Series WX1YZ/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.

गणित (मानक) – सैद्धान्तिक

MATHEMATICS (STANDARD) - Theory

#

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*
Time allowed : 3 hours *Maximum Marks : 80*

नोट / NOTE :

(i) *कृपया जाँच कर लें कि इस प्रश्न–पत्र में मुद्रित पृष्ठ* ***15*** *हैं।*
Please check that this question paper contains ***15*** *printed pages.*

(ii) *प्रश्न–पत्र में दाहिने हाथ की ओर दिए गए प्रश्न–पत्र कोड को छात्र 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 छात्र 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 students 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 **38** प्रश्न हैं। **सभी** प्रश्न अनिवार्य हैं।*

(ii) *प्रश्न-पत्र **पांच** खण्डों में विभाजित है - **खण्ड क, ख, ग, घ** तथा **ड़**।*

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

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

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

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

(vii) ***खण्ड ड़** में प्रश्न संख्या **36** से **38** तक **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 **ड़** के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहां आवश्यक हो, स्वच्छ आकृतियां बनाएं। यदि आवश्यक हो तो $\pi = 22/7$ लें।*

(x) *कैलकुलेटर का उपयोग **वर्जित** है।*

खण्ड – क

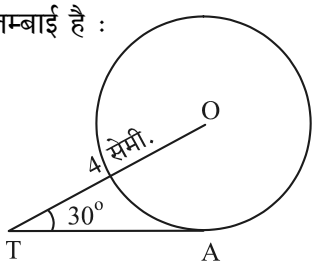
खण्ड – क में बहुविकल्पीय प्रकार के प्रश्न हैं। प्रत्येक प्रश्न 1 अंक का है।

1. समीकरण युग्म : $2x = 5y + 6$ और $15y = 6x - 18$ जिन दो रेखाओं को निरूपित करता है, वे हैं : **1**

(a) प्रतिच्छेदी रेखाएं (b) समांतर रेखाएं

(c) संपाती रेखाएं (d) प्रतिच्छेदी या समांतर रेखाएं

2. दी गई आकृति में, केन्द्र O वाले एक वृत्त पर TA एक स्पर्श रेखा है जहाँ OT = 4 सेमी. और $\angle OTA = 30^o$। TA की लम्बाई है : **1**



(a) $2\sqrt{3}$ सेमी.

(b) 2 सेमी.

(c) $2\sqrt{2}$ सेमी.

(d) $\sqrt{3}$ सेमी.

3. सबसे छोटी संयुक्त संख्या और सबसे छोटी अभाज्य संख्या के HCF का अनुपात उनके LCM से है : **1**

(a) 1:2 (b) 2:1 (c) 1:1 (d) 1:3

4. यदि 6 मी. ऊँचे एक खंभे की छाया, भूमि पर $2\sqrt{3}$ मी. लंबी है, तो सूर्य का उन्नतांश होगा : **1**

(a) 60^o (b) 45^o (c) 30^o (d) 90^o

GENERAL INSTRUCTIONS :

Read the following instructions 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** and **20** are Assertion-Reason based questions of **1** mark each.*

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

(v) *In **section C** – question number **26** to **31** are Short Answer (SA) 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 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 $\pi = 22/7$ wherever required if not stated.*

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

SECTION - A

Section - A consists of Multiple Choice type questions of 1 mark each.

1. The pair of linear equations $2x = 5y + 6$ and $15y = 6x - 18$ represents two lines which are : **1**

(a) intersecting (b) parallel

(c) coincident (d) either intersecting or parallel

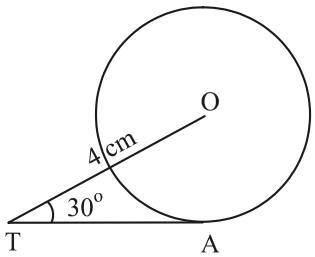
2. In the given figure, TA is a tangent to the circle with centre O such that OT = 4 cm, $\angle OTA = 30^o$, then length of TA is : **1**

(a) $2\sqrt{3}$ cm

(b) 2 cm

(c) $2\sqrt{2}$ cm

(d) $\sqrt{3}$ cm

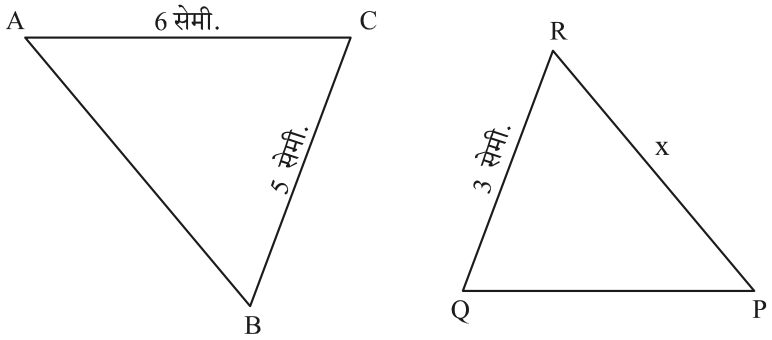


3. The ratio of HCF to LCM of the least composite number and the least prime number is : **1**

(a) 1:2 (b) 2:1 (c) 1:1 (d) 1:3

4. If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then sun's elevation is : **1**

(a) 60^o (b) 45^o (c) 30^o (d) 90^o

5. 

दी गई आकृति में, $\Delta ABC \sim \Delta QPR$। यदि AC = 6 सेमी., BC = 5 सेमी., QR = 3 सेमी. और PR = x है, तो x का मान होगा : **1**

(a) 3.6 सेमी. (b) 2.5 सेमी. (c) 10 सेमी. (d) 3.2 सेमी.

6. मूल बिन्दु से बिन्दु (– 6, 8) की दूरी है : **1**

(a) 6 (b) – 6 (c) 8 (d) 10

7. A.P. : $\sqrt{7}, \sqrt{28}, \sqrt{63}$ का अगला पद है : **1**

(a) $\sqrt{70}$ (b) $\sqrt{80}$ (c) $\sqrt{97}$ (d) $\sqrt{112}$

8. $(\sec^2\theta - 1)(\text{cosec}^2\theta - 1)$ बराबर है : **1**

(a) – 1 (b) 1 (c) 0 (d) 2

9. दो पासों को एक साथ फेंका गया। पासों के ऊपरी फलकों पर आई संख्याओं का अन्तर 3 होने की प्रायिकता है : **1**

(a) $\frac{1}{9}$ (b) $\frac{2}{9}$ (c) $\frac{1}{6}$ (d) $\frac{1}{12}$

10. 52 पत्तों की अच्छी प्रकार से फेंटी गई एक गड्डी से एक पत्ता यादृच्छया निकाला जाता है। निकाला गया पत्ता एक इक्का नहीं होने की प्रायिकता है : **1**

(a) $\frac{1}{13}$ (b) $\frac{9}{13}$ (c) $\frac{4}{13}$ (d) $\frac{12}{13}$

11. समीकरण $x^2 + 3x - 10 = 0$ के मूल हैं : **1**

(a) 2, –5 (b) –2, 5 (c) 2, 5 (d) –2, –5

12. यदि α, β द्विघात बहुपद $x^2 - 1$ के शून्यांक हैं, तो $(\alpha + \beta)$ का मान होगा : **1**

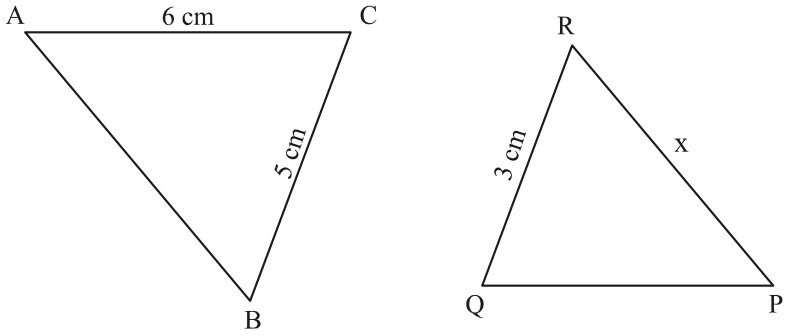
(a) 2 (b) 1 (c) –1 (d) 0

13. यदि α, β बहुपद $p(x) = 4x^2 - 3x - 7$ के शून्यांक हैं तो $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ का मान है : **1**

(a) $\frac{7}{3}$ (b) $\frac{-7}{3}$ (c) $\frac{3}{7}$ (d) $\frac{-3}{7}$

14. 'd' व्यास के अर्धवृत्त का क्षेत्रफल क्या है ? **1**

(a) $\frac{1}{16}\pi d^2$ (b) $\frac{1}{4}\pi d^2$ (c) $\frac{1}{8}\pi d^2$ (d) $\frac{1}{2}\pi d^2$

5. 

