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.

गणित (बुनियादी)
MATHEMATICS (BASIC)

निर्धारित समय : **3 घण्टे**
*Time allowed : **3 hours***

अधिकतम अंक : **80**
*Maximum Marks : **80***

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।

*Please check that this question paper contains **23** printed pages.*

(ii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।

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 **38** प्रश्न हैं ।

*Please check that this question paper contains **38** questions.*

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**

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 परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।

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.

सामान्य निर्देश :

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

(i) इस प्रश्न-पत्र में कुल *38* प्रश्न हैं । **सभी** प्रश्न अनिवार्य हैं ।

(ii) प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – खण्ड-**क, ख, ग, घ** तथा **ङ** ।

(iii) खण्ड – **क** में प्रश्न संख्या *1* से *18* तक बहुविकल्पीय तथा प्रश्न संख्या *19* एवं *20* अभिकथन एवं तर्क आधारित **एक-एक** अंक के प्रश्न हैं ।

(iv) खण्ड – **ख** में प्रश्न संख्या *21* से *25* तक अति लघु-उत्तरीय-I (VSA-I) प्रकार के **दो-दो** अंकों के प्रश्न हैं ।

(v) खण्ड – **ग** में प्रश्न संख्या *26* से *31* तक लघु-उत्तरीय-II (SA-II) प्रकार के **तीन-तीन** अंकों के प्रश्न हैं ।

(vi) खण्ड – **घ** में प्रश्न संख्या *32* से *35* तक दीर्घ-उत्तरीय प्रकार के **पाँच-पाँच** अंकों के प्रश्न हैं ।

(vii) खण्ड – **ङ** में प्रश्न संख्या *36* से *38* **स्रोत / प्रकरण** इकाई आधारित **चार-चार** अंकों के प्रश्न हैं । आंतरिक विकल्प **दो-दो** अंकों के प्रश्न में दिया गया है ।

(viii) प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड – **ख** के *2* प्रश्नों में, खण्ड – **ग** के *2* प्रश्नों में, खण्ड – **घ** के *2* प्रश्नों में तथा खण्ड-**ङ** के *3* प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।

(ix) जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाएँ । यदि आवश्यक हो तो $\pi = \dfrac{22}{7}$ लें ।

(x) कैल्कुलेटर का उपयोग वर्जित है ।

General Instructions :

Read the following instructions vary carefully and follow them :

(i) *This Question Paper contains 38 questions. All questions are compulsory.*

(ii) *Question Paper is divided into FIVE Sections – Section A, B, C, D and E.*

(iii) *In Section–A question number 1 to 18 are Multiple Choice Questions (MCQs) and question number 19 & 20 are Assertion-Reason based questions of 1 mark each.*

(iv) *In Section–B question number 21 to 25 are Very Short Answer-I (VSA-I) type questions of 2 marks each.*

(v) *In Section–C question number 26 to 31 are Short Answer-II (SA-II) type questions carrying 3 marks each.*

(vi) *In Section–D question number 32 to 35 are Long Answer (LA) type questions carrying 5 marks each.*

(vii) *In Section–E question number 36 to 38 are Case Study Based integrated units of Assessment questions carrying 4 marks each. Internal choice is provided in 2 marks question in each case-study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section–B, 2 questions in Section–C, 2 questions in Section–D and 3 questions in Section–E.*

(ix) *Draw neat figures wherever required. Take $\pi = \dfrac{22}{7}$ wherever required if not stated.*

(x) *Use of Calculators is NOT allowed.*

खण्ड – क में **20** प्रश्न हैं और प्रत्येक प्रश्न **1** अंक का है ।

1. 100 m बाधा दौड़ को पूरी के लिए 150 एथलीटों द्वारा लिया गया समय, सेकंड में, नीचे दिया गया है : **1**

समय (से. में)	13-14	14-15	15-16	16-17	17-18	18-19
एथलीटों की संख्या	2	4	5	71	48	20

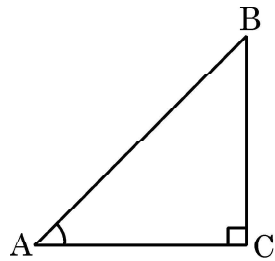17 सेकंड से कम समय में दौड़ पूरी करने वाले एथलीटों की संख्या है :

(a) 11   (b) 71

(c) 82   (d) 68

2. बिन्दु (5, 0) की मूल बिंदु से दूरी है **1**

(a) 0   (b) 5

(c) $\sqrt{5}$ (d) 5^2

3. त्रिभुज ABC में, C समकोण है । यदि $\tan A = \dfrac{8}{7}$ है, तो cot B का मान है : **1**

(a) $\dfrac{7}{8}$ (b) $\dfrac{8}{7}$

(c) $\dfrac{7}{\sqrt{113}}$ (d) $\dfrac{8}{\sqrt{113}}$

Section – A
(Multiple Choice Questions)

Section – A consists of **20** questions of **1** mark each.

1. The time, in seconds, taken by 150 athletes to run a 100 m hurdle race are tabulated below :   **1**

Time (sec.)	13-14	14-15	15-16	16-17	17-18	18-19
Number of Athletes	2	4	5	71	48	20

The number of athletes who completed the race in less than 17 seconds is

(a)   11

(b)   71

(c)   82

(d)   68

2. The distance of the point (5, 0) from the origin is   **1**

(a)   0

(b)   5

(c) $\sqrt{5}$

(d) 5^2

3. In $\triangle$ABC, right angled at C, if $\tan A = \dfrac{8}{7}$, then the value of cot B is   **1**
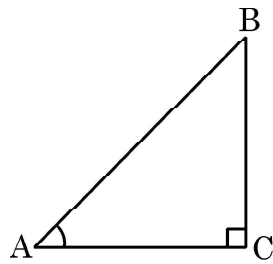
(a) $\dfrac{7}{8}$

(b) $\dfrac{8}{7}$

(c) $\dfrac{7}{\sqrt{113}}$

(d) $\dfrac{8}{\sqrt{113}}$

4. 7 cm त्रिज्या वाले वृत्त के एक चतुर्थांश का क्षेत्रफल है : **1**

   (a) 154 cm²   (b) 77 cm²

   (c) $\frac{77}{2}$ cm²   (d) $\frac{77}{4}$ cm²

5. यदि HCF (72, 120) = 24 है, तो LCM (72, 120) है : **1**

   (a) 72   (b) 120

   (c) 360   (d) 9640

6. 52 ताश के पत्तों की अच्छी प्रकार से फेंटी गई एक गड्डी में से एक पत्ता यादृच्छया निकाला जाता है । इस पत्ते के काला बादशाह होने की प्रायिकता क्या है ? **1**

   (a) $\frac{1}{26}$ (b) $\frac{1}{13}$

   (c) $\frac{1}{52}$ (d) $\frac{1}{2}$

7. किसी बहुपद f(x) के लिए, y = f(x) का ग्राफ दिया गया है । **1**
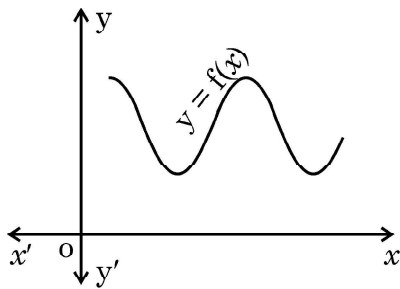
   f(x) के शून्यकों की संख्या है :

