



Series PPQQB/3

SET~3

प्रश्न-पत्र कोड  
Q.P. Code 30/3/3

रोल नं.  
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।  
Candidates must write the Q.P. Code on the title page of the answer-book.

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

अधिकतम अंक : 40

Time allowed : 2 hours

Maximum Marks : 40

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### सामान्य निर्देश:

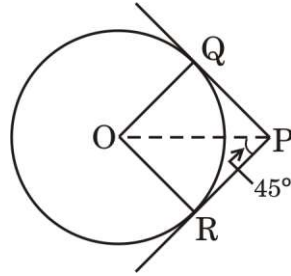
निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख्ती से पालन कीजिए :

- इस प्रश्न-पत्र में कुल 14 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।
- यह प्रश्न-पत्र तीन खण्डों में विभाजित है – खण्ड क, ख तथा ग।
- 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।
- 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।
- 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।
- कैल्कुलेटर के उपयोग की अनुमति नहीं है।

### खण्ड क

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

- आकृति 1 में, केंद्र O वाले वृत्त पर PQ तथा PR स्पर्श-रेखाएँ खींची गई हैं। यदि  $\angle OPR = 45^\circ$  है, तो सिद्ध कीजिए कि ORPQ एक वर्ग है।



आकृति 1

- दिए गए बारंबारता बंटन का बहुलक ज्ञात कीजिए :

वर्ग	बारंबारता
15 – 25	6
25 – 35	11
35 – 45	22
45 – 55	23
55 – 65	14
65 – 75	5

- एक समांतर श्रेणी का प्रथम पद 10 तथा प्रथम 14 पदों का योगफल 1505 है। इस श्रेणी का सार्व अन्तर 'd' ज्ञात कीजिए।
- 'n' के किस मान के लिए, समांतर श्रेणियों 9, 7, 5, ..... और 15, 12, 9, ..... के nवें पद समान होंगे ?

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**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. In Figure 1, PQ and PR are tangents to the circle centred at O. If  $\angle OPR = 45^\circ$ , then prove that ORPQ is a square. 2

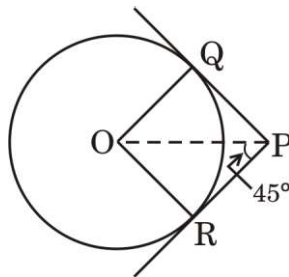


Figure 1

2. Find the mode of the given frequency distribution : 2

Class	Frequency
15 – 25	6
25 – 35	11
35 – 45	22
45 – 55	23
55 – 65	14
65 – 75	5

3. Find the common difference 'd' of an AP whose first term is 10 and the sum of the first 14 terms is 1505. 2
4. For what value of 'n', are the  $n^{\text{th}}$  terms of the APs : 9, 7, 5, ..... and 15, 12, 9, ..... the same ? 2



5. (क)  $x$  के लिए द्विघात समीकरण  
 $x^2 - 2ax - (4b^2 - a^2) = 0$   
को हल कीजिए । 2

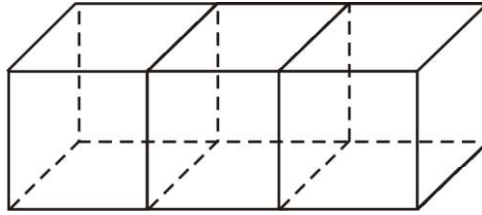
अथवा

- (ख) यदि द्विघात समीकरण  
 $(1 + a^2)x^2 + 2abx + (b^2 - c^2) = 0$   
के मूल बराबर एवं वास्तविक हैं, तो सिद्ध कीजिए कि :  
 $b^2 = c^2(1 + a^2)$  2

6. (क) 7 सेमी व्यास के बेलनाकार बर्तन, जिसमें कुछ पानी भरा है, में 1.4 सेमी व्यास के 150 गोलाकार संगमरमर के टुकड़े इस प्रकार डाले जाते हैं कि पूर्ण रूप से पानी में डूब जाएँ। बेलनाकार बर्तन में जल स्तर की वृद्धि ज्ञात कीजिए । 2