In the given figure, $\Delta ABC \sim \Delta QPR$. If AC = 6 cm, BC = 5 cm, QR = 3 cm and PR = x; then the value of x is : **1**

(a) 3.6 cm (b) 2.5 cm (c) 10 cm (d) 3.2 cm

6. The distance of the point (– 6, 8) from origin is : **1**

(a) 6 (b) – 6 (c) 8 (d) 10

7. The next term of the A.P. : $\sqrt{7}, \sqrt{28}, \sqrt{63}$ is : **1**

(a) $\sqrt{70}$ (b) $\sqrt{80}$ (c) $\sqrt{97}$ (d) $\sqrt{112}$

8. $(\sec^2\theta - 1)(\text{cosec}^2\theta - 1)$ is equal to : **1**

(a) – 1 (b) 1 (c) 0 (d) 2

9. Two dice are thrown together. The probability of getting the difference of numbers on their upper faces equals to 3 is : **1**

(a) $\frac{1}{9}$ (b) $\frac{2}{9}$ (c) $\frac{1}{6}$ (d) $\frac{1}{12}$

10. A card is drawn at random from a well-shuffled pack of 52 cards. The probability that the card drawn is not an ace is : **1**

(a) $\frac{1}{13}$ (b) $\frac{9}{13}$ (c) $\frac{4}{13}$ (d) $\frac{12}{13}$

11. The roots of the equation $x^2 + 3x - 10 = 0$ are : **1**

(a) 2, –5 (b) –2, 5 (c) 2, 5 (d) –2, –5

12. If α, β are zeroes of the polynomial $x^2 - 1$, then value of $(\alpha + \beta)$ is : **1**

(a) 2 (b) 1 (c) –1 (d) 0

13. If α, β are the zeroes of the polynomial $p(x) = 4x^2 - 3x - 7$, then $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ is equal to : **1**

(a) $\frac{7}{3}$ (b) $\frac{-7}{3}$ (c) $\frac{3}{7}$ (d) $\frac{-3}{7}$

14. What is the area of a semi-circle of diameter 'd' ? **1**

(a) $\frac{1}{16}\pi d^2$ (b) $\frac{1}{4}\pi d^2$ (c) $\frac{1}{8}\pi d^2$ (d) $\frac{1}{2}\pi d^2$

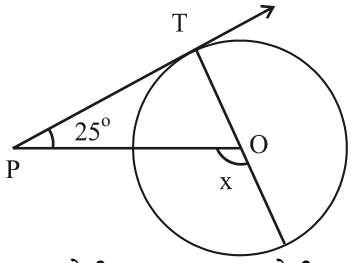
15. निम्न बंटन के लिए :

प्राप्तांक	**10 से कम**	**20 से कम**	**30 से कम**	**40 से कम**	**50 से कम**	**60 से कम**
छात्रों की संख्या	**3**	**12**	**27**	**57**	**75**	**80**

बहुलक वर्ग है : **1**

(a) 10-20 (b) 20-30 (c) 30-40 (d) 50-60

16. दी गई आकृति में, केन्द्र O वाले वृत्त के बिंदु T पर PT एक स्पर्श रेखा है। यदि $\angle TPO = 25^o$ है, तो x का मान है : **1**



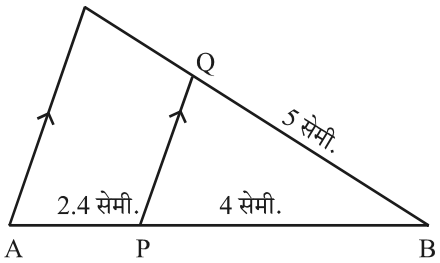
(a) 25^o

(b) 65^o

(c) 90^o

(d) 115^o

17. दी गई आकृति में, PQ||AC । यदि BP = 4 सेमी., AP = 2.4 सेमी. और BQ = 5 सेमी., तो BC की लम्बाई होगी : **1**



(a) 8 सेमी.

(b) 3 सेमी.

(c) 0.3 सेमी.

(d) $\frac{25}{3}$ सेमी.

18. बिंदु (– 4, 0), (4, 0) और (0, 3) शीर्ष हैं एक : **1**

(a) समकोण त्रिभुज के (b) समद्विबाहु त्रिभुज के

(c) समबाहु त्रिभुज के (d) विषम त्रिभुज के

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

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

तर्क (R) : एक गैर लीप–वर्ष में 53 रविवार होने की प्रायिकता $\frac{5}{7}$ है। **1**

(a) अभिकथन (A) तथा कारण (R) दोनों सत्य हैं। कारण (R) अभिकथन (A) की व्याख्या करता है।

(b) अभिकथन (A) तथा कारण (R) दोनों सत्य हैं। कारण (R) अभिकथन (A) की व्याख्या नहीं करता है।

(c) अभिकथन (A) सत्य है परन्तु कारण (R) असत्य है।

(d) अभिकथन (A) असत्य है जबकि कारण (R) सत्य है।

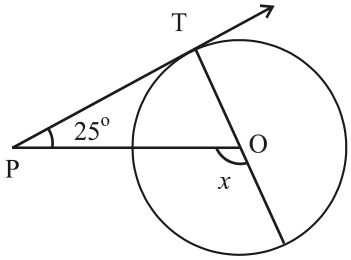
15. For the following distribution :

Marks Below	**10**	**20**	**30**	**40**	**50**	**60**
Number of Students	**3**	**12**	**27**	**57**	**75**	**80**

The modal class is : **1**

(a) 10-20 (b) 20-30 (c) 30-40 (d) 50-60

16. In the given figure, PT is a tangent at T to the circle with centre O. If $\angle TPO = 25^o$, then x is equal to : **1**



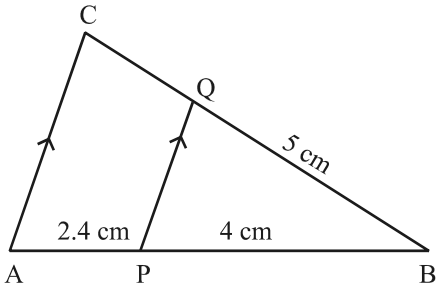
(a) 25^o

(b) 65^o

(c) 90^o

(d) 115^o

17. In the given figure, PQ || AC. If BP = 4 cm, AP = 2.4 cm and BQ = 5 cm, then length of BC is : **1**



(a) 8 cm

(b) 3 cm

(c) 0.3 cm

(d) $\frac{25}{3}$ cm

18. The points (– 4, 0), (4, 0) and (0, 3) are the vertices of a : **1**

(a) right triangle (b) isosceles triangle

(c) equilateral triangle (d) scalene triangle

DIRECTIONS : In the question number **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option out of the following :

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

Reason (R) : The probability that a non-leap year has 53 Sundays is $\frac{5}{7}$. **1**

(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 and 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.

20. **अभिकथन (A)** : a, b, c एक A.P. के पद होंगे अगर और केवल अगर $2b = a + c$ ।

तर्क (R) : पहली 'n' विषम प्राकृत संख्याओं का योग n^2 है। **1**

(a) अभिकथन (A) तथा कारण (R) दोनों सत्य हैं। कारण (R) अभिकथन (A) की व्याख्या करता है।

(b) अभिकथन (A) तथा कारण (R) दोनों सत्य हैं। कारण (R) अभिकथन (A) की व्याख्या नहीं करता है।

(c) अभिकथन (A) सत्य है परन्तु कारण (R) असत्य है।

(d) अभिकथन (A) असत्य है जबकि कारण (R) सत्य है।

खण्ड – ख

खण्ड – ख में अति लघु–उत्तर (VSA) प्रकार के प्रश्न हैं। प्रत्येक प्रश्न के 2 अंक हैं।

21. **(A)** द्विघात समीकरण $2x^2 - 9x + 4 = 0$ के मूलों का योग और गुणनफल ज्ञात कीजिए। **2**

अथवा

(B) द्विघात समीकरण $4x^2 - 5 = 0$ का विविक्तकर (discriminant) ज्ञात कीजिए और समीकरण के मूलों की प्रकृति लिखिए। **2**

22. **(A)** मान ज्ञात कीजिए : $2\sec^2\theta + 3\text{cosec}^2\theta - 2\sin\theta\cos\theta$, if $\theta = 45^\circ$. **2**

अथवा

(B) यदि $\sin\theta - \cos\theta = 0$ है, तो $\sin^4\theta + \cos^4\theta$ का मान ज्ञात कीजिए। **2**

23. एक निष्पक्ष सिक्का दो बार उछाला जाता है। अधिक से अधिक एक चित आने की प्रायिकता ज्ञात कीजिए। **2**

24. दो संख्याएं 2:3 के अनुपात में हैं और उनका LCM 180 है। इन संख्याओं का HCF क्या होगा ? **2**

25. यदि बहुपद $p(x) = 6x^2 + 37x - (k - 2)$ का एक शून्यांक दूसरे शून्यांक का व्युत्क्रम हो, तो k का मान ज्ञात कीजिए। **2**

खण्ड – ग

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

26. 'p' का मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $px^2 - 14x + 8 = 0$ का एक मूल दूसरे मूल का छः गुना है। **3**

27. एक बाह्य बिंदु से, किसी वृत्त पर दो स्पर्श रेखाएं खींची गईं। सिद्ध कीजिए कि बाह्य बिंदु और वृत्त के केंद्र को मिलाने वाली रेखा स्पर्श रेखाओं के बीच के कोण समद्विभाजित करती है। **3**

28. दो संकेंद्रीय वृत्तों की त्रिज्याएं 5 सेमी. और 3 सेमी. हैं। बड़े वृत्त की जीवा, जो छोटे वृत्त को स्पर्श करती है, की लंबाई ज्ञात कीजिए। **3**

29. **(A)** एक A.P. जिसका पहला और पाँचवां पद क्रमशः −14 और 2 है तथा अन्तिम पद 62 है, तो A.P. में कितने पद हैं ? **3**

20. **Assertion (A) :** a, b, c are in A.P. if and only if $2b = a + c$.
Reason (R) : The sum of first n odd natural numbers is n^2. **1**

(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 and 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.