   (a) 0   (b) 2

   (c) 3   (d) 4

4. Area of a quadrant of a circle of radius 7 cm is   1

   (a) 154 cm^2 (b) 77 cm^2

   (c) $\dfrac{77}{2}$ cm^2 (d) $\dfrac{77}{4}$ cm^2

5. If HCF (72, 120) = 24, then LCM (72, 120) is   1
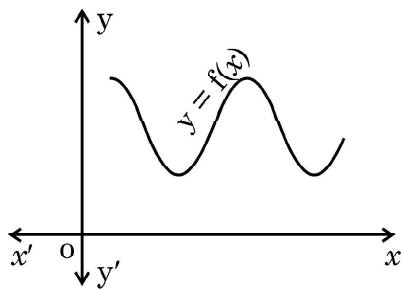
   (a) 72   (b) 120

   (c) 360   (d) 9640

6. One card is drawn at random from a well-shuffled deck of 52 playing
   cards. What is the probability of getting a black king ?   1

   (a) $\dfrac{1}{26}$ (b) $\dfrac{1}{13}$

   (c) $\dfrac{1}{52}$ (d) $\dfrac{1}{2}$

7. The graph of y = f(x) is shown in the figure for some polynomial f(x).   1

   The number of zeroes of f(x) is

   (a) 0   (b) 2

   (c) 3   (d) 4

8. यदि बिन्दु (6, k), समीकरण $x - 3y + 6 = 0$ से निरूपित रेखा पर स्थित हो, तो k का मान है   1

   (a) − 4   (b) 12

   (c) −12   (d) 4

9. संख्या 2304 का अभाज्य गुणनखंडन है :   1

   (a) $2^8 \times 3^2$ (b) $2^7 \times 3^3$

   (c) $2^8 \times 3^1$ (d) $2^7 \times 3^2$

10. यदि n एक प्राकृत संख्या है, तो 8^n निम्न में से किस अंक पर समाप्त नहीं होता है ?   1

   (a) 0   (b) 2

   (c) 4   (d) 6

11. पहली सात अभाज्य संख्याओं का माध्यक है :   1

   (a) 5   (b) 7

   (c) 11   (d) 13

12. यदि बिंदु (2, 4), बिंदुओं (6, 3) और (a, 5) को जोड़ने वाले रेखाखंड का मध्य−बिंदु हो, तो a का मान होगा :   1

   (a) 2   (b) 4

   (c) − 4   (d) −2

13. k का मान जिसके लिए रैखिक समीकरण युग्म $kx + 2y = 5$ और $3x + 4y = 1$ का कोई हल नहीं है, है :   1

   (a) $k = \dfrac{3}{2}$ (b) $k \neq \dfrac{3}{2}$

   (c) $k \neq \dfrac{2}{3}$ (d) $k = 15$

8. The value of k, if (6, k) lies on the line represented by $x - 3y + 6 = 0$, is 1

(a) -4 (b) 12

(c) -12 (d) 4

9. The prime factorisation of the number 2304 is 1

(a) $2^8 \times 3^2$ (b) $2^7 \times 3^3$

(c) $2^8 \times 3^1$ (d) $2^7 \times 3^2$

10. If n is a natural number, then 8^n cannot end with digit 1

(a) 0 (b) 2

(c) 4 (d) 6

11. The median of first seven prime numbers is 1

(a) 5 (b) 7

(c) 11 (d) 13

12. If (2, 4) is the mid-point of the line-segment joining (6, 3) and (a, 5), then the value of a is 1

(a) 2 (b) 4

(c) -4 (d) -2

13. The value of 'k' for which the system of equations $kx + 2y = 5$ and $3x + 4y = 1$ have no solution, is 1

(a) $k = \dfrac{3}{2}$ (b) $k \neq \dfrac{3}{2}$

(c) $k \neq \dfrac{2}{3}$ (d) $k = 15$

14. दी गई आकृति में, बिंदु P से केंद्र O वाले एक वृत्त पर PQ और PR स्पर्श-रेखाएँ हैं जिसमें ∠QPR = 65° है। ∠QOR का माप है : **1**
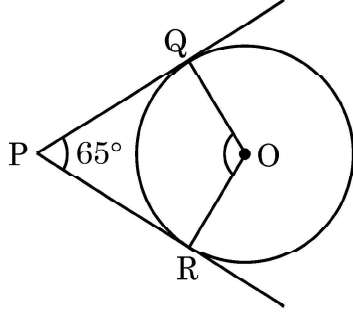
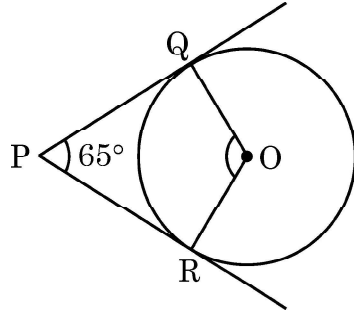(a) 65°   (b) 125°

(c) 115°   (d) 90°

15. द्विघात बहुपद $16x^2 - 9$ के शून्यक हैं : **1**

(a) $\dfrac{3}{4}, \dfrac{3}{4}$ (b) $-\dfrac{3}{4}, \dfrac{3}{4}$

(c) $\dfrac{9}{16}, \dfrac{9}{16}$ (d) $-\dfrac{3}{4}, -\dfrac{3}{4}$

16. यदि $-5, x, 3$ किसी A.P. के तीन क्रमागत पद हैं, तो x का मान होगा : **1**

(a) −2   (b) 2

(c) 1   (d) −1

17. एक निष्पक्ष पासा फेंका जाता है। विषम अभाज्य संख्या प्राप्त होने की प्रायिकता होगी : **1**

(a) $\dfrac{1}{6}$ (b) $\dfrac{1}{2}$

(c) $\dfrac{2}{3}$ (d) $\dfrac{1}{3}$

18. यदि $6, 7, x, 8, y, 14$ का माध्य 9 हो, तो **1**

(a) $x + y = 21$ (b) $x + y = 19$

(c) $x - y = 19$ (d) $x - y = 21$

14. In the given figure, PQ and PR are tangents drawn from P to the circle with centre O such that $\angle QPR = 65°$. The measure of $\angle QOR$ is.　　　　**1**

    (a)　65°　　　　　　　　　　　(b)　125°

    (c)　115°　　　　　　　　　　(d)　90°

15. The zeroes of the quadratic polynomial $16x^2 - 9$ are :　　　　**1**

    (a)　$\dfrac{3}{4}, \dfrac{3}{4}$　　　　　　　　　(b)　$-\dfrac{3}{4}, \dfrac{3}{4}$

    (c)　$\dfrac{9}{16}, \dfrac{9}{16}$　　　　　　　　(d)　$-\dfrac{3}{4}, -\dfrac{3}{4}$

16. If $-5, x, 3$ are three consecutive terms of an A.P., then the value of x is　　　　**1**

    (a)　–2　　　　　　　　　　　(b)　2

    (c)　1　　　　　　　　　　　　(d)　–1

17. An unbiased die is thrown. The probability of getting an odd prime number is　　　　**1**

    (a)　$\dfrac{1}{6}$　　　　　　　　　　　(b)　$\dfrac{1}{2}$

    (c)　$\dfrac{2}{3}$　　　　　　　　　　　(d)　$\dfrac{1}{3}$

18. If the mean of 6, 7, x, 8, y, 14 is 9, then　　　　**1**

    (a)　$x + y = 21$　　　　　　　　(b)　$x + y = 19$

    (c)　$x - y = 19$　　　　　　　　(d)　$x - y = 21$

प्रश्न संख्या 19 तथा 20 के लिए निर्देश : प्रश्न **19** तथा **20** में एक अभिकथन (A) के बाद एक तर्क कथन (R) दिया गया है । निम्न में से सही विकल्प चुनिए :

(a) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं और तर्क (R), अभिकथन (A) की पूरी व्याख्या करता है ।

(b) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं, परंतु तर्क (R), अभिकथन (A) की पूरी व्याख्या नहीं करता है ।

(c) अभिकथन (A) सत्य है, परन्तु तर्क (R) सत्य नहीं है ।

(d) अभिकथन (A) असत्य है, परन्तु तर्क (R) सत्य है ।

19. **अभिकथन (A) :** लीप वर्ष में 53 रविवार होने की प्रायिकता $\frac{2}{7}$ है ।   1

