Series : PPQQD/4

SET ~ 3

प्रश्न–पत्र कोड
Q.P. Code **30/4/3**

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 **12** हैं ।	(I)	Please check that this question paper contains **12** printed pages.
(II)	प्रश्न–पत्र में दाहिने हाथ की ओर दिए गए प्रश्न–पत्र कोड को छात्र उत्तर–पुस्तिका के मुख–पृष्ठ पर लिखें ।	(II)	Q.P. Code number 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, 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 candidates will read the question paper only and will not write any answer on the answer-book during this period. *

गणित (मानक) – सैद्धान्तिक

MATHEMATICS (Standard) – Theory

निर्धारित समय : 2 घण्टे — *अधिकतम अंक : 40*

Time allowed : 2 hours — *Maximum Marks : 40*

सामान्य निर्देश :

(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** तक) **2-2** अंक के हैं । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) *खण्ड-**ख** में **4** प्रश्न (प्र.सं. **7** से **10** तक) **3-3** अंक के हैं । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) *खण्ड-**ग** में **4** प्रश्न (प्र.सं. **11** से **14** तक) **4-4** अंक के हैं । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में **दो** प्रकरण आधारित प्रश्न भी शामिल हैं ।*

(vi) *प्रश्न-पत्र में कोई समग्र विकल्प नहीं है । हालाँकि, कुछ प्रश्नों में आंतरिक विकल्प का चयन प्रदान किया गया है । इस प्रकार के प्रश्नों में से केवल एक ही प्रश्न का उत्तर लिखिए ।*

(vii) *कैलकुलेटर के उपयोग की अनुमति नहीं है ।*

खण्ड – क

प्र.सं. **1** से **6** तक प्रत्येक प्रश्न के **2** अंक हैं ।

1. (क) 'k' का वह मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $2kx^2 - 40x + 25 = 0$ के मूल वास्तविक और बराबर हों । **2**

अथवा

(ख) x के लिए हल कीजिए : $\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x.$ **2**

2. एक वर्गीकृत बारंबारता बंटन का बहुलक 75 और बहुलक वर्ग 65-80 है । बहुलक वर्ग से ठीक पहले वर्ग की बारंबारता 6 तथा बहुलक वर्ग के ठीक बाद में आने वाले वर्ग की बारंबारता 8 है । बहुलक वर्ग की बारंबारता ज्ञात कीजिए । **2**

3. (क) एक लंब वृत्तीय बेलन का वक्र पृष्ठीय क्षेत्रफल 176 वर्ग सेमी और आयतन 1232 घन सेमी है । बेलन की ऊँचाई ज्ञात कीजिए । **2**

अथवा

(ख) 21 सेमी भुजा वाले एक ठोस घन में से बड़े से बड़ा गोला काटकर निकाला गया है । गोले का आयतन ज्ञात कीजिए । **2**

General Instructions :

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

(ii) *This Question Paper is divided into 3 Sections – Section **A, B** and **C**.*

(iii) *Section–**A** comprises of **6** questions (Q. Nos. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) *Section–**B** comprises of **4** questions (Q. Nos. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) *Section–**C** comprises of **4** questions (Q. Nos. **11** to **14**) of **4** marks each. An Internal choice has been provided in **one** question. It also contains two case study based questions.*

(vi) *There is no overall choice in the question paper. However, internal choice has been provided in some questions. Attempt any one choice in such questions.*

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

SECTION – A

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

1. (a) Find the value of 'k' for which the quadratic equation $2kx^2 - 40x + 25 = 0$ has real and equal roots. **2**

OR

(b) Solve for x : $\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x$. **2**

2. The mode of a grouped frequency distribution is 75 and the modal class is 65-80. The frequency of the class preceding the modal class is 6 and the frequency of the class succeeding the modal class is 8. Find the frequency of the modal class. **2**

3. (a) The curved surface area of a right circular cylinder is 176 sq cm and its volume is 1232 cu. cm. What is the height of the cylinder ? **2**

OR

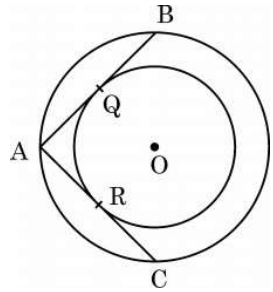
(b) The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere. **2**

4. एक समांतर श्रेढ़ी के सभी 11 पदों का योग ज्ञात कीजिए, जिसका छठा पद 30 है । **2**