SECTION – B

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

21. **(A)** Find the sum and product of the roots of the quadratic equation $2x^2 - 9x + 4 = 0$. **2**

OR

(B) Find the discriminant of the quadratic equation $4x^2 - 5 = 0$ and hence comment on the nature of roots of the equation. **2**

22. **(A)** Evaluate $2\sec^2\theta + 3\text{cosec}^2\theta - 2\sin\theta\cos\theta$ if $\theta = 45^\circ$. **2**

OR

(B) If $\sin\theta - \cos\theta = 0$, then find the value of $\sin^4\theta + \cos^4\theta$. **2**

23. If a fair coin is tossed twice, find the probability of getting 'atmost one head'. **2**

24. Two numbers are in the ratio 2 : 3 and their LCM is 180. What is the HCF of these numbers ? **2**

25. If one zero of the polynomial $p(x) = 6x^2 + 37x - (k - 2)$ is reciprocal of the other, then find the value of k. **2**

SECTION – C

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

26. Find the value of 'p' for which one root of the quadratic equation $px^2 - 14x + 8 = 0$ is 6 times the other. **3**

27. From an external point, two tangents are drawn to a circle. Prove that the line joining the external point to the centre of the circle bisects the angle between the two tangents. **3**

28. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle. **3**

29. **(A)** How many terms are there in A.P. whose first and fifth term are – 14 and 2, respectively and the last term is 62. **3**

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(B) A.P. : 65, 61, 57, 53, ... का कौनसा पद सबसे पहला ऋणात्मक पद होगा? **3**

30. (A) सिद्ध कीजिए कि $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$ **3**

अथवा

(B) सिद्ध कीजिए कि $\sec A (1 - \sin A)(\sec A + \tan A) = 1$ **3**

31. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है। **3**

खण्ड – घ

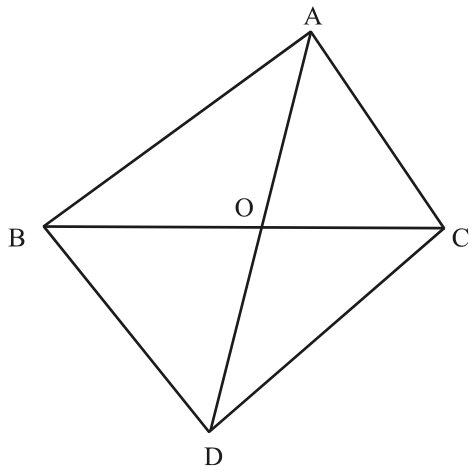
खण्ड – घ में दीर्घ–उत्तर (LA) प्रकार के प्रश्न हैं। प्रत्येक प्रश्न के 5 अंक हैं।

32. (A) एक त्रिभुज PQR में N, भुजा PR पर एक ऐसा बिंदु है जिसके लिए $QN \perp PR$ है। यदि $PN \times NR = QN^2$ है, तो सिद्ध कीजिए कि $\angle PQR = 90^\circ$. **5**

अथवा

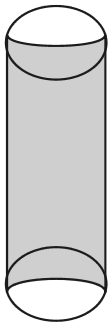
(B) दी गई आकृति में, त्रिभुज ABC और त्रिभुज DBC एक ही आधार BC पर हैं। यदि AD, BC को बिंदु O पर काटे, तो सिद्ध कीजिए कि

$$\frac{\Delta ABC \text{ का क्षेत्रफल}}{\Delta DBC \text{ का क्षेत्रफल}} = \frac{AO}{DO}$$



5

33. लकड़ी के एक ठोस बेलन के प्रत्येक सिरे पर एक अर्धगोला खोदकर निकालते हुए एक वस्तु बनाई गई है, जैसा आकृति में दिखाया गया है। यदि बेलन की ऊँचाई 10 सेमी. है और आधार की त्रिज्या 3.5 सेमी. है, तो इस वस्तु का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए। **5**



34. एक हाउसिंग सोसायटी के 200 परिवारों में दूध पर मासिक खर्च दर्ज किए जो नीचे दिए गए हैं :

मासिक खर्च (₹. में)	**1000-1500**	**1500-2000**	**2000-2500**	**2500-3000**	**3000-3500**	**3500-4000**	**4000-4500**	**4500-5000**
परिवारों की संख्या	**24**	**40**	**33**	***x***	**30**	**22**	**16**	**7**

x का मान ज्ञात कीजिए और दूध पर माध्यक और माध्य खर्च भी ज्ञात कीजिए। **5**

OR

(B) Which term of the A.P. : 65, 61, 57, 53, ... is the first negative term ? **3**

30. (A) Prove that $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$ **3**

OR

(B) Prove that sec A (1 – sin A) (sec A + tan A) = 1. **3**

31. Prove that $\sqrt{5}$ is an irrational number. **3**

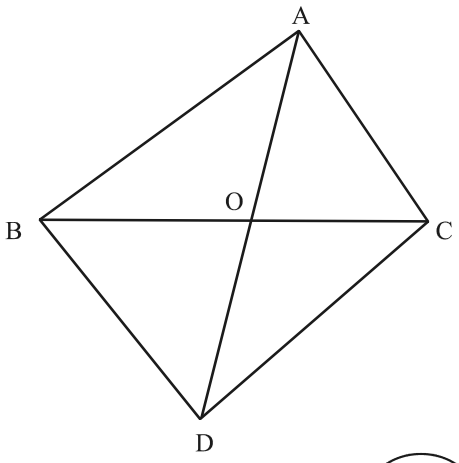
SECTION – D

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

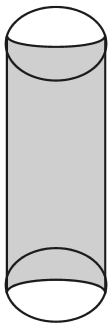
32. (A) In a ΔPQR, N is a point on PR, such that $QN \perp PR$. If $PN \times NR = QN^2$, prove that $\angle PQR = 90^o$. **5**

OR

(B) In the given figure, ΔABC and ΔDBC are on the same base BC. If AD intersects BC at O, prove that $\frac{\text{ar } (\Delta ABC)}{\text{ar } (\Delta DBC)} = \frac{AO}{DO}$ **5**



33. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm, find the total surface area of the article. **5**



34. The monthly expenditure on milk in 200 families of a Housing Society is given below :

Monthly Expenditure (in ₹)	**1000-1500**	**1500-2000**	**2000-2500**	**2500-3000**	**3000-3500**	**3500-4000**	**4000-4500**	**4500-5000**
Number of families	**24**	**40**	**33**	***x***	**30**	**22**	**16**	**7**

Find the value of *x* and also, find the median and mean expenditure on milk. **5**

35. **(A)** एक सीधा राजमार्ग एक मीनार के पाद तक जाता है। एक 75 मी. ऊँचे टॉवर के शीर्ष पर खड़ा एक व्यक्ति दो कारों को 30^o और 60^o के अवनमन कोणों पर देखता है, जो टॉवर के पाद की ओर जा रही हैं। यदि एक कार टॉवर के उसी तरफ दूसरी कार के ठीक पीछे हो, तो दोनों कारों के बीच की दूरी ज्ञात कीजिए। ($\sqrt{3} = 1.73$ लीजिए) **5**