तर्क (R) : गैर–लीप वर्ष में 53 रविवार होने की प्रायिकता $\frac{1}{7}$ है ।

20. **अभिकथन (A) :** $0 < \theta \leq 90°$ के लिए, $\mathrm{cosec}\,\theta - \cot\theta$ और $\mathrm{cosec}\,\theta + \cot\theta$ परस्पर एक दूसरे के व्युत्क्रम हैं ।   1

तर्क (R) : $\cot^2\theta - \mathrm{cosec}^2\theta = 1$

खण्ड – ख

खण्ड–ख में अति लघु-उत्तरीय (VSA) प्रश्न हैं और प्रत्येक प्रश्न **2** अंकों का है ।

21. मान ज्ञात कीजिए : $5\,\mathrm{cosec}^2\,45° - 3\sin^2 90° + 5\cos 0°$.   2

22. (a) एक द्विघात बहुपद ज्ञात कीजिए जिसके शून्यक 6 और –3 हों ।   2

अथवा

(b) बहुपद $x^2 + 4x - 12$ के शून्यक ज्ञात कीजिए ।   2

23. (a) k का वह मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $5x^2 - 10x + \mathrm{k} = 0$ के मूल वास्तविक और बराबर हों ।   2

अथवा

(b) द्विघात समीकरण $3x^2 - 8x - (2\mathrm{k} + 1) = 0$ का एक मूल यदि दूसरे मूल का सात गुना हो, तो k का मान ज्ञात कीजिए ।   2

Directions for Q. 19 & Q. 20 : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

(a) Both Assertion (A) and Reason (R) are true; and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

19. **Assertion (A) :** The probability that a leap year has 53 Sundays is $\dfrac{2}{7}$.   1

   Reason (R) : The probability that a non-leap year has 53 Sundays is $\dfrac{1}{7}$.

20. **Assertion (A) :** For $0 < \theta \le 90°$, $\operatorname{cosec} \theta - \cot \theta$ and $\operatorname{cosec} \theta + \cot \theta$ are reciprocal of each other.   1

   Reason (R) : $\cot^2 \theta - \operatorname{cosec}^2 \theta = 1$

Section – B

Section – B consists of Very Short Answer (VSA) type questions of **2** marks each.

21. Evaluate : $5 \operatorname{cosec}^2 45° - 3 \sin^2 90° + 5 \cos 0°$.   2

22. (a) Find a quadratic polynomial whose zeroes are 6 and –3.   2

   OR

   (b) Find the zeroes of the polynomial $x^2 + 4x - 12$.   2

23. (a) Find the value of k for which the roots of the quadratic equation $5x^2 - 10x + k = 0$ are real and equal.   2

   OR

   (b) If one root of the quadratic equation $3x^2 - 8x - (2k + 1) = 0$ is seven times the other, then find the value of k.   2

24. एक पेटी में 20 डिस्क (discs) हैं, जिन पर 1 से 20 तक की संख्याएँ अंकित हैं । यदि इस पेटी में से एक डिस्क यादृच्छया निकाली जाती है, तो प्रायिकता ज्ञात कीजिए कि इस डिस्क पर अंकित संख्या होगी :

    (i) 2 – अंकों की संख्या

    (ii) 10 से कम की संख्या   1 + 1

25. एक बिंदु P से, जो एक वृत्त के केंद्र से 25 cm दूरी पर है, वृत्त पर स्पर्श-रेखा की लम्बाई 24 cm है । वृत्त की त्रिज्या ज्ञात कीजिए ।   2

खण्ड – ग

खण्ड – ग में लघु उत्तर (SA) प्रकार के प्रश्न है और प्रत्येक प्रश्न 3 अंकों का है ।

26. 3 वर्ष पूर्व वरुण की आयु (वर्षों में) का व्युत्क्रम और अब से 5 वर्ष पश्चात् उसकी आयु के व्युत्क्रम का योग $\frac{1}{3}$ है । इसकी वर्तमान आयु ज्ञात कीजिए ।   3

27. विद्यार्थियों के एक समूह द्वारा एक मोहल्ले के 20 परिवारों पर किए गए सर्वेक्षण के परिणामस्वरूप विभिन्न परिवारों के सदस्यों की संख्या से संबंधित निम्नलिखित आँकड़े प्राप्त हुए :   3

परिवार माप	1-3	3-5	5-7	7-9	9-11
परिवारों की संख्या	7	8	2	2	1

इन आँकड़ों का माध्यक ज्ञात कीजिए ।

28. (a) समांतर चतुर्भुज ABCD की बढ़ाई गई भुजा AD पर स्थित E एक बिंदु है तथा BE भुजा CD को F पर प्रतिच्छेद करती है । दर्शाइए कि ΔABE ~ ΔCFB है ।   3

अथवा
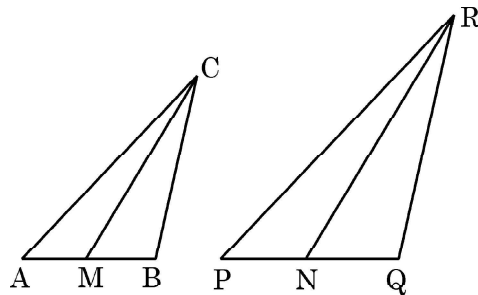
    (b) दी गई आकृति में, CM और RN त्रिभुजों ABC और PQR की क्रमशः माध्यिकाएँ हैं । यदि ΔABC ~ ΔPQR है, तो सिद्ध कीजिए कि ΔAMC ~ ΔPNR है ।   3

29. बिंदुओं (5, 3) और (4, 5) को जोड़ने वाले रेखाखंड का सम-त्रिभाजन करने वाले बिंदुओं के निर्देशांक ज्ञात कीजिए ।   3

24. A box contains 20 discs which are numbered from 1 to 20. If one disc is drawn at random from the box, then find the probability that the number on the drawn disc is a

   (i)   2-digit number

   (ii) number less than 10   **1 + 1**

25. From a point P, the length of the tangent to a circle is 24 cm and the distance of P from the centre of the circle is 25 cm. Find the radius of the circle.   **2**

Section – C

Section – C consists of Short Answer (SA) type questions of **3** marks each.

26. The sum of the reciprocals of Varun's age (in years) 3 years ago and 5 years from now is $\frac{1}{3}$. Find his present age.   **3**

27. A survey conducted on 20 households in a locality by a group of students resulted in the following frequency table for the number of family members in a household :   **3**

Family size	1-3	3-5	5-7	7-9	9-11
Number of Families	7	8	2	2	1

   Find the median of this data.