अथवा

- (ख) आकृति 2 में, 6 सेमी भुजा वाले तीन घन चित्रानुसार परस्पर जोड़ दिए गए हैं। इस प्रकार बने घनाभ का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए । 2

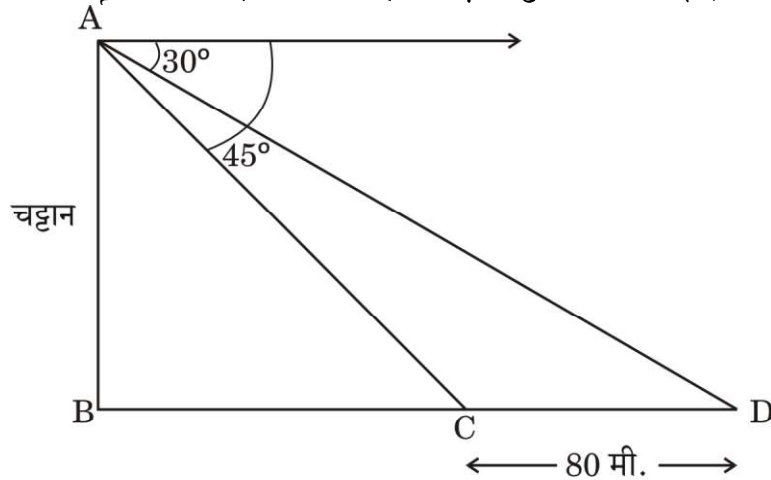


आकृति 2

खण्ड ख

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

7. समुद्र में दो नाव जो एक-दूसरे से 80 मी. की दूरी पर हैं और एक खड़ी चट्टान AB की तरफ आ रही हैं। खड़ी चट्टान के शिखर से देखने पर नावों के अवनमन कोण क्रमशः  $30^\circ$  तथा  $45^\circ$  हैं, जैसे कि आकृति 3 में दिखाया गया है। खड़ी चट्टान की ऊँचाई ज्ञात कीजिए । 3



आकृति 3

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4



5. (a) Solve the quadratic equation for  $x$  :  
 $x^2 - 2ax - (4b^2 - a^2) = 0$  2

**OR**

- (b) If the quadratic equation  
 $(1 + a^2)x^2 + 2abx + (b^2 - c^2) = 0$   
has equal and real roots, then prove that :  
 $b^2 = c^2(1 + a^2)$  2

6. (a) 150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel. 2

**OR**

- (b) Three cubes of side 6 cm each, are joined as shown in Figure 2. Find the total surface area of the resulting cuboid. 2

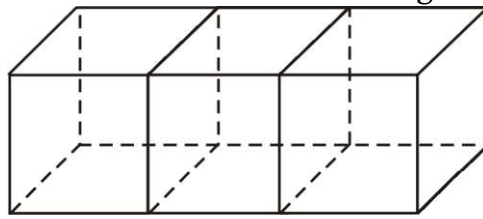


Figure 2

### SECTION B

Question numbers 7 to 10 carry 3 marks each.

7. Two boats are sailing in the sea 80 m apart from each other towards a cliff AB. The angles of depression of the boats from the top of the cliff are  $30^\circ$  and  $45^\circ$  respectively, as shown in Figure 3. Find the height of the cliff. 3