5. निम्न बंटन का माध्यक ज्ञात कीजिए : **2**

अंक	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
छात्रों की संख्या	5	8	20	15	7	5

6. आकृति–1 में, केन्द्र O वाले दो सकेंद्रीय वृत्त दिए गए हैं । यदि बड़े वृत्त के एक बिन्दु A से, छोटे वृत्त पर ARC और AQB दो स्पर्श–रेखाएँ हैं, तो AC की लम्बाई ज्ञात कीजिए, यदि AQ = 5 सेमी है । **2**



आकृति – 1

खण्ड – ख

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

7. 200 मी. की ऊँचाई पर एक हवाईजहाज एक नदी के दो किनारों पर विपरीत बिन्दुओं के अवनमन कोण 45° और 60° का अवलोकन करता है । नदी की चौड़ाई ज्ञात कीजिए ($\sqrt{3} = 1.732$ लीजिए) **3**

8. एक समांतर श्रेढ़ी के पहले तीन पदों का योग 33 है । यदि पहले और तीसरे पदों का गुणनफल, दूसरे पद से 29 अधिक हो, तो समांतर श्रेढ़ी ज्ञात कीजिए । **3**

9. (क) 'p' का मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $p(x-4)(x-2) + (x-1)^2 = 0$ के मूल वास्तविक तथा बराबर हैं । **3**

अथवा

(ख) यदि आरूष ने, 35 अंकों वाली, गणित की एक परीक्षा में 8 अधिक अंक प्राप्त किए होते, तो इन अंकों का 7 गुना उसके वास्तविक अंकों के वर्ग से 4 कम होता । उसने इस परीक्षा में कितने अंक प्राप्त किए थे ? **3**

4. Find the sum of all 11 terms of an A.P. whose 6th term is 30. **2**

5. Find the median of the following distribution : **2**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of students	5	8	20	15	7	5

6. In Fig. 1, there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if AQ = 5 cm. **2**

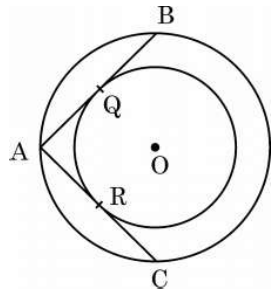


Fig. – 1

SECTION – B

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

7. An aeroplane at an altitude of 200 metres observes the angles of depression of opposite points on the two banks of a river to be 45° and 60°. Find the width of the river. (Use $\sqrt{3} = 1.732$) **3**

8. The sum of the first three terms of an A.P. is 33. If the product of first and third term exceeds the second term by 29, find the A.P. **3**

9. (a) Find the value of 'p' for which the quadratic equation $p(x - 4)(x - 2) + (x - 1)^2 = 0$ has real and equal roots. **3**

OR

(b) Had Aarush scored 8 more marks in a Mathematics test, out of 35 marks, 7 times these marks would have been 4 less than square of his actual marks. How many marks did he get in the test ? **3**

10. 4 सेमी त्रिज्या के एक वृत्त पर ऐसी दो स्पर्श–रेखाओं की रचना कीजिए, जो परस्पर 60° के कोण पर झुकी हों। **3**

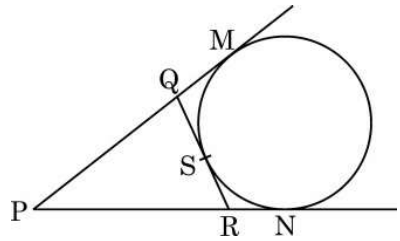
खण्ड – ग

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

11. 8 मी. ऊँचे भवन के शिखर से एक केबल टॉवर के शिखर का उन्नयन कोण 60° और इसके पाद का अवनमन कोण 45° है। टॉवर की ऊँचाई ज्ञात कीजिए। ($\sqrt{3} = 1.732$ लीजिए) **4**

12. (क) आकृति-2 में, यदि एक वृत्त, त्रिभुज PQR की एक भुजा QR को बिंदु S पर स्पर्श करता है और वर्धित भुजाओं PQ और PR को क्रमश: M और N पर स्पर्श करता है, तो सिद्ध कीजिए कि; **4**