28. (a) E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that ΔABE ~ ΔCFB.   **3**

OR
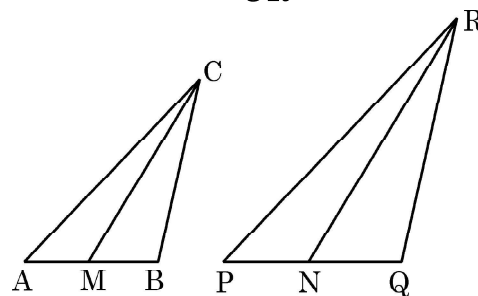
   (b) In the given figure, CM and RN are respectively the medians of ΔABC and ΔPQR. If ΔABC ~ ΔPQR, then prove that ΔAMC ~ ΔPNR.   **3**

29. Find the co-ordinates of the points of trisection of the line-segment joining the points (5, 3) and (4, 5).   **3**

30. सिद्ध कीजिए कि $3 - 2\sqrt{5}$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{5}$ एक अपरिमेय संख्या है । **3**

31. (a) सिद्ध कीजिए कि $\dfrac{\cot A - \cos A}{\cot A + \cos A} = \dfrac{\cos^2 A}{(1 + \sin A)^2}$ **3**

   अथवा

   (b) सिद्ध कीजिए कि $(\sec \theta + \tan \theta)(1 - \sin \theta) = \cos \theta$ **3**

खण्ड – घ

खण्ड – घ में दीर्घ उत्तर (LA) प्रकार के प्रश्न हैं और प्रत्येक प्रश्न के **5** अंक हैं ।

32. (a) 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 m की ऊँचाई पर हो, तो नदी की चौड़ाई ज्ञात कीजिए । ($\sqrt{3} = 1.73$ का प्रयोग करें) **5**

   अथवा

   (b) भूमि के एक बिंदु से एक 20 m ऊँचे भवन के शिखर पर लगी एक संचार मीनार के तल और शिखर के उन्नयन कोण क्रमशः $45°$ और $60°$ हैं । मीनार की ऊँचाई ज्ञात कीजिए । ($\sqrt{3} = 1.73$ का प्रयोग करें) **5**

33. एक A.P. का पहला पद 22 है, अन्तिम पद –6 तथा सभी पदों का योग 64 है । A.P. के पदों की संख्या ज्ञात कीजिए । सार्व-अन्तर भी ज्ञात कीजिए । **5**

34. एक आइसक्रीम से भरे शंकु की त्रिज्या 5 cm और ऊँचाई 10 cm है, आकृति में देखिए । ऐसे 7 शंकुओं में भरी आइसक्रीम का आयतन ज्ञात कीजिए । **5**
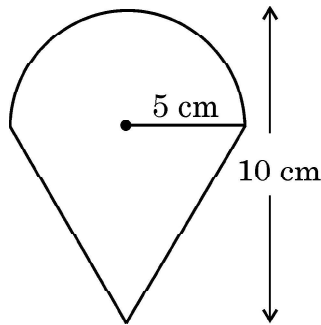
30. Prove that $3 - 2\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number. **3**

31. (a) Prove that $\dfrac{\cot A - \cos A}{\cot A + \cos A} = \dfrac{\cos^2 A}{(1 + \sin A)^2}$ **3**

   OR

   (b) Prove that $(\sec \theta + \tan \theta)(1 - \sin \theta) = \cos \theta$ **3**

Section – D

Section – D consists of Long Answer (LA) type questions of **5** marks each.

32. (a) 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, find the width of the river. (Use $\sqrt{3}$ = 1.73) **5**

   OR

   (b) From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower. (Use $\sqrt{3}$ = 1.73) **5**

33. The first term of an A.P. is 22, the last term is –6 and the sum of all the terms is 64. Find the number of terms of the A.P. Also, find the common difference. **5**

34. An ice-cream filled cone having radius 5 cm and height 10 cm is as shown in the figure. Find the volume of the ice-cream in 7 such cones. **5**
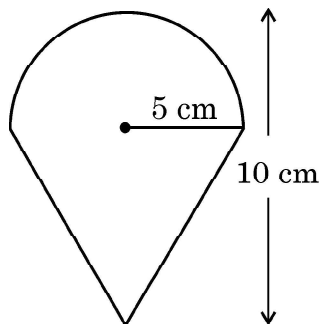
35. (a) सिद्ध कीजिए कि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो ये अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती है ।   **5**

अथवा

(b) दी गई आकृति में, $\dfrac{QR}{QS} = \dfrac{QT}{PR}$ तथा $\angle 1 = \angle 2$ है । सिद्ध कीजिए कि $\triangle PQS \sim \triangle TQR$.   **5**

खण्ड – ङ
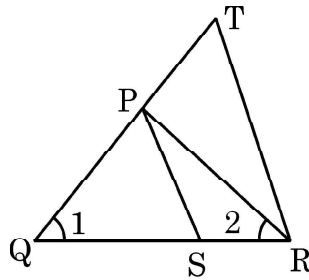
खण्ड – ङ में स्रोत/प्रकरण आधारित प्रश्न हैं और प्रत्येक प्रश्न के 4 अंक हैं ।

36. एक विद्यालय में 'पृथ्वी दिवस' सप्ताह के उद्घाटन के लिए स्वयंसेवकों को बैज दिए गए । आयोजकों ने इन बैजों को एक NGO से खरीदा था, जिसने इन बैजों को एक वृत्त के रूप में बनाया था, जो भुजा 8 cm के एक वर्ग में खुदा हुआ था

35. (a) Prove that a line drawn parallel to one side of a triangle to intersect the other two sides in distinct points, divides the two sides in the same ratio. **5**

<p style="text-align:center">**OR**</p>

(b) In the given figure, $\dfrac{QR}{QS} = \dfrac{QT}{PR}$ and $\angle 1 = \angle 2$. Prove that $\Delta PQS \sim \Delta TQR$. **5**
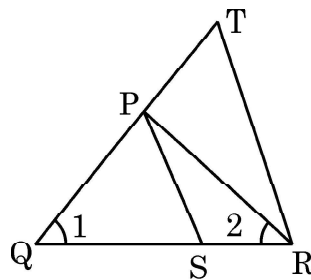
<p style="text-align:center">**Section – E**</p>

Section – E comprises of **3** Case Study questions each of **4** marks.

36. For the inauguration of 'Earth day' week in a school, badges were given to volunteers. Organisers purchased these badges from an NGO, who made these badges in the form of a circle inscribed in a square of side 8 cm.

O वृत्त का केंद्र तथा ∠AOB = 90° है :
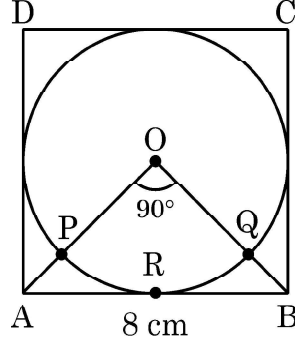
उपरोक्त के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) वर्ग ABCD का क्षेत्रफल कितना है ?   1

(ii) वर्ग ABCD के विकर्ण AC की लम्बाई कितनी है ?   1

(iii) त्रिज्य खंड OPRQO का क्षेत्रफल ज्ञात कीजिए ।   2

अथवा

(iii) वर्ग ABCD का बचा हुआ क्षेत्रफल ज्ञात कीजिए जब वृत्त के क्षेत्रफल को हटा दिया जाता है ।   2

37.

लोकेश, मुंबई में एक प्रोडक्शन मैनेजर, अपने दफ्तर आने के लिए हर रोज एक टैक्सी भाड़े पर लेता है । मुंबई में टैक्सी के भाड़े में एक नियत भाड़े के अतिरिक्त चली गई दूरी पर भाड़ा सम्मिलित किया जाता है । उसका दफ्तर, उसके घर से 10 km की दूरी पर है । 10 km दूरी के लिए वह ₹ 105 का भाड़ा देता है । घर वापस आते समय उसने दूसरा रास्ता अपनाया । उसने 15 km की दूरी तय की और उसके द्वारा भुगतान किया भाड़ा ₹ 155 था ।

O is the centre of the circle and ∠AOB = 90° :
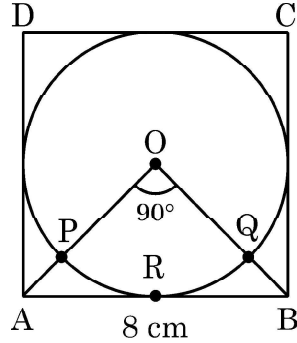
Based on the above information, answer the following questions :

(i)   What is the area of square ABCD ?   1

(ii) What is the length of diagonal AC of square ABCD ?   1

(iii) Find the area of sector OPRQO.   2

<div align="center">OR</div>

(iii) Find the area of remaining part of square ABCD when area of circle
      is excluded.   2

37.

