?　　　3

| वर्ग | बारंबारता |
|------|-----------|
| 0 – 10 | 3 |
| 10 – 20 | 5 |
| 20 – 30 | 11 |
| 30 – 40 | 10 |
| 40 – 50 | x |
| 50 – 60 | 3 |
| 60 – 70 | 2 |

**8.** 3 सेमी त्रिज्या का एक वृत्त खींचिए । इसके किसी बढ़ाए गए व्यास पर केंद्र से 7 सेमी की दूरी पर दो बिंदु P और Q लीजिए । इन दोनों बिंदुओं P और Q से वृत्त पर स्पर्श-रेखाओं की रचना कीजिए ।　　　3

**9.** (क) एक मीनार के पाद-बिंदु से एक भवन के शिखर का उन्नयन कोण 30° है और भवन के पाद-बिंदु से मीनार के शिखर का उन्नयन कोण 60° है । यदि मीनार 50 मी. ऊँची है, तो भवन की ऊँचाई ज्ञात कीजिए ।　　　3

### अथवा

(ख) एक नदी के पुल के एक बिंदु से नदी के सम्मुख किनारों के अवनमन कोण क्रमशः 30° और 45° हैं । यदि पुल किनारों से 3 मी. की ऊँचाई पर हो, तो नदी की चौड़ाई ज्ञात कीजिए ।　　　3

**5.** The product of Rehan's age (in years) 5 years ago and his age 7 years from now, is one more than twice his present age. Find his present age.    *2*

**6.** Two concentric circles are of radii 4 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.    *2*

## SECTION B

*Question numbers **7** to **10** carry **3** marks each.*

**7.** For what value of x, is the median of the following frequency distribution 34·5 ?    *3*

| Class | Frequency |
|-------|-----------|
| 0 – 10 | 3 |
| 10 – 20 | 5 |
| 20 – 30 | 11 |
| 30 – 40 | 10 |
| 40 – 50 | x |
| 50 – 60 | 3 |
| 60 – 70 | 2 |

**8.** Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Construct tangents to the circle from these two points P and Q.    *3*

**9.** (a) The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.    *3*

### OR

(b) From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 3 m from the banks, then find the width of the river.    *3*

**10.** किसी कम्पनी के 30 कर्मचारियों के खाने के दैनिक खर्च निम्न हैं :

| दैनिक खर्च (रुपयों में) | कर्मचारियों की संख्या |
|---|---|
| 100 – 120 | 8 |
| 120 – 140 | 3 |
| 140 – 160 | 8 |
| 160 – 180 | 6 |
| 180 – 200 | 5 |

कर्मचारियों का माध्य दैनिक खर्च ज्ञात कीजिए ।                                3

**खण्ड ग**

*प्रश्न संख्या 11 से 14 तक प्रत्येक प्रश्न के 4 अंक हैं ।*

**11.** (क) ऊँचाई 30 सेमी तथा त्रिज्या 7 सेमी वाले एक ठोस बेलन में से 24 सेमी ऊँचाई तथा इसी त्रिज्या वाला एक शंक्वाकार खोल काटकर निकाल लिया जाता है । शेष बचे ठोस का सम्पूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।                                4

**अथवा**

(ख) 8 मी. चौड़ी तथा 6 मी. गहरी एक नहर में पानी 12 किमी/घंटे की चाल से बह रहा है । 1 घंटे में यह नहर कितने क्षेत्रफल की सिंचाई कर पाएगी, यदि सिंचाई के लिए 0·05 मी. अप्रवाही पानी की आवश्यकता होती है ?                                4

**10.** Following is the daily expenditure on lunch by 30 employees of a company :

| Daily Expenditure (in Rupees) | Number of Employees |
|---|---|
| 100 – 120 | 8 |
| 120 – 140 | 3 |
| 140 – 160 | 8 |
| 160 – 180 | 6 |
| 180 – 200 | 5 |

Find the mean daily expenditure of the employees. *3*

## SECTION C

*Question numbers **11** to **14** carry **4** marks each.*

**11.** (a) From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid. *4*

**OR**

(b) Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0·05 m of standing water is required ? *4*