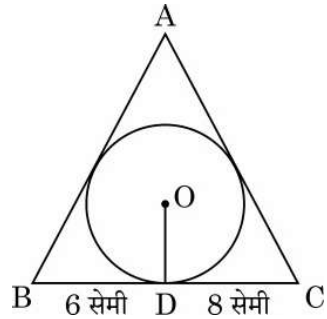
$$PM = \frac{1}{2}(PQ + QR + PR)$$



आकृति – 2

अथवा

(ख) आकृति 3 में 4 सेमी त्रिज्या वाले एक वृत्त के परिगत एक त्रिभुज ABC इस प्रकार खींचा गया है कि रेखाखण्ड BD और DC, जिनमें स्पर्श बिंदु D द्वारा BC विभाजित है, की लंबाइयाँ क्रमश: 6 सेमी तथा 8 सेमी हैं। यदि ΔABC का क्षेत्रफल 84 वर्ग सेमी है, तो भुजाओं AB तथा AC की लंबाइयाँ ज्ञात कीजिए। **4**



आकृति – 3

10. Construct a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°. **3**

SECTION – C

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

11. From the top of an 8 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. (Take $\sqrt{3} = 1.732$). **4**

12. (a) In Fig.-2, if a circle touches the side QR of ΔPQR at S and extended sides PQ and PR at M and N, respectively, **4**

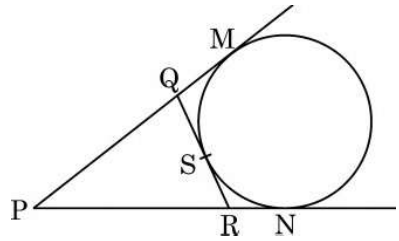


Fig. 2

prove that $PM = \frac{1}{2}(PQ + QR + PR)$

OR

(b) In Fig. 3, a triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 6 cm and 8 cm respectively. If the area of ΔABC is 84 cm^2, find the lengths of sides AB and AC. **4**

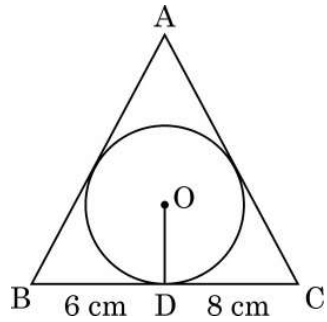
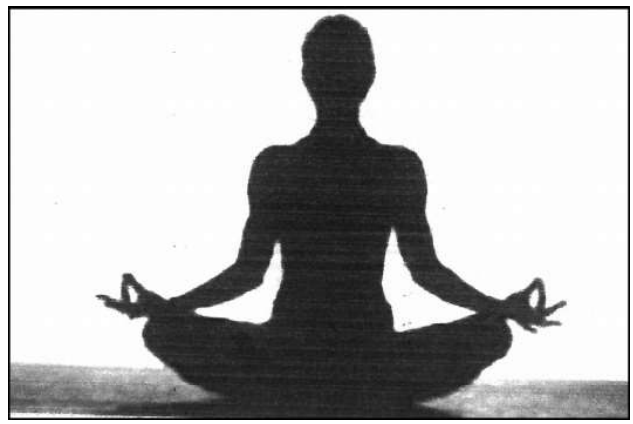


Fig. 3

प्रकरण अध्ययन – 1

13. 'योग' एक प्राचीन अभ्यास है जो ध्यान और व्यायाम का एक रूप है । योग का अभ्यास करने से हम न केवल अपने शरीर को स्वस्थ बनाते हैं बल्कि आत्मिक शांति और मन की शांति भी प्राप्त करते हैं । अंतर्राष्ट्रीय योग दिवस 2015 से हर वर्ष 21 जून को मनाया जाता है ।

योग को बढ़ावा देने हेतु पुणे की ग्रीन पार्क सोसायटी ने अपनी सोसायटी में एक 7-दिवसीय योग शिविर का आयोजन किया । इस शिविर में नामांकित विभिन्न आयु वर्ग के लोगों की संख्या नीचे दी गई हैं :



आयु वर्ग	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
लोगों की संख्या	8	10	15	25	40	24	18

उपरोक्त के आधार पर, निम्न ज्ञात कीजिए :

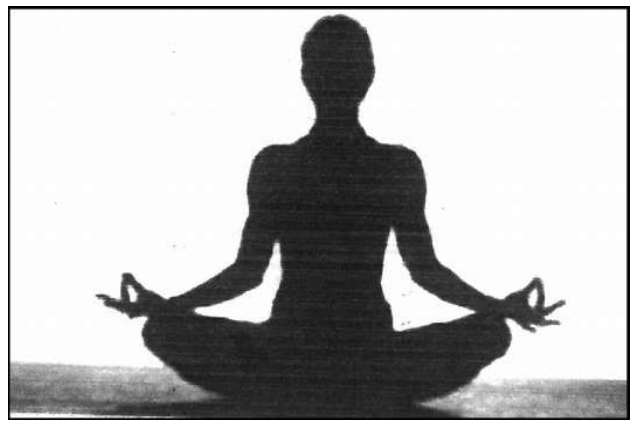
(a) शिविर में नामांकित विभिन्न आयु वर्ग के लोगों की माध्यक आयु ज्ञात कीजिए । **2**