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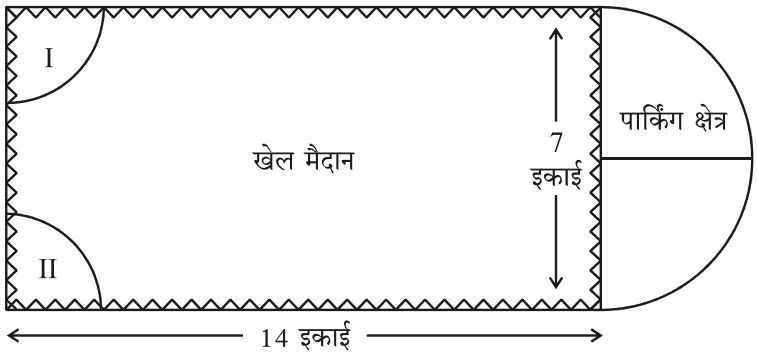
(B) 7 मी. ऊँचे भवन के शिखर से एक केबल टॉवर के शिखर का उन्नयन कोण 60^o है और इसके पाद का अवनमन कोण 30^o है। टॉवर की ऊँचाई ज्ञात कीजिए। **5**

खण्ड – ड़

खण्ड – ड़ में प्रकरण अध्ययन/परिच्छेद आधारित 3 प्रश्न हैं। प्रत्येक प्रश्न के 4 अंक हैं।

36. देहरादून के एक स्थानीय सार्वजनिक विकास प्राधिकरण की गवर्निंग काउंसिल ने एक पहाड़ी की चोटी पर एक साहसिक खेल का मैदान बनाने का फैसला किया, जिसमें पार्किंग के लिए पर्याप्त जगह होगी।



सर्वेक्षण के पश्चात्, आयताकार खेल का मैदान बनाने का निर्णय लिया गया, जिसमें एक तरफ पार्किंग के लिए एक अर्ध–वृत्ताकार क्षेत्र अंकित हो। आयताकार खेल के मैदान की लम्बाई और चौड़ाई क्रमशः 14 इकाई और 7 इकाई है। खेल के मैदान के एक ओर 2 इकाई त्रिज्या के दो चतुर्थांश विशेष सीटों के लिए हैं।

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

(i) पार्किंग क्षेत्र का कुल परिमाप कितना है ? **1**

(ii) (a) पार्किंग क्षेत्र और दो चतुर्थांशों को मिलाकर कुल क्षेत्रफल कितना है ? **2**

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(b) खेल के मैदान के क्षेत्रफल और पार्किंग क्षेत्र के क्षेत्रफल में क्या अनुपात है ? **2**

(iii) खेल के मैदान और पार्किंग क्षेत्र के चारों ओर तार लगवाने का खर्च, 2 रु. प्रति इकाई की दर से ज्ञात कीजिए। **1**

37. दो स्कूलों 'P' और 'Q' ने अपने छात्रों को हॉकी ₹ x प्रति छात्र और क्रिकेट ₹ y प्रति छात्र दो खेलों के लिए पुरस्कार देने का फैसला किया। स्कूल 'P' ने दो खेलों के लिए क्रमशः 5 और 4 छात्रों को कुल 9,500 रु. का पुरस्कार देने का फैसला किया, जबकि स्कूल 'Q' ने दो खेलों के लिए क्रमशः 4 और 3 छात्रों को कुल 7,370 रु. का पुरस्कार देने का फैसला किया।

35. **(A)** A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high tower observes two cars at angles of depression of 30^o and 60^o, which are approaching the foot of the tower. If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (use $\sqrt{3} = 1.73$) **5**

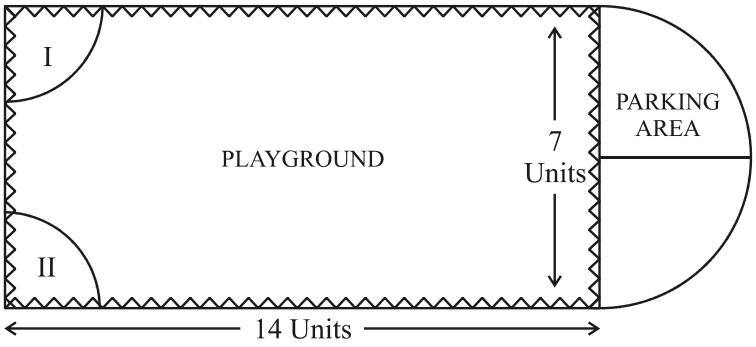
OR

(B) From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60^o and the angle of depression of its foot is 30^o. Determine the height of the tower. **5**

SECTION – E

Section – E consists of three Case Study Based questions of 4 marks each.

36. Governing council of a local public development authority of Dehradun decided to build an adventurous playground on the top of a hill, which will have adequate space for parking.



After survey, it was decided to build rectangular playground, with a semi-circular area allotted for parking at one end of the playground. The length and breadth of the rectangular playground are 14 units and 7 units, respectively. There are two quadrants of radius 2 units on one side for special seats.

Based on the above information, answer the following questions :

(i) What is the total perimeter of the parking area ? **1**

(ii) (a) What is the total area of parking and the two quadrants ? **2**

OR

(b) What is the ratio of area of playground to the area of parking area ? **2**

(iii) Find the cost of fencing the playground and parking area at the rate of ₹ 2 per unit. **1**

37. Two schools 'P' and 'Q' decided to award prizes to their students for two games of Hockey ₹ x per student and Cricket ₹ y per student. School 'P' decided to award a total of ₹ 9,500 for the two games to 5 and 4 students respectively; while school 'Q' decided to award ₹ 7,370 for the two games to 4 and 3 students respectively.

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

(i) उपरोक्त सूचना को, चरों x और y का प्रयोग करके, बीजगणितीय रूप में व्यक्त कीजिए। **1**

(ii) (a) हॉकी के लिए पुरस्कार राशि क्या है ? **2**

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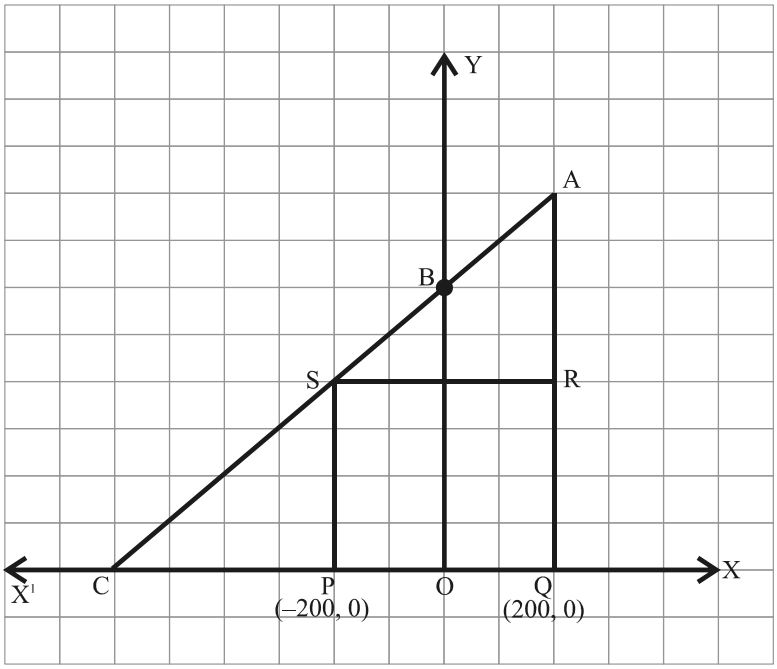
(b) पुरस्कार राशि किस खेल की अधिक है और कितनी अधिक ? **2**

(iii) यदि प्रत्येक खेल से 2 छात्र हों, तो कुल पुरस्कार राशि क्या होगी ? **1**

38. जगदीश के पास एक खेत है जो एक समकोण त्रिभुज AQC के आकार का है। वह खेत के अंदर एक वर्गाकार PQRS के रूप में गेहूँ उगाने के लिए और शेष सब्जियाँ उगाने के लिए (चित्र में दर्शाये अनुसार) जगह छोड़ना चाहता है। खेत में, O के रूप में चिह्नित एक खंभा है।



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

(i) O को मूल बिंदु मान कर, बिंदुओं P और Q के निर्देशांक क्रमशः (−200, 0) और (200, 0) हैं। PQRS एक वर्ग होने के कारण, R और S के निर्देशांक क्या होंगे ? **1**

(ii) (a) वर्ग PQRS का क्षेत्रफल क्या है ? **2**

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(b) वर्ग PQRS में विकर्ण PR की लम्बाई क्या है ? **2**

(iii) यदि बिंदु S, रेखाखण्ड CA को अनुपात K:1 में विभाजित करे, तो K का मान क्या होगा, यदि बिंदु A के निर्देशांक (200, 800) हों ? **1**

Based on the given information, answer the following questions :

(i) Represent the following information algebraically (in terms of x and y). **1**