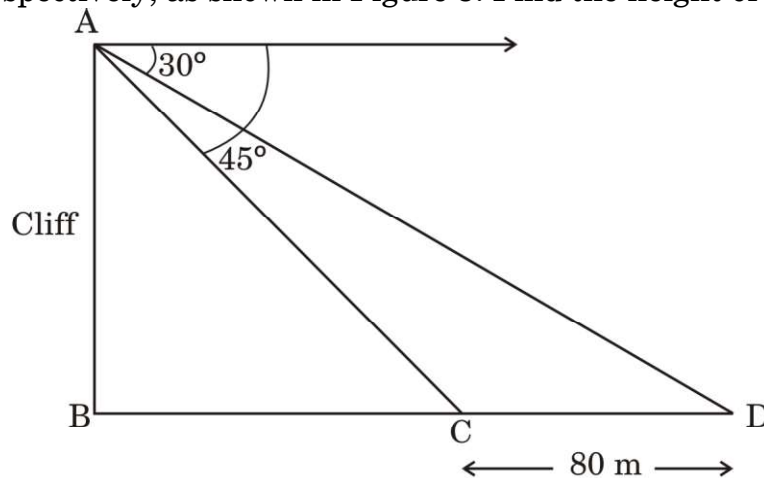


Figure 3

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8. निम्नलिखित बारंबारता बंटन का माध्यक ज्ञात कीजिए :

3

वर्ग	बारंबारता
1400 – 1550	6
1550 – 1700	13
1700 – 1850	25
1850 – 2000	10

9. (क) 8 सेमी लम्बा एक रेखाखंड AB खींचिए । इस रेखाखंड AB पर बिंदु P को इस प्रकार अंकित कीजिए कि  $AP : PB = 1 : 5$  हो ।

3

अथवा

(ख) 3 सेमी त्रिज्या का एक वृत्त खींचिए । केंद्र बिंदु से 6 सेमी की दूरी पर स्थित बिंदु P से वृत्त पर दो स्पर्श-रेखाओं PA तथा PB की रचना कीजिए ।

3

10. निम्नलिखित बारंबारता बंटन का माध्यक ज्ञात कीजिए :

3

वर्ग	बारंबारता
0 – 10	12
10 – 20	18
20 – 30	27
30 – 40	20
40 – 50	17
50 – 60	6

खण्ड ग

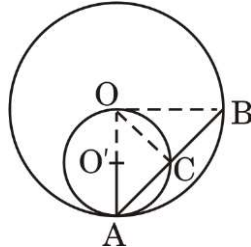
प्रश्न संख्या 11 से 14 तक प्रत्येक प्रश्न के 4 अंक हैं ।

11. भूमि के एक बिंदु X से एक ऊर्ध्वाधर मीनार PQ के शिखर Q का उन्नयन कोण  $60^\circ$  है । बिंदु Y से, जो X के लम्बवत् (ऊर्ध्वाधर) ऊपर 40 मी. पर है, मीनार PQ के शिखर Q का उन्नयन कोण  $45^\circ$  है । मीनार PQ की ऊँचाई और PX की दूरी ज्ञात कीजिए । ( $\sqrt{3} = 1.73$  लीजिए)

4

12. (क) आकृति 4 में, केंद्र O और O' वाले दो वृत्त जो क्रमशः त्रिज्या  $2r$  और  $r$  के हैं, एक-दूसरे को आंतरिक रूप से A पर स्पर्श करते हैं । बड़े वृत्त की एक जीवा AB छोटे वृत्त को C पर मिलती है । दर्शाइए कि C, AB को समद्विभाजित करता है ।

4



आकृति 4

अथवा

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6



8. For the following frequency distribution, find the median : 3

<i>Class</i>	<i>Frequency</i>
1400 – 1550	6
1550 – 1700	13
1700 – 1850	25
1850 – 2000	10

9. (a) Draw a line segment AB of length 8 cm and locate a point P on AB such that AP : PB = 1 : 5. 3

**OR**

- (b) Draw a circle of radius 3 cm. From a point P lying outside the circle at a distance of 6 cm from its centre, construct two tangents PA and PB to the circle. 3

10. Find the mean of the following frequency distribution : 3

<i>Class</i>	<i>Frequency</i>
0 – 10	12
10 – 20	18
20 – 30	27
30 – 40	20
40 – 50	17
50 – 60	6

### SECTION C

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

11. The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is  $60^\circ$ . From a point Y, 40 m vertically above X, the angle of elevation of the top Q of tower PQ is  $45^\circ$ . Find the height of the tower PQ and the distance PX. [Use  $\sqrt{3} = 1.73$ ] 4
12. (a) In Figure 4, two circles with centres at O and O' of radii 2r and r respectively, touch each other internally at A. A chord AB of the bigger circle meets the smaller circle at C. Show that C bisects AB. 4