(b) यदि आयु–वर्ग 65 – 75 में x अधिक लोगों ने शिविर में नामांकन कराया होता, तो माध्य आयु 58 वर्ष होती । x का मान ज्ञात कीजिए । **2**

Case Study – 1

13. Yoga is an ancient practice which is a form of meditation and exercise. By practising yoga, we not even make our body healthy but also achieve inner peace and calmness. The International Yoga Day is celebrated on 21st of June every year since 2015.

To promote Yoga, Green park society in Pune organised a 7-day Yoga camp in their society. The number of people of different age groups who enrolled for this camp is given as follows :



Age Group	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
Number of People	8	10	15	25	40	24	18

Based on the above, find the following :

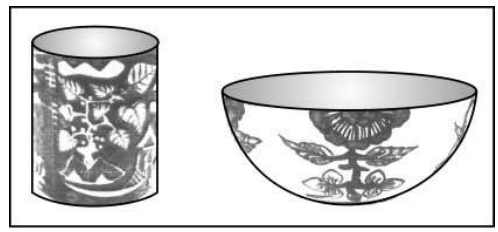
(a) Find the median age of people enrolled for the camp. **2**

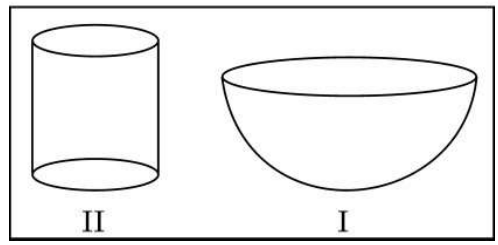
(b) If x more people of age group 65 – 75 had enrolled for the camp, the mean age would have been 58. Find the value of x. **2**

प्रकरण अध्ययन – 2

14. खुर्जा भारतीय राज्य उत्तर प्रदेश का एक शहर है जो मिट्टी के बर्तनों के लिए प्रसिद्ध है । खुर्जा पॉटरी पारंपरिक भारतीय मिट्टी के बर्तनों का काम है जिसने विभिन्न प्रकार के चाय के सेट, क्रॉकरी और सिरेमिक टाइल के कामों के साथ भारतीयों के साथ–साथ विदेशियों को भी आकर्षित किया है । देश में उपयोग किए जाने वाले सिरेमिक के एक बड़े हिस्से की आपूर्ति खुर्जा द्वारा की जाती है और इसे "सिरेमिक टाऊन" भी कहा जाता है ।

बुलंदशहर के निजी स्कूलों में से एक के कक्षा 10 के छात्रों के लिए खुर्जा में शैक्षिक भ्रमण का आयोजन किया । यात्रा को लेकर छात्र बहुत उत्साहित थे । खुर्जा के मिट्टी से बनी कुछ वस्तुएँ नीचे दिखाई गई हैं ।





छात्रों को इन वस्तुओं के आकार बहुत दिलचस्प लगे और वे उन्हें आसानी से गणितीय आकृतियों जैसे गोला, अर्ध–गोला, बेलन इत्यादि से जोड़ सकते थे । छात्रों के साथ आए गणित के शिक्षक ने निम्नलिखित प्रश्न पूछे :

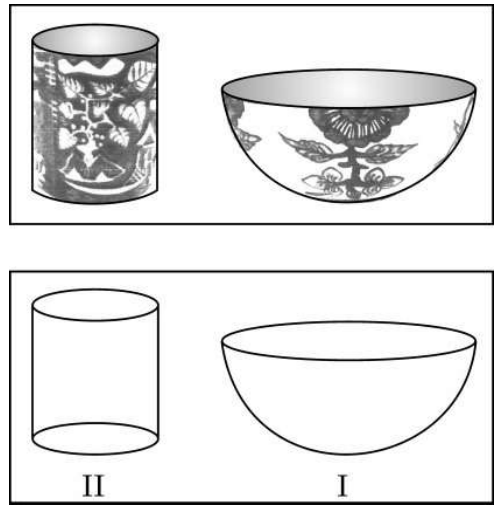
(a) अर्धगोलाकार कटोरे I, जो पूरा पानी से भरा है, की आंतरिक त्रिज्या 9 सेमी है और बेलनाकार जार II की त्रिज्या और ऊँचाई क्रमश: 1.5 सेमी और 4 सेमी हैं । यदि अर्धगोलाकार कटोरे का पूरा पानी बेलनाकार जारों में खाली करना हो, तो कितने बेलनाकार जारों की आवश्यकता होगी ? **2**