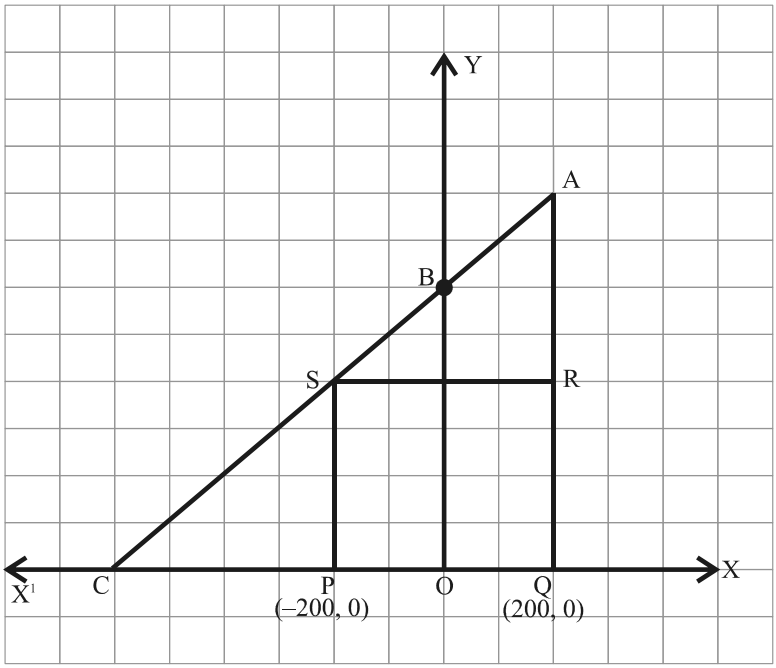
(ii) (a) What is the prize amount for hockey ? **2**

OR

(b) Prize amount on which game is more and by how much ? **2**

(iii) What will be the total prize amount if there are 2 students each from two games ? **1**

38. Jagdish has a field which is in the shape of a right angled triangle AQC. He wants to leave a space in the form of a square PQRS inside the field for growing wheat and the remaining for growing vegetables (as shown in the figure). In the field, there is a pole marked as O.



Based on the above information, answer the following questions :

(i) Taking O as origin, coordinates of P are (–200, 0) and of Q are (200, 0). PQRS being a square, what are the coordinates of R and S ? **1**

(ii) (a) What is the area of square PQRS ? **2**

OR

(b) What is the length of diagonal PR in square PQRS ? **2**

(iii) If S divides CA in the ratio K:1, what is the value of K, where point A is (200, 800) ? **1**

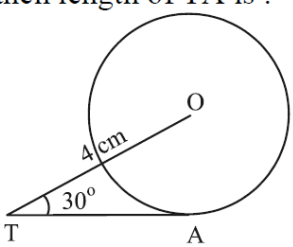
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
MATHEMATICS PAPER CODE 30/4/3

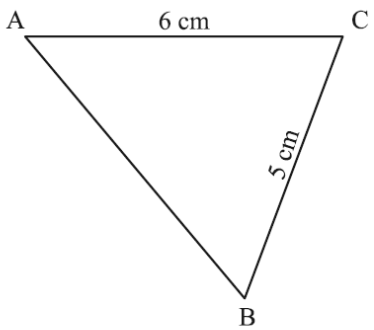
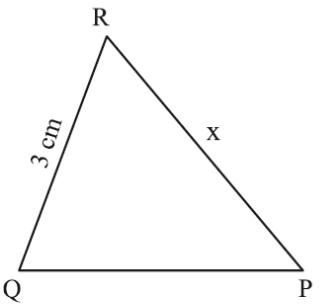
General Instructions: -

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 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.**
4	The Marking scheme carries only suggested value points for the answers. 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	**In Q1-Q20, if a candidate attempts the question more than once (without canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, 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".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	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.

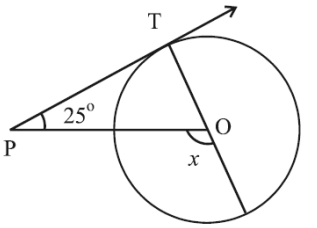
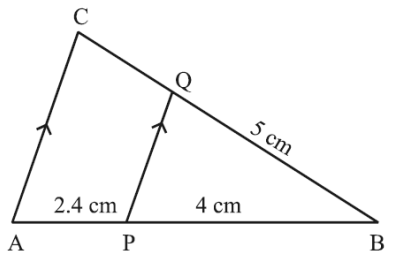
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	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. ● 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 X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	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.
16	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.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
19	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.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/4/3)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each**	
1.	The pair of linear equations $2x = 5y + 6$ and $15y = 6x - 18$ represents two lines which are : (a) intersecting (b) parallel (c) coincident (d) either intersecting or parallel	
Sol.	(c) Coincident	**1**
2.	In the given figure, TA is a tangent to the circle with centre O such that OT = 4 cm, $\angle OTA = 30^\circ$, then length of TA is : (a) $2\sqrt{3}$ cm (b) 2 cm (c) $2\sqrt{2}$ cm (d) $\sqrt{3}$ cm 	
Sol.	(a) $2\sqrt{3}$ cm	**1**
3.	The ratio of HCF to LCM of the least composite number and the least prime number is : (a) 1:2 (b) 2:1 (c) 1:1 (d) 1:3	
Sol.	(a) 1 : 2	**1**
4.	If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then sun's elevation is : (a) 60° (b) 45° (c) 30° (d) 90°	
Sol.	(a) 60°	**1**

5.	  In the given figure, $\Delta ABC \sim \Delta QPR$. If AC = 6 cm, BC = 5 cm, QR = 3 cm and PR = x; then the value of x is : (a) 3.6 cm (b) 2.5 cm (c) 10 cm (d) 3.2 cm	
Sol.	(b) 2.5 cm	**1**
6.	The distance of the point (– 6, 8) from origin is : (a) 6 (b) – 6 (c) 8 (d) 10	
Sol.	(d) 10	**1**
7.	The next term of the A.P. : $\sqrt{7}$, $\sqrt{28}$, $\sqrt{63}$ is : (a) $\sqrt{70}$ (b) $\sqrt{80}$ (c) $\sqrt{97}$ (d) $\sqrt{112}$	
Sol.	(d) $\sqrt{112}$	**1**
8.	$(\sec^2\theta - 1)(\text{cosec}^2\theta - 1)$ is equal to : (a) – 1 (b) 1 (c) 0 (d) 2	
Sol.	(b) 1	**1**
9.	Two dice are thrown together. The probability of getting the difference of numbers on their upper faces equals to 3 is : (a) $\frac{1}{9}$ (b) $\frac{2}{9}$ (c) $\frac{1}{6}$ (d) $\frac{1}{12}$	
Sol.	(c) $\frac{1}{6}$	**1**

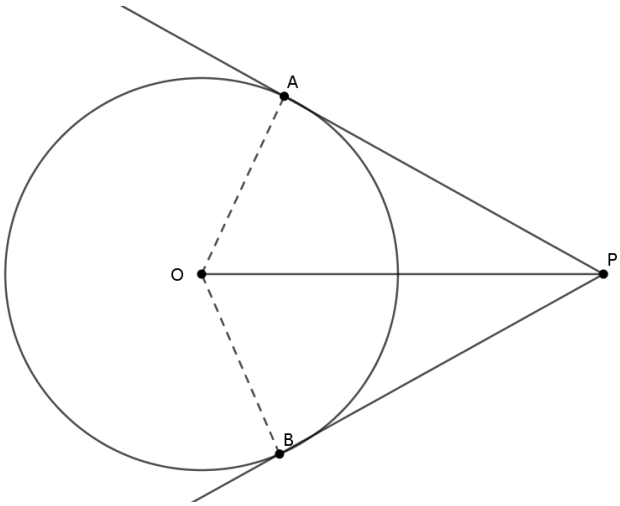
10.	A card is drawn at random from a well-shuffled pack of 52 cards. The probability that the card drawn is not an ace is : (a) $\frac{1}{13}$ (b) $\frac{9}{13}$ (c) $\frac{4}{13}$ (d) $\frac{12}{13}$	
Sol.	(d) $\frac{12}{13}$	**1**
11.	The roots of the equation $x^2 + 3x - 10 = 0$ are : (a) 2, –5 (b) –2, 5 (c) 2, 5 (d) –2, –5	
Sol.	(a) 2, – 5	**1**
12.	If α, β are zeroes of the polynomial x^2-1, then value of $(\alpha + \beta)$ is : (a) 2 (b) 1 (c) –1 (d) 0	
Sol.	(d) 0	**1**
13.	If α, β are the zeroes of the polynomial $p(x) = 4x^2 - 3x - 7$, then $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ is equal to : (a) $\frac{7}{3}$ (b) $\frac{-7}{3}$ (c) $\frac{3}{7}$ (d) $\frac{-3}{7}$	
Sol.	(d) $-\frac{3}{7}$	**1**
14.	What is the area of a semi-circle of diameter 'd' ? (a) $\frac{1}{16}\pi d^2$ (b) $\frac{1}{4}\pi d^2$ (c) $\frac{1}{8}\pi d^2$ (d) $\frac{1}{2}\pi d^2$	
Sol.	(c) $\frac{1}{8}\pi d^2$	**1**
15.	For the following distribution : **Marks Below** | **10** | **20** | **30** | **40** | **50** | **60** **Number of Students** | **3** | **12** | **27** | **57** | **75** | **80** The modal class is : (a) 10-20 (b) 20-30 (c) 30-40 (d) 50-60	
Sol.	(c) 30-40	**1**