12. आकृति 1 में, त्रिभुज ABC दर्शाया गया है जिसमें ∠ B = 90° है । AB को व्यास लेते हुए एक वृत्त खींचा गया है, जो AC को बिंदु P पर प्रतिच्छेद करता है । सिद्ध कीजिए कि बिंदु P पर खींची गई स्पर्श रेखा BC को समद्विभाजित करती है । *4*
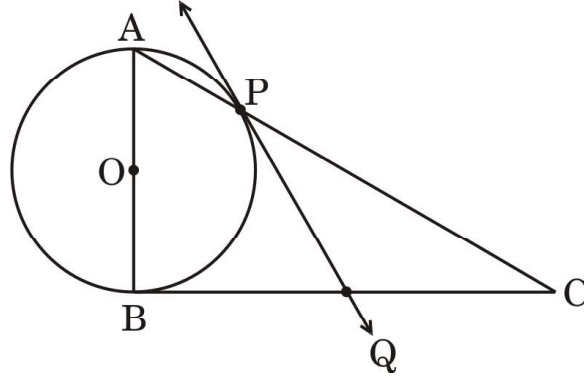


*आकृति 1*

**प्रकरण अध्ययन – 1**

13. गणित में संबंधों को कई प्रकार से व्यक्त किया जा सकता है । माचिस की तीलियों से बनाए गए पैटर्न रेखीय संबंधों पर आधारित हैं । अलग-अलग आकृतियों में प्रयुक्त माचिस की तीलियों की संख्या ज्ञात करने के लिए भिन्न युक्तियाँ प्रयुक्त की जा सकती हैं ।

एक ऐसा ही पैटर्न नीचे दर्शाया गया है । पैटर्न को ध्यानपूर्वक देखिए तथा समांतर श्रेढ़ी का उपयोग करते हुए निम्न प्रश्नों के उत्तर दीजिए :
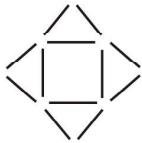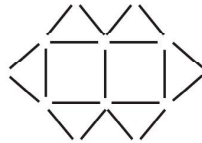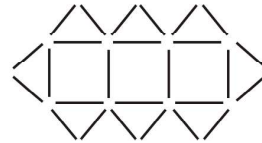


*आकृति 1*     *आकृति 2*     *आकृति 3*

(क) आकृतियों में प्रयुक्त त्रिभुजों की संख्या को दर्शाने वाली एक समांतर श्रेढ़ी लिखिए । इस समांतर श्रेढ़ी का nवाँ पद भी लिखिए । *2*

(ख) किस आकृति में 61 माचिस की तीलियों का उपयोग हुआ है ? *2*

**12.** In Figure 1, a triangle ABC with ∠ B = 90° is shown. Taking AB as diameter, a circle has been drawn intersecting AC at point P. Prove that the tangent drawn at point P bisects BC. *4*
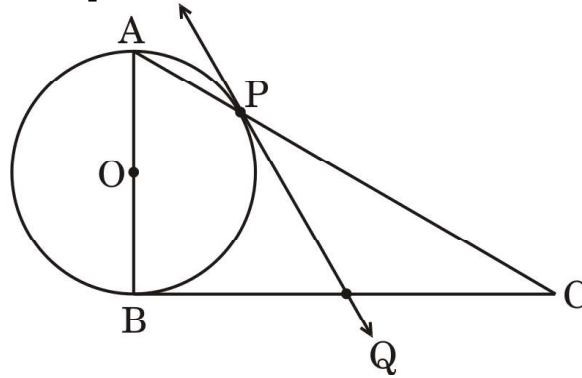


*Figure 1*

**Case Study – 1**

**13.** In Mathematics, relations can be expressed in various ways. The matchstick patterns are based on linear relations. Different strategies can be used to calculate the number of matchsticks used in different figures.