(b) यदि पानी से पूरे भरे हुए बेलनाकार जार में समान ऊँचाई और समान व्यास की एक शंक्वाकार कीप डुबाई जाये, तो जार से कितना पानी बाहर बह जाएगा ? **2**

Case Study – 2

14. Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'.

One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.



Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc. Maths teacher who was accompanying the students asked following questions :

(a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ? **2**

(b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ? **2**

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

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

[Paper Code : 30/4/3]

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 : 30/4/3]

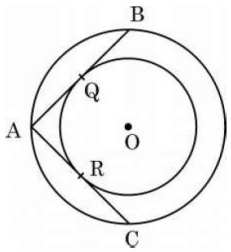
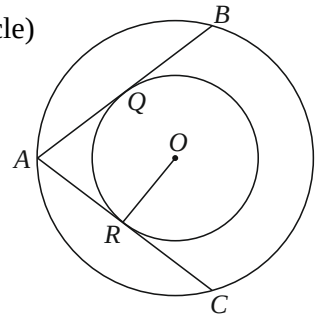
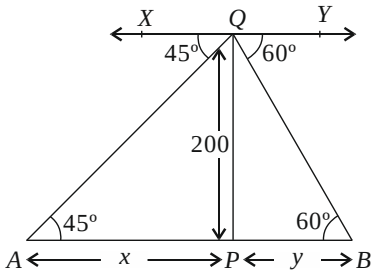
***Instructions* :**

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.

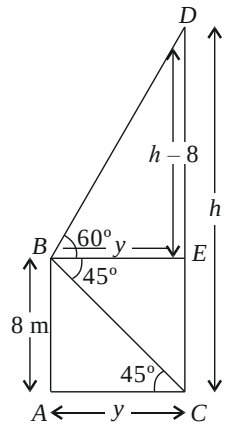
Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION—A	
1.(a)	Find the value of 'k' for which the quadratic equation $2kx^2 - 40x + 25 = 0$ has real and equal roots.	
Sol.	$2kx^2 - 40x + 25 = 0$ $a = 2k,\ b = -40,\ c = 25$ Q.E. has equal roots $\Rightarrow D = 0$ $b^2 - 4ac = 0 \Rightarrow 1600 - 200k = 0$ $k = 8$	1 1
	Or	
1.(b)	Solve for x : $\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x$.	
Sol.	$\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x$ $\frac{25x^2 + 4}{10} = 1 - 2x \Rightarrow 25x^2 + 4 = 10 - 20x$ $25x^2 + 20x - 6 = 0$ $a = 25, b = 20, c = -6$	½