Lokesh, a production manager in Mumbai, hires a taxi everyday to go to
his office. The taxi charges in Mumbai consists of a fixed charges together
with the charges for the distance covered. His office is at a distance of
10 km from his home. For a distance of 10 km to his office, Lokesh paid
₹ 105. While coming back home, he took another route. He covered a
distance of 15 km and the charges paid by him were ₹ 155.

उपरोक्त सूचना के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) नियत भाड़ा कितना है ? 1

(ii) प्रति km भाड़ा कितना है ? 1

(iii) यदि नियत भाड़ा ₹ 20 और प्रति km भाड़ा ₹ 10 हो, तो लोकेश को 10 km की दूरी तय करने के लिए कितना भाड़ा देना होगा ? 2

अथवा

(iii) यदि नियत भाड़ा और प्रति km भाड़ा वही है जो ऊपर (i) और (ii) में ज्ञात किए गए हैं, तो ज्ञात कीजिए कि लोकेश ने घर से दफ्तर की दूरी 10 km और दफ्तर से घर की दूरी 25 km तय करने के लिए कुल कितना भाड़ा दिया । 2

38.

Road
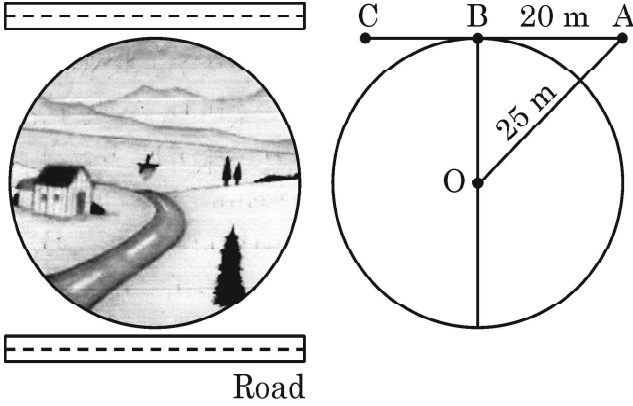
वृत्ताकार गाँव "धरमकोट" के लोग इसके सबसे नजदीक एक सड़क बनाना चाहते हैं । सड़क गाँव से होकर नहीं जा सकती । लेकिन लोग चाहते हैं कि सड़क गाँव के केंद्र से कम से कम दूरी पर हो । मान लीजिए कि सड़क A से शुरू होती है जो वृत्ताकार गाँव के बाहर है (जैसा चित्र में दिखाया गया है) और B पर वृत्ताकार गाँव की सीमा को इस प्रकार स्पर्श करती है कि AB = 20 m । गाँव के केंद्र O से बिंदु A की दूरी 25 m है ।

उपरोक्त सूचना के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) यदि B, AC का मध्य-बिन्दु है, तो AC की दूरी ज्ञात कीजिए । 1

(ii) गाँव के केंद्र से सड़क की न्यूनतम दूरी ज्ञात कीजिए । 1

(iii) गाँव की परिधि ज्ञात कीजिए । 2

अथवा

(iii) गाँव का क्षेत्रफल ज्ञात कीजिए । 2

Based on the above information, answer the following questions :

(i) What are the fixed charges ? 1

(ii) What are the charges per km ? 1

(iii) If fixed charges are ₹ 20 and charges per km are ₹ 10, then how much Lokesh have to pay for travelling a distance of 10 km ? 2

OR

(iii) Find the total amount paid by Lokesh for travelling 10 km from home to office and 25 km from office to home. [Fixed charges and charges per km are as in (i) & (ii). 2

38.
Road

People of a circular village Dharamkot want to construct a road nearest to it. The road cannot pass through the village. But the people want the road at a shortest distance from the centre of the village. Suppose the road starts from A which is outside the circular village (as shown in the figure) and touch the boundary of the circular village at B such that AB = 20 m. Also the distance of the point A from the centre O of the village is 25 m.

Based on the above information, answer the following questions :

(i) If B is the mid-point of AC, then find the distance AC. 1

(ii) Find the shortest distance of the road from the centre of the village. 1

(iii) Find the circumference of the village. 2

OR

(iii) Find the area of the village. 2

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
SUBJECT NAME MATHEMATICS (BASIC) (SUBJECT CODE 241)
(PAPER CODE 430/6/1)

	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 News Paper/Website etc may invite action under various rules of the Board and IPC."**
3	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. **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 due 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, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the **Answer**s These are in the nature of Guidelines only and do not constitute the complete **Answer**. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	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. If there is any variation, the same should be zero after deliberation and discussion. 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.
6	Evaluators will mark(√) wherever **Answer** is correct. For wrong **Answer** CROSS 'X" be marked. Evaluators will not put right (✓)while evaluating which gives an impression that **Answer** is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	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 totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	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.
9	If a student has attempted an extra question, **Answer** of the question deserving more marks should be retained and the other **Answer** scored out with a note **"Extra Question"**. However, for MCQs (Q1 to Q20) only first attempt to be evaluated.

10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _____(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the **Answer** deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day 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).
13	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 totaling of marks awarded on an **Answer**. ● Wrong transfer of marks from the inside pages of the **Answer** book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the **Answer** book to online award list. ● **Answer**s 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 X for incorrect **Answer**.) ● Half or a part of **Answer** marked correct and the rest as wrong, but no marks awarded.
14	While evaluating the **Answer** books if the **Answer** is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
15	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate 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.
16	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17	Every Examiner shall also ensure that all the **Answer**s are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the **Answer** Book on request on payment of the prescribed processing fee. All Examiners/Additional Head 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.

SECTION A

1. The time, in seconds, taken by 150 athletes to run a 100 m hurdle race are tabulated below :

Time (sec.)	13-14	14-15	15-16	16-17	17-18	18-19
Number of Athletes	2	4	5	71	48	20

The number of athletes who completed the race in less than 17 seconds is

(a) 11   (b) 71

(c) 82   (d) 68

Answer (c) 82   1

----

2. The distance of the point (5, 0) from the origin is

(a)   0   (b)   5

(c) $\sqrt{5}$ (d) 5^2

Answer (b) 5   1

----

3. In $\triangle ABC$, right angled at C, if $\tan A = \dfrac{8}{7}$, then the value of cot B is

(a) $\dfrac{7}{8}$ (b) $\dfrac{8}{7}$

(c) $\dfrac{7}{\sqrt{113}}$ (d) $\dfrac{8}{\sqrt{113}}$

Answer (b) $\dfrac{8}{7}$ 1

3

4. Area of a quadrant of a circle of radius 7 cm is

    (a)   154 cm^2 (b)   77 cm^2

    (c) $\dfrac{77}{2}$ cm^2 (d) $\dfrac{77}{4}$ cm^2

Answer (c) $\dfrac{77}{2}$ cm^2 1

---

5. If HCF (72, 120) = 24, then LCM (72, 120) is

    (a)   72   (b)   120

    (c)   360   (d)   9640

Answer (c) 360   1

---

6. One card is drawn at random from a well-shuffled deck of 52 playing cards. What is the probability of getting a black king ?