One such pattern is shown below. Observe the pattern and answer the following questions using Arithmetic Progression :
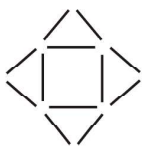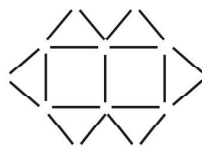


*Figure 1*          *Figure 2*          *Figure 3*
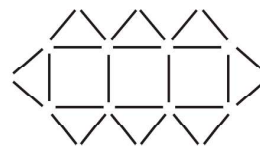
(a)   Write the AP for the number of triangles used in the figures. Also, write the $n^{th}$ term of this AP. *2*

(b)   Which figure has 61 matchsticks ? *2*

प्रकरण अध्ययन – 2

14. गड़ीसर झील राजस्थान के जैसलमेर जिले में स्थित है । इसको जैसलमेर के राजा ने बनवाया था तथा 14वीं शताब्दी में गड़सी सिंह ने इसे दुबारा बनवाया । इस झील में बहुत-सी छतरियाँ बनी हुई हैं । उनमें से एक छतरी को नीचे दर्शाया गया है :



चित्र को ध्यानपूर्वक देखिए । पानी की सतह से $h$ मी. ऊँचाई पर स्थित बिंदु A से छतरी के शीर्ष (बिंदु B) का उन्नयन कोण 45° है तथा इसी बिंदु से पानी में छतरी के प्रतिबिम्ब (बिंदु C) का अवनमन कोण 60° है । पानी की सतह के ऊपर छतरी की ऊँचाई यदि 10 मी. हो, तो

(क) उपर्युक्त सूचना के आधार पर अच्छी प्रकार से अंकित एक आकृति खींचिए ।    *2*

(ख) पानी की सतह से बिंदु A की ऊँचाई ($h$) ज्ञात कीजिए ।
($\sqrt{3}$ = 1·73 का प्रयोग कीजिए)    *2*

**Case Study – 2**

14. Gadisar Lake is located in the Jaisalmer district of Rajasthan. It was built by the King of Jaisalmer and rebuilt by Gadsi Singh in 14$^{th}$ century. The lake has many Chhatris. One of them is shown below :



Observe the picture. From a point A $h$ m above from water level, the angle of elevation of top of Chhatri (point B) is 45° and angle of depression of its reflection in water (point C) is 60°. If the height of Chhatri above water level is (approximately) 10 m, then

(a) draw a well-labelled figure based on the above information; *2*

(b) find the height ($h$) of the point A above water level.
(Use $\sqrt{3} = 1·73$) *2*

# Strictly Confidential : (For Internal and Restricted use only)
## Secondary School Examination
## Term–II, 2022

# Marking Scheme : MATHEMATICS (Standard) (Subject Code : 041)
# [ Paper Code : 30/1/1 ]

*General Instructions* :

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.

2. ''**Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. Its leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in Newspaper/ Website, etc., may invite action under IPC.**''

3. Evaluation is to be done as per instruction provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them. In Class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**

4. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.

5. Evaluators will mark (3) wherever answer is correct. For wrong answer '7' be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing**.

6. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written in the left-hand margin and encircled. This may be followed strictly.

7. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).

12. Ensure that you do not make the following common types of errors committed by the Examiner in the past :
   - Leaving answer or part thereof unassessed in an answer book
   - Giving more marks for an answer than assigned to it
   - Wrong totalling of marks awarded on a reply
   - Wrong transfer of marks from the inside pages of the answer book to the title page
   - Wrong questionwise totalling on the title page
   - Wrong totalling of marks of the two columns on the title page
   - Wrong grand total
   - Marks in words and figures not tallying
   - Wrong transfer of marks from the answer book to online award list
   - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the 7 for incorrect answer).
   - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.

14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.

16. Every examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

Secondary School Examination TERM–II, 2022

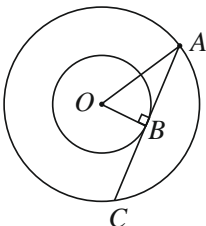# MATHEMATICS (Standard) (Subject Code–041)
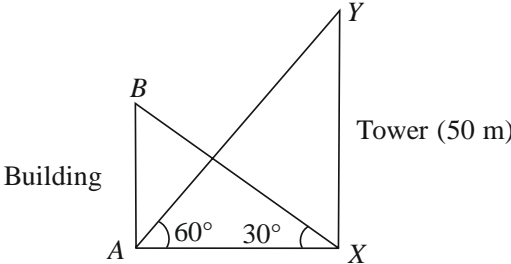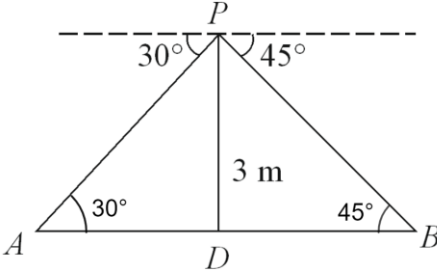
## [ Paper Code : 30/1/1 ]