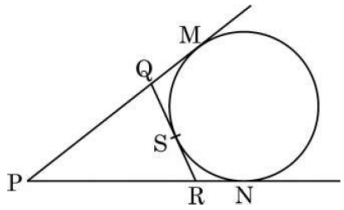
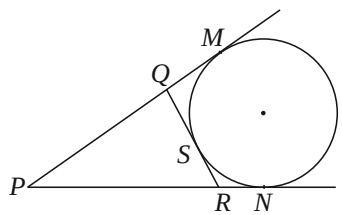
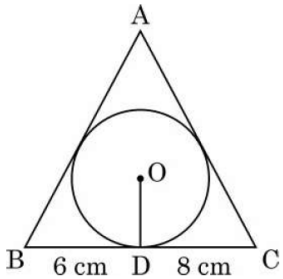
	$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{-20\pm\sqrt{400+600}}{2\times 25}$ $x=\frac{-20\pm\sqrt{1000}}{50}=\frac{-20\pm 10\sqrt{10}}{50}$ $x=\frac{-2\pm\sqrt{10}}{5}$; $x=\frac{-2+\sqrt{10}}{5},\frac{-2-\sqrt{10}}{5}$	1 ½
2. **Sol.**	The mode of a grouped frequency distribution is 75 and the modal class is 65-80. The frequency of the class preceding the modal class is 6 and the frequency of the class succeeding the modal class is 8. Find the frequency of the modal class. Mode = 75, Modal class = 65 – 80 $l = 65$ $f_0 = 6$, $f_2 = 8$ Mode = $l+\frac{f_1-f_0}{2f_1-f_0-f_2}\times h$ $75 = 65+\left(\frac{f_1-6}{2f_1-6-8}\right)\times 15$ $4f_1-28 = 3f_1-18 \Rightarrow f_1 = 10$ ∴ Frequency of modal class is 10.	½ 1 ½
3.(a) **Sol.**	The curved surface area of a right circular cylinder is 176 sq cm and its volume is 1232 cu cm. What is the height of the cylinder ? Let h be the height of cylinder CSA of cylinder = $176 \Rightarrow 2\pi rh = 176 \ldots (i)$ Volume of cylinder = $1232 \Rightarrow \pi r^2 h = 1232$ on dividing, $\frac{\cancel{\pi} r^{\cancel{2}} \cancel{h}}{2\cancel{\pi}\cancel{r}\cancel{h}}=\frac{1232}{176}$ we get, r = 14 cm $\therefore (i) \Rightarrow 2\times\frac{22}{\cancel{7}}\times\cancel{14}^{2}\times h = 176$ $\Rightarrow h = 2$ cm	½ ½ ½ ½
	Or	
3.(b) **Sol.**	The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere. Diameter of sphere = side of cube = 21 cm	

	$\therefore$ radius $r = \frac{21}{2}$ cm Volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$ $= 4851\,\text{cm}^3$	½ 1 ½
4. **Sol.**	Find the sum of all 11 terms of an A.P. whose 6th term is 30. $n = 11$ $a_6 = 30$ $a + 5d = 30 \ldots (i)$ Now $S_{11} = \frac{11}{2}[2a + (11-1)d]$ $= \frac{11}{2}[2a + 10d] = \frac{11}{\cancel{2}} \times \cancel{2}[a + 5d]$ $= 11 \times 30$ [Using (i)] $= 330$	½ ½ ½ ½
5. **Sol.**	Find the median of the following distribution : **Marks** | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 **Number of students** | 5 | 8 | 20 | 15 | 7 | 5 *Marks* | *No. of Students* (f) | *cf* 0–10 | 5 | 5 10–20 | 8 | 13 20–30 | 20 | 33 30–40 | 15 | 48 40–50 | 7 | 55 50–60 | 5 | 60 $N = 60$, $\frac{N}{2} = 30$, $\therefore$ Median class is 20–30 $l = 20$, $c = 13$, $f = 33$, $h = 10$ Median $= l + \left(\frac{\frac{N}{2} - c}{f}\right) \times h$	½ for table ½

	$= 20 + \left(\frac{30-13}{20}\right) \times 10$ $= 20 + \frac{17}{2} = 20 + 8 \cdot 5$ $= 28 \cdot 5$	½ ½
6.	In Fig. 1, there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if AQ = 5 cm.  	
Sol.	$AQ = AR$ (tangents drawn from external point to the circle) $\therefore AR = 5$ cm Join OR $\therefore OR \perp AC$ (radius tangent) Now AC is the chord of larger circle and we know that perpendicular from the centre bisects the chord $\therefore AR = RC = 5$ cm $\Rightarrow$ AC = 5 + 5 = 10 cm  	½ ½ ½ ½
	SECTION—B	
7.	An aeroplane at an altitude of 200 metres observes the angles of depression of opposite points on the two banks of a river to be 45° and 60°. Find the width of the river. (Use $\sqrt{3} = 1.732$)	
Sol.	Correct Figure  $AB =$ width of river $PQ =$ Height of aeroplane = 200 m $\angle XQA = \angle QAP = 45°$ $\angle YQB = \angle QBP = 60°$ Let $AP = x$, $BP = y$ In ΔAQP, $\tan 45° = \frac{200}{x} \Rightarrow x = 200$ In ΔBQP, $\tan 45° = \frac{200}{y} \Rightarrow y\sqrt{3} = 200$	1 ½