    (a) $\dfrac{1}{26}$ (b) $\dfrac{1}{13}$

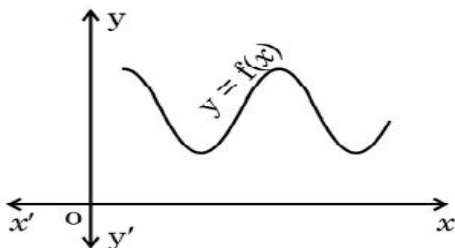   (c) $\dfrac{1}{52}$ (d) $\dfrac{1}{2}$

Answer (a) $\dfrac{1}{26}$ 1

---

7. The graph of $y = f(x)$ is shown in the figure for some polynomial $f(x)$.

The number of zeroes of $f(x)$ is

    (a)   0   (b)   2

    (c)   3   (d)   4

Answer (a) 0   1

---

8. The value of k, if (6, k) lies on the line represented by $x - 3y + 6 = 0$, is

   (a) -4 (b) 12

   (c) -12 (d) 4

   Answer (d) 4   1

---

9. The prime factorisation of the number 2304 is

   (a) $2^8 \times 3^2$ (b) $2^7 \times 3^3$

   (c) $2^8 \times 3^1$ (d) $2^7 \times 3^2$

   Answer (a) $2^8 \times 3^2$ 1

---

10. If n is a natural number, then 8^n cannot end with digit

    (a) 0   (b) 2

    (c) 4   (d) 6

    Answer (a) 0   1

---

11. The median of first seven prime numbers is

    (a) 5   (b) 7

    (c) 11   (d) 13

    Answer (b) 7   1

---

12. If (2, 4) is the mid-point of the line-segment joining (6, 3) and (a, 5), then the value of a is

    (a) 2   (b) 4

    (c) -4 (d) -2

    Answer (d) -2 1

5

13. The value of 'k' for which the system of equations $kx + 2y = 5$ and $3x + 4y = 1$ have no solution, is

(a) $k = \dfrac{3}{2}$

(b) $k \neq \dfrac{3}{2}$

(c) $k \neq \dfrac{2}{3}$

(d) $k = 15$

Answer (a) $k = \dfrac{3}{2}$ 1

----

14. In the given figure, PQ and PR are tangents drawn from P to the circle with centre O such that $\angle QPR = 65°$. The measure of $\angle QOR$ is.
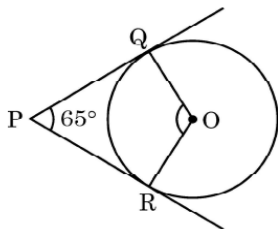
(a) 65°

(b) 125°

(c) 115°

(d) 90°

Answer (c) 115°   1

----

15. The zeroes of the quadratic polynomial $16x^2 - 9$ are :

(a) $\dfrac{3}{4}, \dfrac{3}{4}$

(b) $-\dfrac{3}{4}, \dfrac{3}{4}$

(c) $\dfrac{9}{16}, \dfrac{9}{16}$

(d) $-\dfrac{3}{4}, -\dfrac{3}{4}$

Answer (b) $-\dfrac{3}{4}, \dfrac{3}{4}$ 1

----

16. If $-5, x, 3$ are three consecutive terms of an A.P., then the value of x is

(a) −2

(b) 2

(c) 1

(d) −1

Answer (d) − 1   1

6

17. An unbiased die is thrown. The probability of getting an odd prime number is

   (a) $\dfrac{1}{6}$ (b) $\dfrac{1}{2}$

   (c) $\dfrac{2}{3}$ (d) $\dfrac{1}{3}$

Answer (d) $\dfrac{1}{3}$ 1

----

18. If the mean of 6, 7, x, 8, y, 14 is 9, then

   (a) $x + y = 21$ (b) $x + y = 19$

   (c) $x - y = 19$ (d) $x - y = 21$

Answer (b) x + y = 19   1

   Directions for Q. 19 & Q. 20 : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

   (a)   Both Assertion (A) and Reason (R) are true; and Reason (R) is the correct explanation of Assertion (A).

   (b)   Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

   (c)   Assertion (A) is true, but Reason (R) is false.

   (d)   Assertion (A) is false, but Reason (R) is true.

19. **Assertion (A) :** The probability that a leap year has 53 Sundays is $\dfrac{2}{7}$.

   Reason (R) :   The probability that a non-leap year has 53 Sundays is $\dfrac{1}{7}$.

Answer (b)Both Assertion(A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).   1

----

20. **Assertion (A) :** For $0 < \theta \le 90°$, cosec θ – cot θ and cosec θ + cot θ are reciprocal of each other.

   Reason (R) : $\cot^2 \theta - \csc^2 \theta = 1$

Answer (c) Assertion(A) is true, but Reason (R) is false.   1

7

SECTION B

21. Evaluate : $5 \csc^2 45° - 3 \sin^2 90° + 5 \cos 0°$.

Solution $5 \csc^2 45° - 3 \sin^2 90° + 5 \cos 0°$

$$= 5\left(\sqrt{2}\right)^2 - 3(1)^2 + 5(1)$$

$1\frac{1}{2}$

$$= 12$$

$\frac{1}{2}$

----

22. (a) Find a quadratic polynomial whose zeroes are 6 and −3.

Solution (a) Sum of zeroes = 6+ (−3) = 3

$\frac{1}{2}$

Product of zeroes = 6(− 3) = − 18

$\frac{1}{2}$

Quadratic polynomial is $(x^2 - 3x - 18)$ or k $(x^2 - 3x - 18)$

1

OR

(b) Find the zeroes of the polynomial $x^2 + 4x - 12$.

Solution (b) $x^2 + 4x - 12 = (x + 6)(x - 2)$

1

Zeroes are − 6, 2

1

----

23. (a) Find the value of k for which the roots of the quadratic equation $5x^2 - 10x + k = 0$ are real and equal.

Solution a = 5, b = − 10, c = k

½

Roots are real and equal

$$D = 0 \Rightarrow b^2 - 4ac = 0$$

½

$$(- 10)^2 - 4(5)(k) = 0 \Rightarrow 100 - 20k = 0$$

½

k = 5

½

OR

(b) If one root of the quadratic equation $3x^2 - 8x - (2k + 1) = 0$ is seven times the other, then find the value of k.

Solution Let roots be α, 7α

½

$$\alpha + 7\alpha = -\left(\frac{-8}{3}\right) = \frac{8}{3} \Rightarrow 8\alpha = \frac{8}{3} \text{ gives } \alpha = \frac{1}{3}$$

½

$$\alpha(7\alpha) = -\frac{(2k + 1)}{3} \Rightarrow 7\alpha^2 = -\frac{(2k + 1)}{3}$$

½

$$k = -\frac{5}{3}$$

½

8

----

24. A box contains 20 discs which are numbered from 1 to 20. If one disc is drawn at random from the box, then find the probability that the number on the drawn disc is a
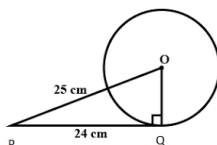   (i) 2-digit number
    (ii) number less than 10

Solution P(2 digit number) = $\frac{11}{20}$ *1*

         P(number less than 10) = $\frac{9}{20}$ *1*

----

25. From a point P, the length of the tangent to a circle is 24 cm and the distance of P from the centre of the circle is 25 cm. Find the radius of the circle.

Solution

                                                                       figure ½

$OQ = \sqrt{25^2 - 24^2}$ 1

$OQ = 7$ cm   ½

SECTION C

26. The sum of the reciprocals of Varun's age (in years) 3 years ago and 5 years from now is $\frac{1}{3}$. Find his present age.

Solution Let Varun's present age = x years

                         ATQ, $\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$ 1

$\frac{x+5+x-3}{(x-3)(x+5)} = \frac{1}{3} \Rightarrow \frac{2x+2}{x^2+2x-15} = \frac{1}{3}$

$6x + 6 = x^2 + 2x - 15 \Rightarrow x^2 - 4x - 21 = 0$ 1

$(x - 7)(x + 3) = 0$ ½

$x = 7, x = -3$ (rejecting)   ½

∴ Varun's present age = 7 years

9

27. A survey conducted on 20 households in a locality by a group of students resulted in the following frequency table for the number of family members in a household :

Family size	1-3	3-5	5-7	7-9	9-11
Number of Families	7	8	2	2	1

Find the median of this data.