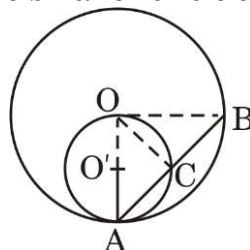


Figure 4

**OR**

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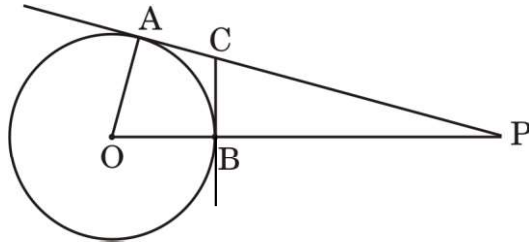
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- (ख) आकृति 5 में, 5 सेमी त्रिज्या वाले वृत्त का केंद्र बिंदु O है। PA तथा BC क्रमशः बिंदु A तथा B पर खींची गई स्पर्श-रेखाएँ हैं। यदि  $OP = 13$  सेमी है, तो स्पर्श-रेखाओं PA तथा BC की लम्बाई ज्ञात कीजिए।

4



आकृति 5

### प्रकरण अध्ययन – 1

13. नीचे दिए गए चित्र में, एक परिवार ने अपने घर के पीछे की जमीन पर एक आयताकार स्विमिंग पूल बनवाया। पूल के चारों तरफ  $x$  मी. चौड़ा सीमेंट (कंक्रीट) से बना पक्का फुटपाथ है। फुटपाथ की बाहरी भुजाएँ 7 मी. तथा 12 मी. हैं। पूल का क्षेत्रफल 36 वर्ग मी. है।



- (क) उपर्युक्त सूचना के आधार पर  $x$  के पदों में एक द्विघात समीकरण बनाइए। 2
- (ख) पूल के चारों ओर बने फुटपाथ की चौड़ाई ज्ञात कीजिए। 2

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8







- (b) In Figure 5, O is centre of a circle of radius 5 cm. PA and BC are tangents to the circle at A and B respectively. If  $OP = 13$  cm, then find the length of tangents PA and BC. 4

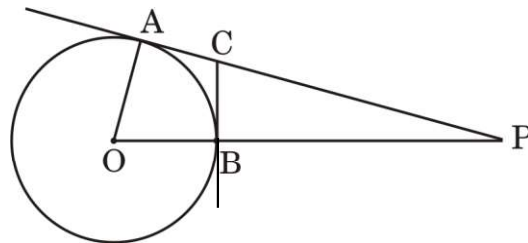


Figure 5

### Case Study – 1

13. In the picture given below, one can see a rectangular in-ground swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width  $x$  m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.



- (a) Based on the information given above, form a quadratic equation in terms of  $x$ . 2
- (b) Find the width of the sidewalk around the pool. 2



## प्रकरण अध्ययन – 2

14. जॉन ने अपनी छोटी बहन के लिए अपने दोस्तों के साथ मिलकर जन्मदिन की पार्टी की योजना बनाई। बच्चों ने तय किया कि जन्मदिन पार्टी की टोपियाँ वो खुद बनाएँगे तथा केक बेकरी की दुकान से खरीदेंगे। इन दोनों चीज़ों के लिए उन्होंने निम्न विमाएँ निश्चित कीं :

केक : 24 सेमी व्यास तथा 14 सेमी ऊँचाई का बेलनाकार

टोपी : शंक्वाकार टोपी जिसकी ऊँचाई 24 सेमी तथा वृत्ताकार आधार की परिधि 44 सेमी है।



उपर्युक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

- (क) इस प्रकार की 4 टोपियाँ बनाने में कितना वर्ग सेमी कागज प्रयुक्त होगा ? 2
- (ख) बेकरी की दुकान पर केक भार (0.5 kg, 1 kg, 1.5 kg, इत्यादि) के हिसाब से मिलता है। अपनी आवश्यकतानुसार बच्चों को कितना केक ऑर्डर करना चाहिए, यदि 650 सेमी<sup>3</sup> केक 100 g केक के बराबर है ? 2



## Case Study – 2

14. John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions :

Cake : Cylindrical shape with diameter 24 cm and height 14 cm.