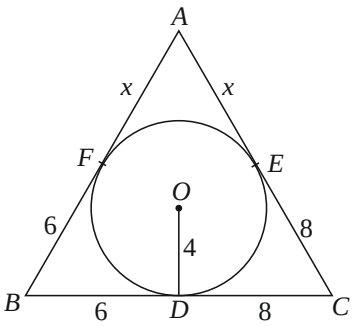
	$y=\frac{200}{\sqrt{3}}=\frac{200\sqrt{3}}{3}$ $\therefore$ Width of river $=AB=x+y=200+\frac{200\sqrt{3}}{3}$ $AB=200+\frac{200(1\cdot732)}{3}$ $=200+\frac{346\cdot4}{3}=200+115\cdot46=315\cdot46$ m $\therefore$ Width of river $=315\cdot46$ m	½ ½ ½
8. **Sol.**	The sum of the first three terms of an A.P. is 33. If the product of first and third term exceeds the second term by 29, find the A.P. Let three terms of AP be $a-d$, a, $a+d$ Sum $=33\Rightarrow a-d+a+a+d=33$ $3a=33\Rightarrow a=11$ ATQ, $(a-d)(a+d)=a+29$ $a^2-d^2=11+29=40$ $121-d^2=40$ $d^2=121-40=81$ $d=\pm9$ When $d=9$, $a=11$; A.P. is 2, 11, 20, … When $d=-9$, $a=11$; A.P. is 20, 11, 2, …	 1 ½ ½ ½ ½
9.(a) **Sol.**	Find the value of 'p' for which the quadratic equation p$(x-4)(x-2)+(x-1)^2=0$ has real and equal roots. $p(x-4)(x-2)+(x-1)^2=0$ $p(x^2-6x+8)+x^2-2x+1=0$ $(p+1)x^2-(6p+2)x+(8p+1)=0$ $a=p+1,\ b=6p+2,\ c=8p+1$ For real and equal roots, $\therefore D=0\Rightarrow b^2-4ac=0$	 ½

	$\Rightarrow \quad (6p+2)^2 - 4(p+1)(8p+1) = 0$ $36p^2 + 24p + 4 - 4(8p^2 + 9p + 1) = 0$ $4p^2 - 12p = 0 \Rightarrow 4p(p-3) = 0$ $\Rightarrow \quad p = 0, 3$	1 1 ½
	Or	
9.(b)	Had Aarush scored 8 more marks in a Mathematics test, out of 35 marks, 7 times these marks would have been 4 less than square of his actual marks. How many marks did he get in the test ?	
Sol.	Let actual marks be x ATQ $\quad 7(x+8) = x^2 - 4$ $x^2 - 7x - 60 = 0$ $x^2 - 12x + 5x - 60 = 0$ $(x-12)(x+5) = 0$ $x = 12, \ x = -5$ (rejecting) ∴ Actual marks obtained by Aarush = 12	 1 ½ 1 ½
10.	Construct a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.	
Sol.	Correct Construction	3
	SECTION—C	
11.	From the top of an 8 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. (Take $\sqrt{3} = 1.732$).	
Sol.	Correct figure  Let AB = height of building = 8 m Let CD = height of tower = h m $\angle DBE = 60°$ $\angle ACB = \angle EBC = 45°$ $AC = BE = y$ (let) In right ΔABC, $\tan 45° = \frac{8}{AC}$ $1 = \frac{8}{AC}$ $\Rightarrow AC = 8 \text{ m} \Rightarrow y = 8 \text{ m}$ In right ΔBDE, $\tan 60° = \frac{h-8}{BE}$	1 1

	$\sqrt{3} = \frac{h-8}{y} \Rightarrow \sqrt{3}y = h-8$ $\sqrt{3}(8) = h-8$ $h = 8\sqrt{3}+8 = 8(\sqrt{3}+1)$ $h = 8(1\cdot732+1) = 8(2\cdot732) = 21\cdot856$ m $\therefore$ Height of tower = 21·856 m	 1 ½ ½
12.(a)	In Fig.-2, if a circle touches the side QR of ΔPQR at S and extended sides PQ and PR at M and N, respectively, then  **Fig. 2** prove that PM = $\frac{1}{2}$(PQ + QR + PR)	
Sol.	We know that tangents drawn from the external point to the circle are equal $\therefore\ QS = QM$ $RS = RN$ $PM = PN$  Now $2PM = PM + PN$ $= (PQ + QM) + (PR + RN)$ $= PQ + QS + PR + RS$ $= PQ + (QS + RS) + PR$ $= PQ + QR + PR$ $\therefore$ PM $= \frac{1}{2}(PQ + QR + PR)$	 1 1 ½ 1 ½
	Or	
12.(b)	In Fig. 3, a triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 6 cm and 8 cm respectively. If the area of ΔABC is 84 cm^2, find the lengths of sides AB and AC.  	