**Instructions :**

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.
2. Evaluation is to be done as per instructions provided in the marking scheme. It should not be done according to one's own interpretation or any other consideration — Marking Scheme should be strictly adhered to and religiously followed.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.
5. A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.
6. Separate Marking Scheme for all the three sets has been given.
7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

| Q. No. | EXPECTED ANSWER / VALUE POINTS | Marks |
|---|---|---|
| | SECTION—A | |
| **1.a** <br> Sol. | Find the sum of first 30 terms of AP : $-30, -24, -18, \ldots\ldots$ . <br> Here <br> $\qquad a = -30,\ d = 6,\ n = 30$ <br><br> $\qquad S_{30} = \dfrac{30}{2}[-60 + 29 \times 6]$ <br><br> $\qquad = 1710$ <br><br> **Or** | <br><br> 1 <br><br> ½ <br><br> ½ |
| **b.** <br><br> Sol. | In an AP if $S_n = n(4n+1)$, then find the AP. <br><br> $a = S_1 = 1(4 \times 1 + 1) = 5$ <br> $a + (a+d) = S_2 = 2(4 \times 2 + 1) = 18$ <br> $\therefore d = 8$ <br> Hence, AP is <br> $\qquad 5,\ 13,\ 21, \ldots$ | <br><br> ½ <br><br><br> 1 <br><br> ½ |
| **2.** | A solid metallic sphere of radius 10·5 cm is melted and recast into a number of smaller cones, each of radius 3·5 cm and height 3 cm. Find the number of cones so formed. | |

| | | |
|---|---|---|
| Sol. | $n \times \dfrac{1}{3}.\pi.(3.5)^2(3) = \dfrac{4}{3}\pi(10.5)^3$ | 1 |
| | $\Rightarrow n = 126$ | 1 |
| 3.a. | Find the value of m for which the quadratic equation<br><br>$\qquad (m-1)\,x^2 + 2\,(m-1)\,x + 1 = 0$<br><br>has two real and equal roots. | |
| Sol. | For real and equal roots<br><br>$\qquad 4(m-1)^2 - 4(m-1) = 0$<br>$\qquad \Rightarrow m = 1 \text{ or } m = 2$<br>$\qquad m \neq 1 \Rightarrow m = 2$<br><br>**Or** | ½<br>1<br>½ |
| b. | Solve the following quadratic equation for x :<br>$\qquad \sqrt{3}\,x^2 + 10x + 7\sqrt{3} = 0$ | |
| Sol. | $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$<br>$or\ \sqrt{3}x^2 + 3x + 7x + 7\sqrt{3} = 0$<br>$or\ (\sqrt{3}x+7)(x+\sqrt{3}) = 0$<br>$\qquad \Rightarrow x = -\dfrac{7}{\sqrt{3}},\ -\sqrt{3} \text{ or } -\dfrac{7}{3}\sqrt{3},\ -\sqrt{3}$ | 1<br><br>1 |
| 4. | Find the mode of the following frequency distribution :<br><br>| Class | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 |<br>|---|---|---|---|---|---|<br>| Frequency | 15 | 10 | 12 | 17 | 4 | | |
| Sol. | Modal class is 40–50<br><br>Mode $= 40 + 10 \times \dfrac{17-12}{34-12-4}$<br><br>$= 42.7 \text{ or } 42\dfrac{7}{9}$ | ½<br><br>1<br><br>½ |
| 5. | The product of Rehan's age (in years) 5 years ago and his age 7 years from now, is one more than twice his present age. Find his present age. | |
| Sol. | Let Rehan's present age be $x$ years<br><br>$\qquad \therefore (x-5)(x+7) = 2x+1$<br>$\qquad \Rightarrow x^2 = 36$<br>$\qquad \Rightarrow x = 6$ | 1<br>½<br>½ |