Cap : Conical shape with base circumference 44 cm and height 24 cm.



Based on the above information, answer the following questions :

- (a) How many square cm paper would be used to make 4 such caps ? 2
- (b) The bakery shop sells cakes by weight (0.5 kg, 1 kg, 1.5 kg, etc.). To have the required dimensions, how much cake should they order, if  $650 \text{ cm}^3$  equals 100 g of cake ? 2



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**Secondary School Examination**

**Term–II, 2022**

**Marking Scheme : MATHEMATICS (Standard) (Subject Code : 041)**

**[ Paper Code : 30/3/3 ]**

**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.



## MARKING SCHEME

Secondary School Examination TERM–II, 2022

### MATHEMATICS (Standard) (Subject Code–041)

[ Paper Code : 30/3/3 ]

**General 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														
<b>SECTION—A</b>																
<b>1.</b>	<p>In Figure 2, PQ and PR are tangents to the circle centred at O. If <math>\angle OPR = 45^\circ</math>, then prove that ORPQ is a square.</p> <div style="text-align: center;"> </div>															
<b>Sol.</b>	<p><math>\triangle OQP \cong \triangle ORP \Rightarrow \angle QPO = \angle RPO = 45^\circ</math>  <math>\Rightarrow \angle QPR = 90^\circ</math>. Also <math>\angle OQP = \angle ORP = \angle QOR = 90^\circ</math>                      Also <math>OQ = OR</math>. This implies ORPQ is a square.</p>	$\frac{1}{2}$ 1 $\frac{1}{2}$														
<b>2.</b>	<p>Find the mode of the given frequency distribution</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Class</th> <th style="text-align: center;">Frequency</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">15 – 25</td> <td style="text-align: center;">6</td> </tr> <tr> <td style="text-align: center;">25 – 35</td> <td style="text-align: center;">11</td> </tr> <tr> <td style="text-align: center;">35 – 45</td> <td style="text-align: center;">22</td> </tr> <tr> <td style="text-align: center;">45 – 55</td> <td style="text-align: center;">23</td> </tr> <tr> <td style="text-align: center;">55 – 65</td> <td style="text-align: center;">14</td> </tr> <tr> <td style="text-align: center;">65 – 75</td> <td style="text-align: center;">5</td> </tr> </tbody> </table>	Class	Frequency	15 – 25	6	25 – 35	11	35 – 45	22	45 – 55	23	55 – 65	14	65 – 75	5	
Class	Frequency															
15 – 25	6															
25 – 35	11															
35 – 45	22															
45 – 55	23															
55 – 65	14															
65 – 75	5															
<b>Sol.</b>	Modal class is 45 – 55	$\frac{1}{2}$														



	$\text{Mode} = 45 + 10 \times \frac{23 - 22}{46 - 22 - 14}$ $= 46$	1 ½
3.	Find the common difference 'd' of an AP whose first term is 10 and the sum of the first 14 terms is 1505.	
Sol.	<p>Here <math>a = 10</math>, <math>n = 14</math>, <math>S_{14} = 1505</math></p> $1505 = \frac{14}{2} [20 + 13d]$ $\Rightarrow d = 15$	1 ½ ½
4.	For what value of 'n', are the $n^{\text{th}}$ terms of the APs : 9, 7, 5, ..... and 15, 12, 9, ..... the same ?	
Sol.	<p><math>n^{\text{th}}</math> terms are <math>9 + (n - 1)(-2)</math> and <math>15 + (n - 1)(-3)</math></p> <p>Thus, <math>9 - 2(n - 1) = 15 - 3(n - 1)</math> gives <math>n = 7</math></p>	½+½ 1
5.	(a) Solve the quadratic equation for x : $x^2 - 2ax - (4b^2 - a^2) = 0$	
Sol.	<p><math>x^2 - 2ax - (4b^2 - a^2) = 0</math> gives</p> $x^2 - 2ax + a^2 - 4b^2 = 0$ $\Rightarrow (x - a)^2 - (2b)^2 = 0$ $\Rightarrow (x - a + 2b)(x - a - 2b) = 0$ <p><math>\therefore x = a - 2b</math> and <math>a + 2b</math></p> <p style="text-align: center;">Or</p> <p>(b) If the quadratic equation <math display="block">(1 + a^2)x^2 + 2abx + (b^2 - c^2) = 0</math> has equal and real roots, then prove that : <math display="block">b^2 = c^2(1 + a^2)</math></p>	1 1
Sol.	<p>The equation has equal roots</p> <p>therefore <math>4a^2b^2 - 4(1 + a^2)(b^2 - c^2) = 0</math></p> $\Rightarrow b^2 = c^2(1 + a^2)$	1 1
6.	(a) 150 spherical marbles, each of diameter 1.4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel.	