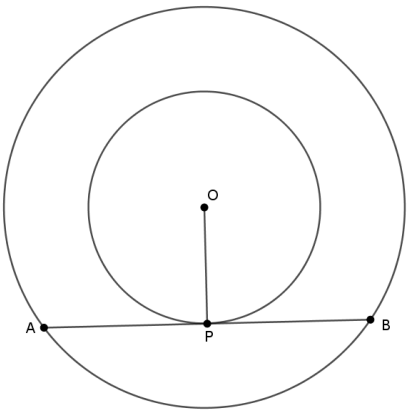
16.	In the given figure, PT is a tangent at T to the circle with centre O. If $\angle TPO = 25^\circ$, then x is equal to : (a) 25° (b) 65° (c) 90° (d) 115° 	
Sol.	(d) 115°	**1**
17.	In the given figure, PQ||AC. If BP = 4 cm, AP = 2.4 cm and BQ = 5 cm, then length of BC is : (a) 8 cm (b) 3 cm (c) 0.3 cm (d) $\frac{25}{3}$ cm 	
Sol.	(a) 8 cm	**1**
18.	The points (– 4, 0), (4, 0) and (0, 3) are the vertices of a : (a) right triangle (b) isosceles triangle (c) equilateral triangle (d) scalene triangle	
Sol.	(b) isosceles triangle	**1**
	DIRECTIONS : In the question number **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option out of the following :	
19.	**Assertion (A) :** The probability that a leap year has 53 Sundays is $\frac{2}{7}$. **Reason (R) :** The probability that a non-leap year has 53 Sundays is $\frac{5}{7}$. (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 and 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.	

Sol.	(c) Assertion (A) is true but Reason (R) is false	**1**
20.	**Assertion (A) :** a, b, c are in A.P. if and only if $2b = a + c$. **Reason (R) :** The sum of first n odd natural numbers is n^2. (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 and 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.	
Sol.	(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).	**1**
	SECTION B **This section comprises very short answer (VSA) type questions of 2 marks each.**	
21(A).	Find the sum and product of the roots of the quadratic equation $2x^2 - 9x + 4 = 0$.	
Sol.	$2x^2 - 9x + 4 = 0$ $a = 2, b = -9, c = 4$ Let α, β be roots of $2x^2 - 9x + 4 = 0$ Sum $= \alpha + \beta = -\frac{b}{a} = \frac{9}{2}$ Product of roots $= \alpha\beta = \frac{c}{a} = \frac{4}{2} = 2$	**1** **1**
21(B).	Find the discriminant of the quadratic equation $4x^2 - 5 = 0$ and hence comment on the nature of roots of the equation.	
Sol.	$4x^2 - 5 = 0$ $a = 4, b = 0, c = -5$ Discriminant $= b^2 - 4ac = 0 - 4(4)(-5) = 80 > 0$ $\Rightarrow$ roots are real and distinct.	**$1\frac{1}{2}$** **$\frac{1}{2}$**

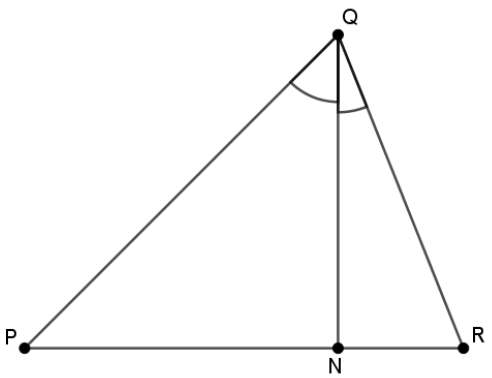
22(A).	Evaluate $2\sec^2\theta + 3\operatorname{cosec}^2\theta - 2\sin\theta\cos\theta$ if $\theta = 45^\circ$.	
Sol.	$2\sec^2 45^\circ + 3\operatorname{cosec}^2 45^\circ - 2\sin 45^\circ \cos 45^\circ$ $= 2\left(\sqrt{2}\right)^2 + 3\left(\sqrt{2}\right)^2 - 2\left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{\sqrt{2}}\right)$ $= 4 + 6 - 1 = 9$	$1\frac{1}{2}$ $\frac{1}{2}$
22(B).	If $\sin\theta - \cos\theta = 0$, then find the value of $\sin^4\theta + \cos^4\theta$.	
Sol.	$\sin\theta - \cos\theta = 0 \Rightarrow \sin\theta = \cos\theta \Rightarrow \tan\theta = 1$ $\Rightarrow \theta = 45^\circ$ $\sin^4 45^\circ + \cos^4 45^\circ = \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4$ $= \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$	$\frac{1}{2}$ 1 $\frac{1}{2}$
23.	If a fair coin is tossed twice, find the probability of getting 'atmost one head'.	
Sol.	Total outcomes are HH, HT, TH, TT Favourable outcomes are HT, TH, TT P (at most one head) = $\frac{3}{4}$	$\frac{1}{2}$ $\frac{1}{2}$ 1
24.	Two numbers are in the ratio 2 : 3 and their LCM is 180. What is the HCF of these numbers ?	

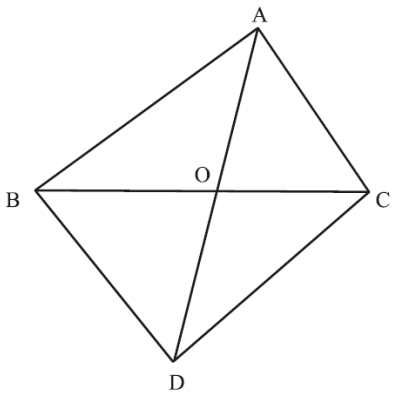
Sol.	Let the numbers be 2x, 3x LCM = 6x = 180 $\Rightarrow$ x = 30 $\therefore$ Numbers are 60, 90 HCF (60, 90) = 30	**1** **1**
25.	If one zero of the polynomial $p(x) = 6x^2 + 37x - (k - 2)$ is reciprocal of the other, then find the value of k.	
Sol.	$p(x) = 6x^2 + 37x - (k - 2)$ Let the zeroes be α, $\frac{1}{\alpha}$ Product of zeroes = $\alpha \cdot \frac{1}{\alpha} = -\frac{(k-2)}{6}$ $6 = -k + 2 \Rightarrow k = -4$	**$\frac{1}{2}$** **1** **$\frac{1}{2}$**
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26.	Find the value of 'p' for which one root of the quadratic equation $px^2 - 14x + 8 = 0$ is 6 times the other.	
Sol.	Let roots of the quadratic equation be α, 6α $px^2 - 14x + 8 = 0$ $\therefore \alpha + 6\alpha = \frac{14}{p} \Rightarrow 7\alpha = \frac{14}{p} \Rightarrow \alpha = \frac{2}{p}$ and $\alpha \cdot 6\alpha = \frac{8}{p} \Rightarrow 6\alpha^2 = \frac{8}{p} \Rightarrow 6 \cdot \frac{4}{p^2} = \frac{8}{p}$ $\Rightarrow p = 3$	**1** **1+$\frac{1}{2}$** **$\frac{1}{2}$**

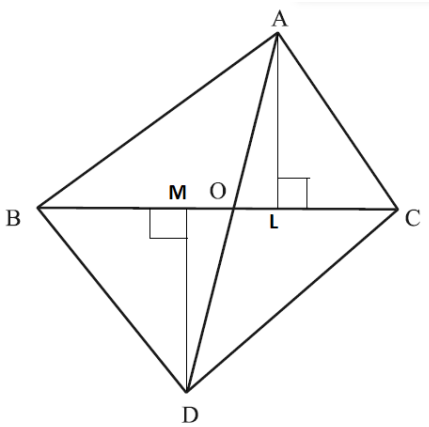
27.	From an external point, two tangents are drawn to a circle. Prove that the line joining the external point to the centre of the circle bisects the angle between the two tangents.	
Sol.	Given : PA and PB are tangents drawn from an external point P to the circle with centre O.  To prove: $\angle OPA = \angle OPB$ Construction: Join OA, OB Proof: In Δ OPA and Δ OPB OP = OP (common) OA = OA (radii) $\angle OAP = \angle OBP$ (each 90°, radius $\perp$ tangents) $\therefore \Delta OPA \cong \Delta OPB$ (RHS) $\Rightarrow \angle OPA = \angle OPB$ (CPCT)	**1 mark for correct figure** **$\frac{1}{2}$** **1** **$\frac{1}{2}$**