Solution

Family size	$1-3$	$3-5$	$5-7$	$7-9$	$9-11$
Number of families	7	8	2	2	1
Cf	7	15	17	19	20

For correct cf   1

Median class $3-5$ ½

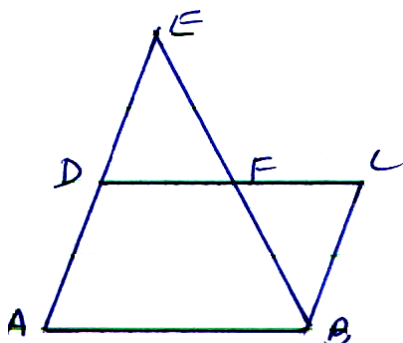$$\text{Median} = l + \frac{\frac{N}{2} - C}{f} \times h$$

$$= 3 + \frac{10 - 7}{8} \times 2$$ 1

$$= 3 \cdot 75$$ ½

---

28. (a) E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that ΔABE ~ ΔCFB.

Solution

(a) ABCD is a parallelogram   (1 for figure)

To prove: Δ ABE $\sim \Delta$ CFB

In Δ ABE and Δ CFB,

$\angle$ A = $\angle$ C (opp. angles of parallelogram)   1/2
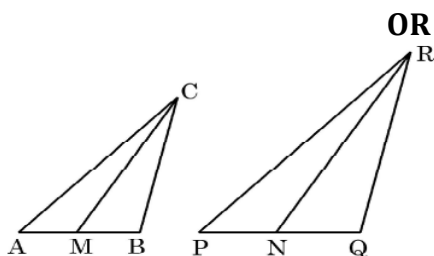
$\angle$ AEB = $\angle$ CBF (alt. int. angles)   1/2

$\therefore \Delta$ ABE $\sim \Delta$ CFB (AA similarity)   1

10

OR

(b)   In the given figure, CM and RN are respectively the medians of
$\triangle ABC$ and $\triangle PQR$. If $\triangle ABC \sim \triangle PQR$, then prove that $\triangle AMC \sim \triangle PNR$.

Solution $\triangle ABC \sim \triangle PQR$

$\dfrac{AB}{PQ} = \dfrac{AC}{PR} \Rightarrow \dfrac{2AM}{2PN} = \dfrac{AC}{PR}$ ½+1

$\dfrac{AM}{PN} = \dfrac{AC}{PR}$

Also $\angle A = \angle P$ ($\triangle ABC \sim \triangle PQR$)

$\therefore \triangle AMC \sim \triangle PNR$ (SAS similarity) $\Bigg\}$ 1½

----

29.   Find the co-ordinates of the points of trisection of the line-segment joining the points (5, 3) and (4, 5).

Solution

Let C divides AB in the ratio 1 : 2

                                                                                          ½

$\therefore C\left(\dfrac{1 \times 4 + 2 \times 5}{1 + 2}, \dfrac{1 \times 5 + 2 \times 3}{1 + 2}\right)$, i.e., $C\left(\dfrac{14}{3}, \dfrac{11}{3}\right)$ 1

Let D divides AB in the ratio 2 : 1   ½

$\therefore D\left(\dfrac{2 \times 4 + 1 \times 5}{2 + 1}, \dfrac{2 \times 5 + 1 \times 3}{2 + 1}\right)$, i.e., $D\left(\dfrac{13}{3}, \dfrac{13}{3}\right)$ 1

----

30.   Prove that $3 - 2\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number.

Solution   Let us assume that $3 - 2\sqrt{5}$ is a rational number.

$\therefore 3 - 2\sqrt{5} = \dfrac{p}{q}$, $q \neq 0$, p and q are integers   1

$\Rightarrow \sqrt{5} = \dfrac{3q - p}{2q}$ 1

Now RHS is rational but LHS is irrational

$\therefore$ Our assumption is wrong   1

$\therefore$ $3 - 2\sqrt{5}$ is an irrational number. $\Bigg\}$

----

31.   (a)   Prove that $\dfrac{\cot A - \cos A}{\cot A + \cos A} = \dfrac{\cos^2 A}{(1 + \sin A)^2}$

11

Solution LHS $= \dfrac{cot\ A - \cos A}{cot\ A + \cos A} = \dfrac{\frac{\cos A}{\sin A} - \cos A}{\frac{\cos A}{\sin A} + \cos A}$ ½

$= \dfrac{1 - sin\ A}{1 + sin\ A}$ 1

$= \dfrac{(1 - \sin A)(1 + \sin A)}{(1 + \sin A)(1 + \sin A)}$ 1

$= \dfrac{1 - \sin^2 A}{(1 + \sin A)^2} = \dfrac{cos^2\ A}{(1 + \sin A)^2}$ ½

OR

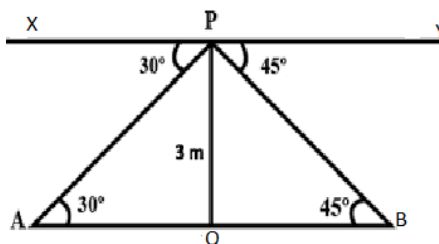(b) Prove that $(\sec\ \theta + \tan\ \theta)\ (1 - \sin\ \theta) = \cos\ \theta$

Solution LHS $= (\sec\ \theta + \tan\ \theta)\ (1 - \sin\ \theta)$

$= \left(\dfrac{1}{cos\ \theta} + \dfrac{\sin\ \theta}{\cos\ \theta}\right)(1 - \sin\ \theta)$ 1

$= \left(\dfrac{1 + \sin\ \theta}{\cos\ \theta}\right)(1 - \sin\ \theta) = \dfrac{(1 - \sin^2\ \theta)}{\cos\ \theta}$ ½ + ½

$= \dfrac{cos^2\ \theta}{\cos\ \theta} = \cos\ \theta = \text{RHS}$ 1

SECTION D

32. (a) 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, find the width of the river. (Use $\sqrt{3}$ = 1.73)
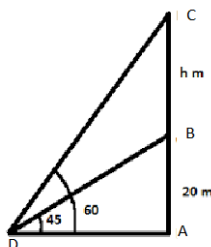
Solution

For fig. 1

In Δ APQ, $\tan 30° = \dfrac{3}{AQ}$ 1

$\dfrac{1}{\sqrt{3}} = \dfrac{3}{AQ} \Rightarrow AQ = 3\sqrt{3}$ ½

In Δ PBQ, $\tan 45° = \dfrac{3}{BQ}$ 1

$BQ = 3$ ½

$\therefore AB = AQ + BQ = 3\sqrt{3} + 3$ ½

$= 3(1 \cdot 73 + 1) = 8 \cdot 19$

Width of river $= 8 \cdot 19$ m ½

12

OR

(b) From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower. (Use $\sqrt{3}$ = 1.73)

Solution BC = transmission tower = h and AD = x

For fig. 1   1

In Δ ABD, tan 45° = $\frac{20}{x}$ 1

$\qquad$ x = 20   ½

In Δ ACD, tan 60° = $\frac{20 + h}{x}$ 1

$\qquad \sqrt{3}x = 20 + h$ ½

$\qquad \therefore h = 20\,(\sqrt{3} - 1)$ m   ½

$\qquad h = 14.6$ m   ½

----

33. The first term of an A.P. is 22, the last term is −6 and the sum of all the terms is 64. Find the number of terms of the A.P. Also, find the common difference.

Solution a = 22, a_n = − 6, S_n = 64

$\qquad S_n = 64 \Rightarrow \frac{n}{2}\,[22 - 6] = 64$ 2

$\qquad\qquad n = 8$ 1

$\qquad 22 + (8\text{-}1)\,d = \text{-}6$ 1

$\qquad \Rightarrow d = - 4$ 1

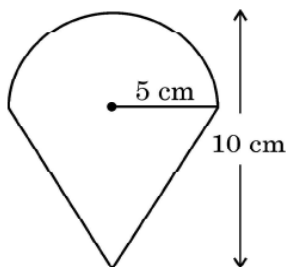
34. An ice-cream filled cone having radius 5 cm and height 10 cm is as shown in the figure. Find the volume of the ice-cream in 7 such cones.