| 6. | Two concentric circles are of radii 4 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle. | |
|---|---|---|
| Sol. | For correct figure | ½ |
| | Here $OB = 3$ cm, $OA = 4$ cm | |
| | $OB \perp AC$ | 1 |
| | $\therefore\ AB = \sqrt{4^2 - 3^2} = \sqrt{7}$ cm | |
| | Hence $AC = 2\sqrt{7}$ cm | ½ |
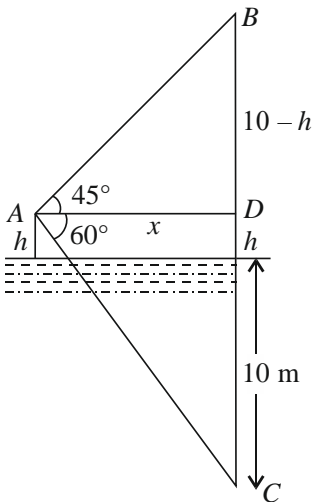
**SECTION—B**

**7.** For what value of x, is the median of the following frequency distribution 34·5 ?

| Class | Frequency |
|---|---|
| 0 – 10 | 3 |
| 10 – 20 | 5 |
| 20 – 30 | 11 |
| 30 – 40 | 10 |
| 40 – 50 | x |
| 50 – 60 | 3 |
| 60 – 70 | 2 |

Sol. Median class is 30–40 ......... ½

| Class | Frequency | c.f. |
|---|---|---|
| 0–10 | 3 | 3 |
| 10–20 | 5 | 8 |
| 20–30 | 11 | 19 |
| 30–40 | 10 | 29 |
| 40–50 | $x$ | $29 + x$ |
| 50–60 | 3 | $32 + x$ |
| 60–70 | 2 | $34 + x$ |

Correct table ......... 1

$$\therefore\ 34{\cdot}5 = 30 + \frac{10}{10}\left(\frac{34 + x}{2} - 19\right)$$ ......... 1

$$\Rightarrow x = 13$$ ......... ½

| 8. | Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Construct tangents to the circle from these two points P and Q. | |
|---|---|---|
| Sol. | Correct Construction. | 3 |

| 9.a. | The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building. | |
|---|---|---|
| Sol. | For correct figure | 1 |



$$\tan 30° = \frac{AB}{AX} \quad \text{and} \quad \tan 60° = \frac{50}{AX}$$

$$\Rightarrow AB = \frac{1}{\sqrt{3}} AX \quad \text{and} \quad AX = \frac{50}{\sqrt{3}} \qquad \frac{1}{2}+\frac{1}{2}$$

$$\therefore \quad AB = \frac{1}{\sqrt{3}} \cdot \frac{50}{\sqrt{3}} = \frac{50}{3} \text{ m} \qquad 1$$

**OR**

| b. | From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 3 m from the banks, then find the width of the river. | |
|---|---|---|
| Sol. | For correct figure | 1 |



Here, $\dfrac{PD}{AD} = \tan 30° = \dfrac{1}{\sqrt{3}} \Rightarrow AD = 3\sqrt{3}$ m ½

and $\dfrac{PD}{BD} = \tan 45° = 1 \Rightarrow BD = 3$ m ½

So, $AB = AD + BD = (3\sqrt{3} + 3)$ m $= 3(\sqrt{3}+1)$ m 1

| | |
|---|---|
| **10.** | Following is the daily expenditure on lunch by 30 employees of a company : |

| Daily Expenditure (in Rupees) | Number of Employees |
|---|---|
| 100 – 120 | 8 |
| 120 – 140 | 3 |
| 140 – 160 | 8 |
| 160 – 180 | 6 |
| 180 – 200 | 5 |

Find the mean daily expenditure of the employees.