28.	Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.	
Sol.	AB is the chord of larger circle touching the smaller circle at P.  OA = 5 cm, OP = 3 cm To find AB OP ⊥ AB (radius ⊥ tangent) AB is the chord of larger circle and OP ⊥ AB ∴ AP = PB In right-angled Δ AOP, $AP^2 = 5^2 - 3^2 = 16$ AP = 4 cm ∴ AB = 2AP = 8 cm	**$\frac{1}{2}$** **1** **1** **$\frac{1}{2}$**
29(A).	How many terms are there in an A.P. whose first and fifth terms are – 14 and 2, respectively and the last term is 62.	
Sol.	$a = -14$, $a_5 = 2 \Rightarrow a + 4d = 2$ $-14 + 4d = 2 \Rightarrow d = 4$ $a_n = 62 \Rightarrow a + (n-1)d = 62$ $-14 + (n-1)4 = 62 \Rightarrow n = 20$	**1** **1** **1**

29(B).	Which term of the A.P. : 65, 61, 57, 53, ... is the first negative term ?	
Sol.	65, 61, 57, 53, ... a = 65, d = – 4 Let a_n be the first negative term $a_n < 0 \Rightarrow a + (n-1)d < 0$ $65 + (n-1)(-4) < 0 \Rightarrow 69 - 4n < 0$ $n > \frac{69}{4}$ $\therefore$ Least positive integral value of n which satisfies $n > \frac{69}{4}$ is 18 $\therefore$ 1^{st} negative term of AP = 18	**$\frac{1}{2}$** **1** **1** **$\frac{1}{2}$**
30(A).	Prove that $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$	
Sol.	LHS = $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \frac{\sin A (1 - 2\sin^2 A)}{\cos A (2\cos^2 A - 1)}$ $= \frac{\sin A[1 - 2(1 - \cos^2 A)]}{\cos A[2\cos^2 A - 1]} = \frac{\sin A[1 - 2 + 2\cos^2 A]}{\cos A[2\cos^2 A - 1]}$ $= \frac{\sin A[2\cos^2 A - 1]}{\cos A[2\cos^2 A - 1]} = \tan A = RHS$	**1** **1** **1**
30(B).	Prove that sec A (1 – sin A) (sec A + tan A) = 1.	
Sol.	LHS = sec A (1 – sin A) (sec A + tan A) $= \frac{1}{\cos A}(1 - \sin A)\left(\frac{1}{\cos A} + \frac{\sin A}{\cos A}\right)$	**1**

	$= \frac{1}{\cos A}(1 - \sin A)\frac{(1 + \sin A)}{\cos A}$ $= \frac{1 - \sin^2 A}{\cos^2 A} = \frac{\cos^2 A}{\cos^2 A} = 1 = RHS$	**1** **1**
31.	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{p}{q}$, where $q \neq 0$ and let p & q be co-primes. $5q^2 = p^2 \Rightarrow p^2$ is divisible by 5 $\Rightarrow$ p is divisible by 5 $\Rightarrow p = 5a$, where 'a' is some integer ----- (i) $25a^2 = 5q^2 \Rightarrow q^2 = 5a^2 \Rightarrow q^2$ is divisible by 5 $\Rightarrow$ q is divisible by 5 $\Rightarrow q = 5b$, where 'b' is some integer ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{5}$ is an irrational number.	½ 1 ½ 1
	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	
32(A).	In a ΔPQR, N is a point on PR, such that $QN \perp PR$. If $PN \times NR = QN^2$, prove that $\angle PQR = 90^o$.	
Sol.	 $PN \times NR = QN^2$ $\frac{PN}{QN} = \frac{QN}{NR}$	**1 mark for correct figure**

	$\angle$ PNQ = $\angle$ QNR Δ PNQ ~ Δ QNR $\Rightarrow \angle 2 = \angle P$ and $\angle 1 = \angle R$ $\Rightarrow \angle 1 + \angle 2 = \angle P + \angle R$ $\Rightarrow \angle PQR = \angle P + \angle R$ In Δ PQR, $\angle P + \angle PQR + \angle R = 180°$ $\Rightarrow 2 \angle PQR = 180° \Rightarrow \angle PQR = 90°$	$1\frac{1}{2}$ **1** **1** $\frac{1}{2}$
32(B).	In the given figure, ΔABC and ΔDBC are on the same base BC. If AD intersects BC at O, prove that $\frac{\text{ar } (\Delta ABC)}{\text{ar } (\Delta DBC)} = \frac{AO}{DO}$  	

Sol.	 Draw AL ⊥ BC and DM ⊥ BC In ΔAOL and ΔDOM, $\angle AOL = \angle DOM$ $\angle ALO = \angle DMO$ $\Delta AOL \sim \Delta DOM$ $\Rightarrow \frac{AL}{DM} = \frac{AO}{DO}$.....(i) $\frac{ar(\Delta \text{ ABC})}{ar(\Delta \text{ DBC})} = \frac{\frac{1}{2} \times \text{BC} \times \text{AL}}{\frac{1}{2} \times \text{BC} \times \text{DM}}$ $= \frac{AL}{DM} = \frac{AO}{DO}$ [using (i)]	**1** **2** **$\frac{1}{2}$** **1** **$\frac{1}{2}$**
33.	A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm, find the total surface area of the article.	
Sol.	Height of cylinder = 10 cm	

Radius of cylinder = radius of hemisphere = $3{\cdot}5 = \frac{7}{2}$ cm **1**

Total surface area of the article

= CSA of cylinder + CSA of 2 hemispheres

$= 2\pi rh + 2 \times 2\pi r^2$

$= 2\pi r(h + 2r)$

$= 2 \times \frac{22}{7} \times \frac{7}{2}(10 + 2 \times \frac{7}{2})$ **$1\frac{1}{2} + 1\frac{1}{2}$**

$= 22 \times 17 = 374\ cm^2$ **1**

34. The monthly expenditure on milk in 200 families of a Housing Society is given below :

Monthly Expenditure (in ₹)	**1000-1500**	**1500-2000**	**2000-2500**	**2500-3000**	**3000-3500**	**3500-4000**	**4000-4500**	**4500-5000**
Number of families	**24**	**40**	**33**	***x***	**30**	**22**	**16**	**7**

Find the value of x and also, find the median and mean expenditure on milk.

Sol.

Monthly Exp. (in ₹)	x	f_i	c_f	d	$x_i f_i$
1000 – 1500	1250	24	24	– 3	– 72
1500 – 2000	1750	40	64	– 2	– 80
2000 – 2500	2250	33	97	– 1	– 33
2500 – 3000	2750	x=28	125	0	0
3000 – 3500	3250	30	155	1	30

2 for correct table

3500 – 4000	3750	22	177	2	44
4000 – 4500	4250	16	193	3	48
4500 – 5000	4750	7	200	4	28
Total					– 35

$172 + x = 200 \quad \Rightarrow x = 28$ **1**

l = lower limit of median class = 2500

$\frac{N}{2} = \frac{200}{2} = 100$

C = 97, f = 28, h = 500

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

$$= 2500 + \frac{100 - 97}{28} \times 500$$

$$= 2500 + \frac{3}{28} \times 500 = 2553{\cdot}6$$ **1**

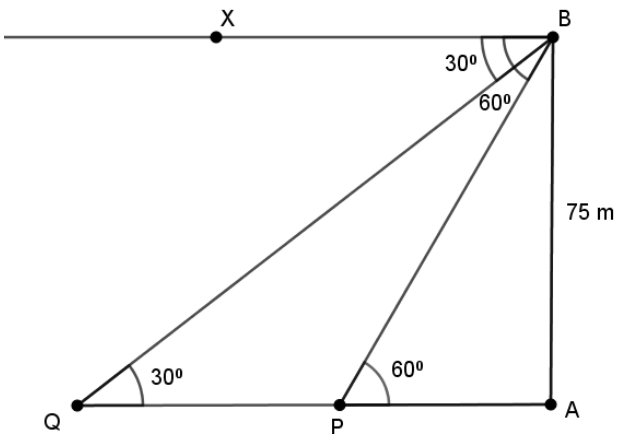
Median Expenditure = ₹ 2553·6

$$\text{Mean} = 2750 - \frac{35 \times 500}{200} = 2750 - 87{\cdot}5 = 2662{\cdot}5$$ **1**

Mean Expenditure = ₹ 2662·5

35(A). A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high tower observes two cars at angles of depression of 30° and 60°, which are approaching the foot of the tower. If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (use $\sqrt{3} = 1.73$)

Sol.