13

430/6/1

Solution Height of conical part = 10 – 5 = 5 cm   ½

Volume of 1 ice cream cone

$$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$ 1

$$= \frac{1}{3}\pi r^2(h + 2r)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 5 \times 5[5 + 10]$$ 1½

$$= \frac{22 \times 25 \times 15}{21} \text{ cm}^3$$ 1

Volume of 7 ice cream cones

$$= 7 \times \frac{22 \times 25 \times 15}{21}$$ $\frac{1}{2}$

$$= 2750 \text{ cm}^3$$ $\frac{1}{2}$

-- ------
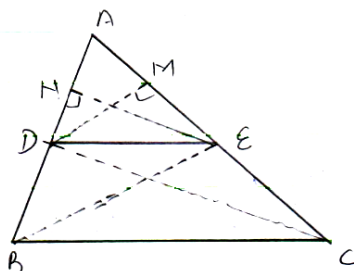
35. (a) Prove that a line drawn parallel to one side of a triangle to intersect the other two sides in distinct points, divides the two sides in the same ratio.

Solution

For figure1

Given In Δ ABC, DE // BC $\frac{1}{2}$

To prove : $\frac{AD}{DB} = \frac{AE}{EC}$ $\frac{1}{2}$

Const. : Join BE, CD. Draw DM ⊥ AC and EN ⊥ AB $\frac{1}{2}$

Proof : $\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB}$ _____ (i)   1

similarly $\frac{ar(\Delta ADE)}{ar(\Delta CDE)} = \frac{AE}{EC}$ _____ (ii) $\frac{1}{2}$

Δ BDE and Δ CDE are on the same base DE and between the same parallel lines BC and DE.

ar(Δ ADE) = ar(Δ CDE) _____ (iii) $\frac{1}{2}$

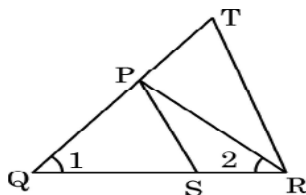From (i), (ii) and (iii) $\frac{AD}{DB} = \frac{AE}{EC}$ $\frac{1}{2}$

14

430/6/1

OR

(b) In the given figure, $\dfrac{QR}{QS} = \dfrac{QT}{PR}$ and $\angle 1 = \angle 2$. Prove that $\triangle PQS \sim \triangle TQR$.

Solution In $\triangle$ PQR, $\angle 1 = \angle 2$

$\therefore$ PQ = PR (sides opposite to equal angles)   1

Now $\dfrac{QR}{QS} = \dfrac{QT}{PR}$

$\therefore \dfrac{QS}{QR} = \dfrac{PR}{QT} \Rightarrow \dfrac{QS}{QR} = \dfrac{PQ}{QT}$ (as PR = PQ) _____ (i)   2

In $\triangle$ PQS and $\triangle$ TQR,

$\angle$ Q = $\angle$ Q (common)

$\dfrac{QS}{QR} = \dfrac{PQ}{QT}$ (from (i)) $1\frac{1}{2}$

$\therefore \triangle$ PQS $\sim \triangle$ TQR (SAS similarity) $\frac{1}{2}$

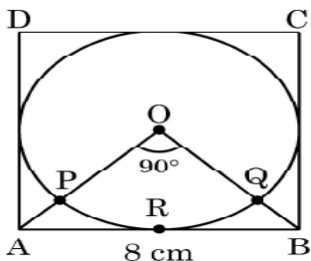---

SECTION E

36. For the inauguration of 'Earth day' week in a school, badges were given to volunteers. Organisers purchased these badges from an NGO, who made these badges in the form of a circle inscribed in a square of side 8 cm.

O is the centre of the circle and $\angle AOB = 90°$:

Based on the above information, answer the following questions :

(i)   What is the area of square ABCD ?

(ii)   What is the length of diagonal AC of square ABCD ?

(iii)   Find the area of sector OPRQO.

OR

(iii)   Find the area of remaining part of square ABCD when area of circle is excluded.

Solution (i) Area of square ABCD $= (8)^2 = 64$ cm^2 1

     (ii) AC $= \sqrt{(8)^2 + (8)^2} = \sqrt{128} = 8\sqrt{2}$ cm   1

    (iii) We know that diagonals of square bisect each other at 90°

$$\angle AOB = 90°$$

Area of sector OPRQ $= \dfrac{\pi r^2 \theta}{360°}$

$= \dfrac{22}{7}$ x 4 x 4 x $\dfrac{90}{360}$ 1

$= \dfrac{88}{7}$ cm^2 1

OR

(iii) Area of circle $= \pi r^2 = \dfrac{22}{7}$ x 4 x 4 $= \dfrac{352}{7}$ cm^2 1

Required area $= 64 - \dfrac{352}{7} = \dfrac{96}{7}$ cm^2 1

16

37.

Lokesh, a production manager in Mumbai, hires a taxi everyday to go to his office. The taxi charges in Mumbai consists of a fixed charges together with the charges for the distance covered. His office is at a distance of 10 km from his home. For a distance of 10 km to his office, Lokesh paid ₹ 105. While coming back home, he took another route. He covered a distance of 15 km and the charges paid by him were ₹ 155.

Based on the above information, answer the following questions :

(i)   What are the fixed charges ?

(ii)   What are the charges per km ?

(iii) If fixed charges are ₹ 20 and charges per km are ₹ 10, then how much Lokesh have to pay for travelling a distance of 10 km ?

OR

(iii) Find the total amount paid by Lokesh for travelling 10 km from home to office and 25 km from office to home. [Fixed charges and charges per km are as in (i) & (ii).

Solution (i) Let fixed charge= ₹ x   and charges per km = ₹ y

$x + 10y = 105$, $x + 15y = 155$ $\frac{1}{2}$

On solving, $x = 5$

∴Fixed charge = ₹ 5 $\frac{1}{2}$

(ii) on solving, we get $y =10$

Charge per km = ₹10   1
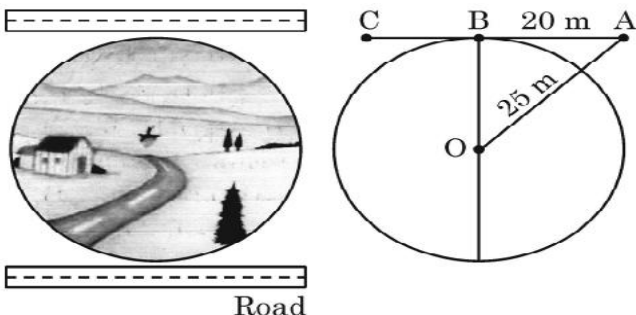
(iii) $x + 10y = 20 + 10(10) = ₹ 120$ 1+1

OR

(iii) Required amount = $x + 10y + x + 25y = 2x + 35y$ 1

$= 2(5) + 35(10) = 10 + 350 = ₹ 360$ 1

38.

Road

People of a circular village Dharamkot want to construct a road nearest to it. The road cannot pass through the village. But the people want the road at a shortest distance from the centre of the village. Suppose the road starts from A which is outside the circular village (as shown in the figure) and touch the boundary of the circular village at B such that AB = 20 m. Also the distance of the point A from the centre O of the village is 25 m.

Based on the above information, answer the following questions :

(i)   If B is the mid-point of AC, then find the distance AC.   1

(ii) Find the shortest distance of the road from the centre of the village.   1

(iii) Find the circumference of the village.   2

OR

(iii) Find the area of the village.   2

Solution (i) AC = AB + BC = 20 + 20 = 40 m   *1*

(ii) Shortest distance OB = $\sqrt{25^2 - 20^2}$ = 15 m   1

(iii) Circumference = $2\pi(15) = 30\pi$ m   or $\dfrac{660}{7}$ m   1+1

OR

Area = $\pi(15)^2 =$ 225π sq. m or $\dfrac{4950}{7}$ sq. m   1+1