Sol.

$BF = BD = 6$ cm
$CE = DC = 8$ cm
Let $AF = AE = x$ cm



1

$\Rightarrow AB = (6+x)$ cm, $AC = (8+x)$ cm & $BC = 14$ cm

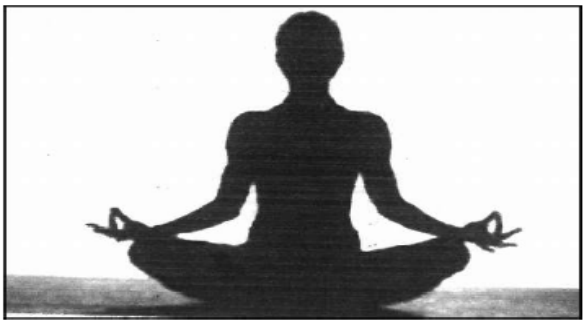
Ar $(\Delta ABC) = \frac{1}{2}[p] \cdot r = \frac{1}{2} \times (28 + 2x) \times 4 = 84$ 1

$\Rightarrow 14 + x = 21 \Rightarrow x = 7$ cm 1

$\Rightarrow AB = 13$ cm, $AC = 15$ cm ½+½

13. Yoga is an ancient practice which is a form of meditation and exercise. By practising yoga, we not even make our body healthy but also achieve inner peace and calmness. The International Yoga Day is celebrated on 21st of June every year since 2015.

To promote Yoga, Green park society in Pune organised a 7-day Yoga camp in their society. The number of people of different age groups who enrolled for this camp is given as follows :



Age Group	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
Number of People	8	10	15	25	40	24	18

Based on the above, find the following :

(a) Find the median age of people enrolled for the camp.

(b) If x more people of age group 65 – 75 had enrolled for the camp, the mean age would have been 58. Find the value of x.

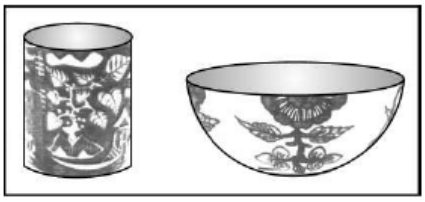
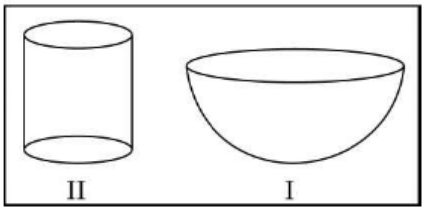
Sol.

(a)

Age Group	No. of people (f)	Cf
15–25	8	8
25–35	10	18
35–45	15	33
45–55	25	58
55–65	40	98
65–75	24	122
75–85	18	140

½ for table

$N = 140, \therefore \frac{N}{2} = 70$, which corresponds to 55–65

	∴ Median class = 55–65 ∴ $l = 55,\ f = 40,\ cf = 58,\ h = 10$ Median = $l + \dfrac{\frac{N}{2} - cf}{f} \times h$ $= 55 + \frac{70-58}{40} \times 10 = 55 + 3$ ∴ Median = 58	½ 1
	(b) **Any student who has attempted the question (even if deleted) will be awarded full credit of 2 marks**	
14.	Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'. One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.   II I Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc. Maths teacher who was accompanying the students asked following questions : (a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ? (b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ?	
Sol.	*(a)* Cylinder— $h = 4$ cm, $r = 1 \cdot 5$ cm $= \frac{3}{2}$ cm Volume of cylinder $= \pi r^2 h$	

	$= \pi \times (1.5)^2 \times 4\ cm^3$ Radius of hemisphere $R = 9$ cm Volume of hemisphere $= \frac{2}{3}\pi R^3$ $= \frac{2}{3} \times \pi \times (9)^3 cm^3$ Let the number of cylindrical jars be n $\therefore n \times \pi \times (1.5)^2 \times 4 = \frac{2}{3} \times \pi \times (9)^3$ $\Rightarrow \mathrm{n} = \frac{9\times9\times9\times2}{4\times1.5\times1.5\times3} = 54$ $\therefore$ Number of cylindrical jars required $= 54$	½ ½ ½ ½
	(b) For conical funnel, $r = \frac{3}{2}\ cm$, $h = 4\ cm$ $\therefore$ Volume of conical funnel $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 4$ $= \frac{66}{7}\ cm^3$ of water will flow out.	½ 1 ½

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