1 mark for correct figure

AB = Height of tower = 75 m

P, Q are positions of cars

$\angle$ XBQ = $\angle$ BQA = 30°

$\angle$ XBP = $\angle$ BPA = 60°

In Δ APB, $\tan 60° = \frac{75}{AP} \Rightarrow AP = \frac{75}{\sqrt{3}} = 25\sqrt{3}$ $\quad 1\frac{1}{2}$

In Δ AQB, $\tan 30° = \frac{75}{AQ} \Rightarrow AQ = 75\sqrt{3}$ $\quad 1\frac{1}{2}$

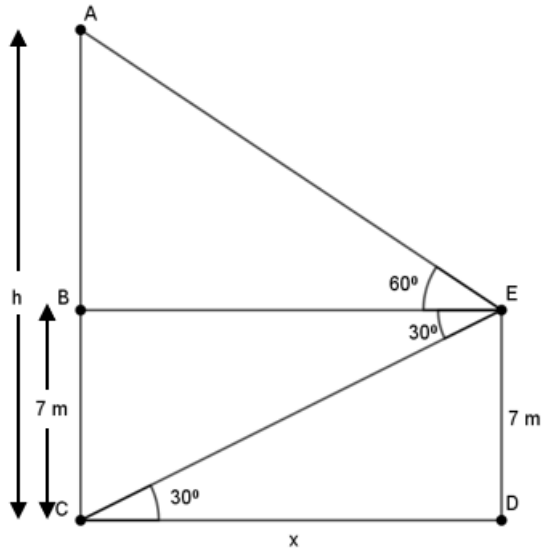
Distance between the cars = PQ = AQ – AP

$= 75\sqrt{3} - 25\sqrt{3} = 50\sqrt{3}$ $\quad \frac{1}{2}$

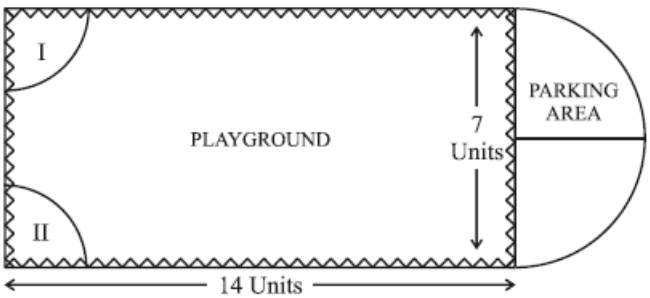
$= 50 \times 1{\cdot}73 = 86{\cdot}5$ m $\quad \frac{1}{2}$

35(B). From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60^o and the angle of depression of its foot is 30^o. Determine the height of the tower.

Sol.

	 Let AC be h m, BC = DE = 7 m, AB = (h−7) m $\angle AEB = 60^\circ$ and $\angle BEC = 30^\circ$ $\therefore \angle ECD = 30^\circ$ Let CD be x m $\frac{DE}{CD} = \frac{7}{x} = \tan 30° \Rightarrow x = 7\sqrt{3}$ $\Rightarrow BE = 7\sqrt{3}$ Again $\frac{AB}{BE} = \tan 60^\circ$ $\Rightarrow \frac{h-7}{7\sqrt{3}} = \sqrt{3}$ $\Rightarrow h = 28$ $\therefore$ Height of tower = 28 m	**1 mark for correct figure** **$1\frac{1}{2}$** **1** **1** **$\frac{1}{2}$**
	SECTION E **This section comprises of 3 case-study based questions of 4 marks each.**	

36. Governing council of a local public development authority of Dehradun decided to build an adventurous playground on the top of a hill, which will have adequate space for parking.



After survey, it was decided to build rectangular playground, with a semi-circular area allotted for parking at one end of the playground. The length and breadth of the rectangular playground are 14 units and 7 units, respectively. There are two quadrants of radius 2 units on one side for special seats.

Based on the above information, answer the following questions :

(i) What is the total perimeter of the parking area ?

(ii) (a) What is the total area of parking and the two quadrants ?

OR

(b) What is the ratio of area of playground to the area of parking area ?

(iii) Find the cost of fencing the playground and parking area at the rate of ₹ 2 per unit.

Sol.

(i) Total perimeter = $\pi r + 2r$

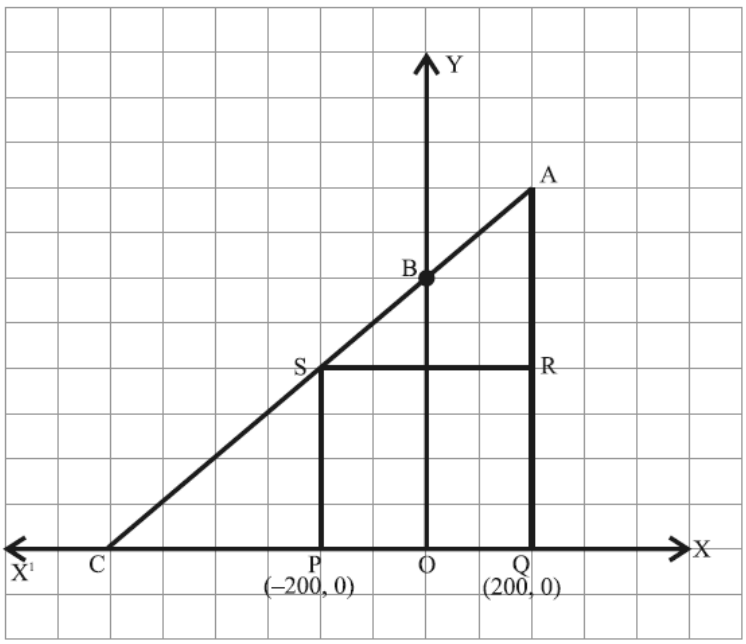
$$= \frac{22}{7} \times \frac{7}{2} + 7 = 18 \text{ units} \quad \textbf{1}$$

(ii) (a) Area of parking $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{77}{4}$ **1**

Area of quadrants $= 2 \cdot \frac{22}{7} \times 2 \times 2 \times \frac{1}{4} = \frac{44}{7}$ **$\frac{1}{2}$**

Total Area $= \frac{77}{4} + \frac{44}{7} = \frac{715}{28}$ or 25·54 sq. units **$\frac{1}{2}$**

	OR (ii) (b) $\frac{\text{Area of playground}}{\text{Area of parking}} = \frac{98}{77/4} = \frac{56}{11} = 56 : 11$ (iii) Required Perimeter = $2(l + b) + \frac{2\pi r}{2}$ $= 2(14 + 7) + \frac{22}{7} \times \frac{7}{2} = 53$ units Cost of fencing = $53 \times 2 =$ ₹ 106	**1+1** **$\frac{1}{2}$** **$\frac{1}{2}$**
37.	Two schools 'P' and 'Q' decided to award prizes to their students for two games of Hockey ₹ x per student and Cricket ₹ y per student. School 'P' decided to award a total of ₹ 9,500 for the two games to 5 and 4 students respectively; while school 'Q' decided to award ₹ 7,370 for the two games to 4 and 3 students respectively.  Based on the above information, answer the following questions : (i) Represent the following information algebraically (in terms of x and y). (ii) (a) What is the prize amount for hockey ? **OR** (b) Prize amount on which game is more and by how much ? (iii) What will be the total prize amount if there are 2 students each from two games ?	
Sol.	(i) 5x + 4y = 9500 _____ (1) 4x + 3y = 7370 _____ (2) (ii) (a) Solving (1) and (2), x = 980 ∴ Prize Amount for Hockey = ₹ 980 **OR** (ii) (b) On solving x = 980, y = 1,150	**$\frac{1}{2}$** **$\frac{1}{2}$** **1** **1** **1**

	∴ Prize Amount for Cricket is more by ₹ (1,150 – 980) = ₹ 170 (iii) 2(x + y) = 2(980 + 1150) = 2(2130) = ₹ 4,260	**1** **1**
38.	Jagdish has a field which is in the shape of a right angled triangle AQC. He wants to leave a space in the form of a square PQRS inside the field for growing wheat and the remaining for growing vegetables (as shown in the figure). In the field, there is a pole marked as O.  Based on the above information, answer the following questions : (i) Taking O as origin, coordinates of P are (–200, 0) and of Q are (200, 0). PQRS being a square, what are the coordinates of R and S ? (ii) (a) What is the area of square PQRS ? **OR** (b) What is the length of diagonal PR in square PQRS ? (iii) If S divides CA in the ratio K:1, what is the value of K, where point A is (200, 800) ?	
Sol.	(i) R(200, 400), S(– 200, 400)	$\frac{1}{2}+\frac{1}{2}$

	(ii) (a) side PQ = (200+200) m = 400 m Area of square PQRS = 400 × 400 = 160000 sq. units **OR** (ii) (b) Diagonal PR = $\sqrt{(400)^2 + (400)^2}$ = $\sqrt{3200}$ or $400\sqrt{2}$ (iii) $C(-600,0); A(200,800); S(-200,400)$ S divides CA in the ratio k: 1 $-200 = \frac{k(200)+1(-600)}{k+1}$ $\Rightarrow k = 1$	**1** **1** **1** **1** **1**