Sol.

| *Class* | *x* | *f* | *d* | *f.d* |
|---|---|---|---|---|
| 100–120 | 110 | 8 | –40 | –320 |
| 120–140 | 130 | 3 | –20 | –60 |
| 140–160 | 150 | 8 | 0 | 0 |
| 160–180 | 170 | 6 | 20 | 120 |
| 180–200 | 190 | 5 | 40 | 200 |
| | | 30 | | –60 |

For correct table — 2

$$\text{Mean} = 150 + \frac{-60}{30} = 148$$

1

Therefore, mean expenditure = Rs. 148

**SECTION—C**

| | | |
|---|---|---|
| **11. a.** | From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid. | |
| Sol. | $$l = \sqrt{576 + 49} = 25 \ cm$$ | 1 |

| | | |
|---|---|---|
| | TSA $=$ $2\pi rh + \pi r^2 + \pi rl$ | |
| | $= \dfrac{22}{7} \times 7 \ [60 + 7 + 25]$ | 2 |
| | $= 2024 \text{ cm}^2$ | 1 |

**Or**

**b.** Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0·05 m of standing water is required ?

Sol. Distance covered by water in 1 hr = 12000 m   ½

∴ Volume of water flown in 1 hr

$= 8 \times 6 \times 12000 \text{ m}^3$   1½

Hence area of field × 0·05 = 8 × 6 × 12000

⇒  Area of field $= 1152 \times 10^4 \text{ m}^2$ or 11520000 m²   1½   ½

**12.** In Figure 1, a triangle ABC with ∠ B = 90° is shown. Taking AB as diameter, a circle has been drawn intersecting AC at point P. Prove that the tangent drawn at point P bisects BC.

*Figure 1*

| Sol. | | |
|---|---|---|
| |  | |
| | PR=RB (tangents from external point)………………(i) | 1 |
| | Proving ∠ RPC = ∠ RCP | 2 |
| | ⇒ PR =CR ………………(ii) | ½ |
| | Using equations (i) and (ii) | |
| | BR= RC | ½ |
| | Hence the tangent drawn at point P bisects BC | |

**13.**

In Mathematics, relations can be expressed in various ways. The matchstick patterns are based on linear relations. Different strategies can be used to calculate the number of matchsticks used in different figures.

One such pattern is shown below. Observe the pattern and answer the following questions using Arithmetic Progression :



Figure 1          Figure 2          Figure 3

(a)  Write the AP for the number of triangles used in the figures. Also, write the $n^{th}$ term of this AP.

(b)  Which figure has 61 matchsticks ?

| Sol. | (a)  Number of triangles in figures are 4, 6, 8, ... | ½ |
|---|---|---|
| | This is an A.P. with $a = 4,\ d = 2$ | 1 |
| | $\therefore\ a_n = 4 + (n-1) \times 2 = 2n+2$ | ½ |
| | | |
| | (b)  Number of matchsticks in figures are 12, 19, 26, ... | ½ |

| | | |
|---|---|---|
| | This is an A.P. with $a = 12$, $d = 7$ | 1 |
| | $\therefore\ 61 = 12 + (n-1) \times 7$ | |
| | $\Rightarrow\ n = 8$ | ½ |
| **14.** | **Case Study—2** | |
| | Gadisar Lake is located in the Jaisalmer district of Rajasthan. It was built by the King of Jaisalmer and rebuilt by Gadsi Singh in 14<sup>th</sup> century. The lake has many Chhatris. One of them is shown below : | |
| |  | |
| | Observe the picture. From a point A $h$ m above from water level, the angle of elevation of top of Chhatri (point B) is 45° and angle of depression of its reflection in water (point C) is 60°. If the height of Chhatri above water level is (approximately) 10 m, then | |
| | (a) draw a well-labelled figure based on the above information; | |
| | (b) find the height ($h$) of the point A above water level. (Use $\sqrt{3} = 1.73$) | |
| Sol. | (a)  | |
| | | Correct Figure | 2 |

(b)  $\tan 45° = 1 = \dfrac{10-h}{x}$

$\Rightarrow x = 10-h$ ... (i) ½

$\tan 60° = \sqrt{3} = \dfrac{10+h}{x}$

$\Rightarrow x = \dfrac{10+h}{\sqrt{3}}$ ... (ii) ½

Solving (i) and (ii)  $10(\sqrt{3}-1) = h(\sqrt{3}+1)$

$\Rightarrow h = \dfrac{10(\sqrt{3}-1)^2}{2}$

$= 2{\cdot}67$ m or 2.7m          1

* * *