**Sol.** Let  $h$  cm be the rise in the water level. Then

$$\pi(3.5)^2 h = \frac{4\pi}{3}(0.7)^3(150)$$

$$\Rightarrow h = 5.6 \text{ cm}$$

Or

(b) Three cubes of side 6 cm each, are joined as shown in Figure 1. Find the total surface area of the resulting cuboid.

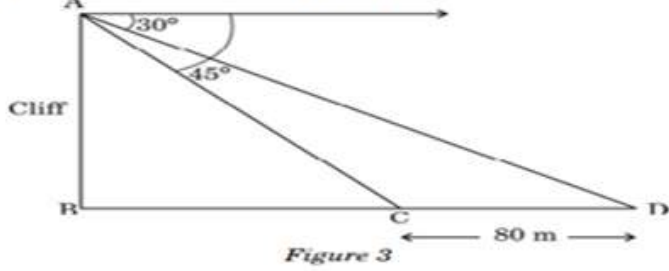


**Sol.** Length of cuboid=18cm

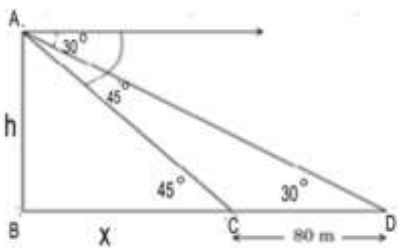
$$\begin{aligned} \text{Total surface area of solid} &= 2(18 \times 6 + 6 \times 6 + 6 \times 18) \\ &= 504 \text{ cm}^2 \end{aligned}$$

**SECTION—B**

7. Two boats are sailing in the sea 80 m apart from each other towards a cliff AB. The angles of depression of the boats from the top of the cliff are  $30^\circ$  and  $45^\circ$  respectively, as shown in Figure 3. Find the height of the cliff.



**Sol.**



$$\tan 45^\circ = \frac{h}{x} = 1$$

$$\Rightarrow h = x \dots \dots \dots \text{(i)}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{h}{x+80} \dots \dots \dots \text{(ii)}$$

Using (i) and (ii)

$$h = \frac{80}{\sqrt{3}-1} = 40(\sqrt{3}+1) \text{ m}$$

$\therefore$  Height of the cliff =  $40(\sqrt{3}+1)$  m

1½  
½

½  
1  
½

1  
1  
1



<p><b>8.</b></p> <p><b>Sol.</b></p>	<p>For the following frequency distribution, find the median :</p> <table border="1" data-bbox="416 264 943 488"> <thead> <tr> <th><i>Class</i></th> <th><i>Frequency</i></th> </tr> </thead> <tbody> <tr> <td>1400 – 1550</td> <td>6</td> </tr> <tr> <td>1550 – 1700</td> <td>13</td> </tr> <tr> <td>1700 – 1850</td> <td>25</td> </tr> <tr> <td>1850 – 2000</td> <td>10</td> </tr> </tbody> </table> <table border="1" data-bbox="416 544 932 842"> <thead> <tr> <th><i>Class</i></th> <th><i>f</i></th> <th><i>Cf</i></th> </tr> </thead> <tbody> <tr> <td>1400–1550</td> <td>6</td> <td>6</td> </tr> <tr> <td>1550–1700</td> <td>13</td> <td>19</td> </tr> <tr> <td>1700–1850</td> <td>25</td> <td>44</td> </tr> <tr> <td>1850–2000</td> <td>10</td> <td>54 = <i>N</i></td> </tr> </tbody> </table> <p style="text-align: right;">Correct Table</p> <p>Median class is 1700 – 1850</p> $\text{Median} = 1700 + \frac{150}{25}(27 - 19)$ $= 1748$	<i>Class</i>	<i>Frequency</i>	1400 – 1550	6	1550 – 1700	13	1700 – 1850	25	1850 – 2000	10	<i>Class</i>	<i>f</i>	<i>Cf</i>	1400–1550	6	6	1550–1700	13	19	1700–1850	25	44	1850–2000	10	54 = <i>N</i>	<p>1 ½ 1 ½</p>
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<p><b>9.</b></p> <p><b>Sol.</b></p>	<p>(a) Draw a line segment AB of length 8 cm and locate a point P on AB such that AP : PB = 1 : 5.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) Draw a circle of radius 3 cm. From a point P lying outside the circle at a distance of 6 cm from its centre, construct two tangents PA and PB to the circle.</p> <p>Correct construction</p>	<p>3</p>																									

10.

Find the mean of the following frequency distribution :

Class	Frequency
0 – 10	12
10 – 20	18
20 – 30	27
30 – 40	20
40 – 50	17
50 – 60	6

Sol.

Class	$x$	$f$	$d = x - 25$	$fd$
0-10	5	12	-20	-240
10-20	15	18	-10	-180
20-30	25	27	0	0
30-40	35	20	10	200
40-50	45	17	20	340
50-60	55	6	30	180
		100		300

Correct Table

$$\bar{x} = 25 + \frac{300}{100} = 28$$

2

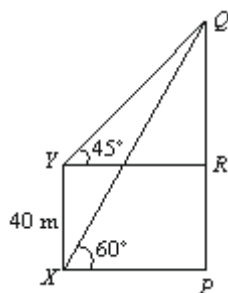
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SECTION—C

11.

The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60°. From a point Y, 40 m vertically above X, the angle of elevation of the top Q of tower PQ is 45°. Find the height of the tower PQ and the distance PX. [Use  $\sqrt{3} = 1.73$ ]

Sol.



Correct Figure

In  $\Delta YRQ$ ,  $\tan 45^\circ = \frac{QR}{YR} \Rightarrow QR = YR \dots \dots \dots$  (i)

In  $\Delta XPQ$ ,  $\tan 60^\circ = \frac{PQ}{XP} \Rightarrow \sqrt{3} = \frac{PQ}{XP} \dots \dots \dots$  (ii)

Further,  $PR = 40 \text{ m} \dots \dots \dots$  (iii)

From (i) to (iii), we get

$PQ=94.6 \text{ m}$  ,  $PX=54.6 \text{ m}$

1

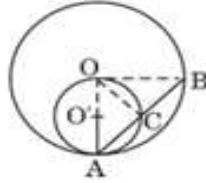
1

1

$\frac{1}{2} + \frac{1}{2}$

12.

- (a) In Figure 3, two circles with centres at  $O$  and  $O'$  of radii  $2r$  and  $r$  respectively, touch each other internally at  $A$ . A chord  $AB$  of the bigger circle meets the smaller circle at  $C$ . Show that  $C$  bisects  $AB$ .



**Sol.**

$$\angle OCA = 90^\circ$$

In  $\Delta$ s  $OCA$  and  $OCB$ , we have

$$OA = OB, \angle OCA = \angle OCB = 90^\circ$$

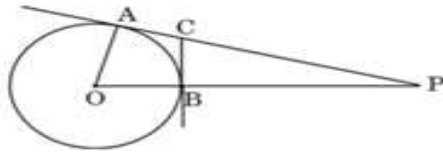
and  $OC = OC$

So,  $\Delta OCA \cong \Delta OCB$

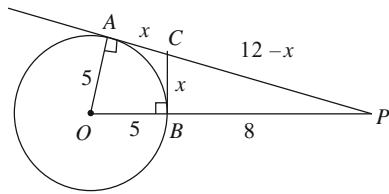
$$\Rightarrow AC = BC \Rightarrow C \text{ bisects } AB$$

**Or**

- (b) In Figure 4,  $O$  is centre of a circle of radius 5 cm.  $PA$  and  $BC$  are tangents to the circle at  $A$  and  $B$  respectively. If  $OP = 13$  cm, then find the length of tangents  $PA$  and  $BC$ .



**Sol.**



$$PA^2 = OP^2 - OA^2 = 169 - 25$$

$$\Rightarrow PA = 12 \text{ cm}$$

$$\text{Let } BC = x \Rightarrow AC = x$$

$$\therefore PC = 12 - x$$

$$OP \perp BC \Rightarrow (12 - x)^2 = x^2 + 8^2$$

$$\Rightarrow x = \frac{10}{3} \text{ cm}$$

$$\therefore BC = \frac{10}{3} \text{ cm}$$

1

2

1

1

1

1

1

Q13.

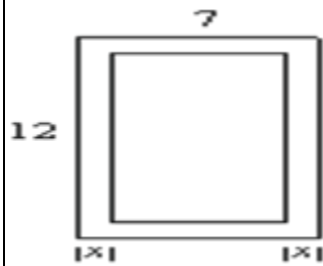
**Case Study – 1**

In the picture given below, one can see a rectangular in-ground swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width  $x$  m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.



- (a) Based on the information given above, form a quadratic equation in terms of  $x$ .  
(b) Find the width of the sidewalk around the pool.

Sol.



(a) Sides of pool are  $7-2x$  and  $12-2x$   
Area = 36 sq. m

$$\Rightarrow (7-2x)(12-2x) = 36$$

$$\Rightarrow 4x^2 - 38x + 48 = 0$$

(b)  $\Rightarrow 2x^2 - 19x + 24 = 0$

$$\Rightarrow (x-8)(2x-3) = 0$$

$$x \neq 8\text{m} \therefore x = \frac{3}{2}\text{m}$$

$\therefore$  width of sidewalk around the pool is  $\frac{3}{2}$  m

$\frac{1}{2}$

1  
 $\frac{1}{2}$

1

1



Q14.

**Case Study – 2**

John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions :

**Cake :** Cylindrical shape with diameter 24 cm and height 14 cm.

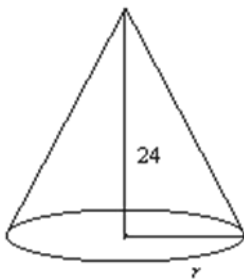
**Cap :** Conical shape with base circumference 44 cm and height 24 cm.



Based on the above information, answer the following questions :

- (a) How many square cm paper would be used to make 4 such caps ?
- (b) The bakery shop sells cakes by weight (0.5 kg, 1 kg, 1.5 kg, etc.). To have the required dimensions, how much cake should they order, if  $650 \text{ cm}^3$  equals 100 g of cake ?

**Sol.**



$$(a) \quad 2\pi r = 44 \\ \Rightarrow r = 7$$

$$\text{Therefore, } l = \sqrt{24^2 + 7^2} = 25 \text{ cm}$$

$$\begin{aligned} \text{Paper required for 4 caps} &= 4 \times \pi r l \\ &= 4 \times \frac{22}{7} \times 7 \times 25 \\ &= 2200 \text{ cm}^2 \text{ or } 700 \pi \text{ cm}^2 \end{aligned}$$

$$(b) \quad \text{Volume of cake} = \frac{22}{7} \times 12 \times 12 \times 14 \\ = 6336 \text{ cm}^3$$

$6336 \text{ cm}^3$  is nearest to  $6500 \text{ cm}^3$

$$\text{Now, } 650 \text{ cm}^3 = 100 \text{ g}$$

$$\Rightarrow 6500 \text{ cm}^3 = 1 \text{ kg}$$

$\therefore$  1 kg cake should be ordered.

1/2

1/2

1

1

1

\*\*\*

