Series C3ABD/1

SET ~ 3

रोल नं. *Roll No.*							

प्रश्न–पत्र कोड
Q.P. Code **30/1/3**

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

नोट / NOTE :

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

(ii) कृपया जाँच कर लें कि इस प्रश्न–पत्र में **38** प्रश्न हैं।
Please check that this question paper contains **38** questions.

(iii) 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.

(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 minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)

MATHEMATICS (STANDARD)

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

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 -* ***क, ख, ग, घ*** *तथा* ***ड़।***

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

(iv) ***खण्ड ख*** *में प्रश्न संख्या* ***21*** *से* ***25*** *तक अति लघु-उत्तरीय (VSA) प्रकार के* ***2*** *अंकों के प्रश्न हैं।*

(v) ***खण्ड ग*** *में प्रश्न संख्या* ***26*** *से* ***31*** *तक लघु-उत्तरीय (SA) प्रकार के* ***3*** *अंकों के प्रश्न हैं।*

(vi) ***खण्ड घ*** *में प्रश्न संख्या* ***32*** *से* ***35*** *तक दीर्घ-उत्तरीय (LA) प्रकार के* ***5*** *अंकों के प्रश्न हैं।*

(vii) ***खण्ड ड़*** *में प्रश्न संख्या* ***36*** *से* ***38*** *तक* ***प्रकरण अध्ययन आधारित 4*** *अंकों के प्रश्न हैं। प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प* ***2*** *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 बनाइए। यदि आवश्यक हो तो* $\pi = \frac{22}{7}$ *लीजिए, यदि अन्यथा न दिया गया हो।*

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

खण्ड – क

20×1 = 20

इस खण्ड में 20 प्रश्न हैं जिनमें प्रत्येक का 1 अंक है।

1. यदि दो घन पूर्णांकों p तथा q को $p = 18\,a^2b^4$ तथा $q = 20\,a^3b^2$ के रूप में लिखा जा सकता है, जहाँ a तथा b अभाज्य संख्याएं हैं, तो LCM (p, q) है : **1**

(a) $2\,a^2b^2$ (b) $180\,a^2b^2$ (c) $12\,a^2b^2$ (d) $180\,a^3b^4$

2. एक समांतर श्रेढ़ी (A.P.) का प्रथम पद $(a) = -16$ तथा सार्वअंतर $(d) = -2$ है। इसके प्रथम 10 पदों का योगफल है : **1**

(a) -200 (b) -70 (c) -250 (d) 250

3. किन्हीं आँकड़ों $x_1, x_2, \ldots\ldots x_n$ जहाँ $f_1, f_2, \ldots\ldots f_n$ क्रमशः उनकी बारंबारताएँ हैं, के लिए $\sum_1^n f_i \left(x_i - \bar{x} \right)$ का मान है : **1**

(a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0

4. भुजा 2 cm वाले एक ठोस घन से काटकर निकाले जा सकने वाले अधिकतम आयतन के शंकु का आयतन है : **1**

(a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm

General Instructions :

Read the following instructions carefully and follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Question numbers **1** to **18** are multiple choice questions (MCQs) and question numbers **19** and **20** are Assertion – Reason based questions of **1** mark each.*

(iv) *In **Section B,** Question numbers **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Question numbers **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Question numbers **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Question numbers **36** to **38** are **case–study based integrated** 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 of 2 marks in Section **E**.*

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

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

SECTION - A **20×1 = 20**

This section consists of 20 questions of 1 mark each.

1. If two positive integers p and q can be expressed as $p = 18\ a^2b^4$ and $q = 20\ a^3b^2$, where a and b are prime numbers, then LCM (p, q) is : **1**

(a) $2\ a^2b^2$ (b) $180\ a^2b^2$ (c) $12\ a^2b^2$ (d) $180\ a^3b^4$

2. In an A.P., if the first term (a) = – 16 and the common difference (d) = – 2, then the sum of first 10 terms is : **1**

(a) – 200 (b) – 70 (c) – 250 (d) 250

3. For some data $x_1, x_2, \ldots\ldots x_n$ with respective frequencies $f_1, f_2, \ldots\ldots f_n$, the value of $\sum_1^n f_i \left(x_i - \bar{x} \right)$ is equal to : **1**

(a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0

4. The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is : **1**

(a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm

5. एक ठोस गोले को दो अर्धगोलों में काटा गया। इस गोले के पृष्ठीय क्षेत्रफल का दोनों अर्धगोलों के संपूर्ण पृष्ठीय क्षेत्रफल से अनुपात है : **1**

(a) 1 : 1 (b) 1 : 4 (c) 2 : 3 (d) 3 : 2

6. एक वृत्त का केंद्र बिंदु (2, 0) पर है। यदि वृत्त के एक व्यास का एक सिरा बिंदु (6, 0) पर है, तो इसके दूसरे सिरे के निर्देशांक हैं : **1**

(a) (0, 0) (b) (4, 0) (c) (– 2, 0) (d) (– 6, 0)

7. अच्छी प्रकार से फेंटी गई 52 पत्तों की ताश की एक गड्डी में से यादृच्छया एक पत्ता निकाला गया। इस पत्ते के लाल रंग के इक्के के होने की प्रायिकता है : **1**

(a) $\frac{1}{13}$ (b) $\frac{1}{26}$ (c) $\frac{1}{52}$ (d) $\frac{1}{2}$

8. प्रत्येक प्रकार के आँकड़ों को क्रम में व्यवस्थित करने पर सबसे बीच का प्रेक्षण होता है : **1**

(a) बहुलक (b) माध्यक (c) माध्य (d) विचलन

9. $\theta = 30^o$ के लिए, $(2 \sin \theta \cos \theta)$ का मान है : **1**

(a) 1 (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{\sqrt{3}}{4}$ (d) $\frac{3}{2}$

10. यदि समीकरण $ax^2 + bx + c = 0$, $a \neq 0$ के मूल वास्तविक और समान हैं, तो निम्न में से कौनसा संबंध सही है ? **1**

(a) $a = \frac{b^2}{c}$ (b) $b^2 = ac$ (c) $ac = \frac{b^2}{4}$ (d) $c = \frac{b^2}{a}$

11. आँकड़ों 1, 4, 7, 9, 16, 21, 25 में से यदि सभी सम संख्याएँ निकाल दी गई हों, तो शेष में यादृच्छया एक अभाज्य संख्या आने की प्रायिकता है : **1**

(a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

12. त्रिभुज ABC के शीर्ष A(5, – 6), B(6, 4) तथा C(0, 0) हैं तथा AD त्रिभुज की एक माध्यिका है। AD की लंबाई है : **1**

(a) $\sqrt{68}$ इकाई (b) $2\sqrt{15}$ इकाई (c) $\sqrt{101}$ इकाई (d) 10 इकाई

13. दो पासों को एक साथ उछाला गया। दोनों पासों पर आई संख्याओं का योग 2, 3 या 5 आने की प्रायिकता है : **1**

(a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$

14. यदि बिंदुओं (3, – 5) तथा $(x, – 5)$ के बीच की दूरी 15 इकाई है, तो x के मान हैं : **1**

(a) 12, – 18 (b) – 12, 18 (c) 18, 5 (d) – 9, – 12

5. A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is : **1**

(a) 1 : 1 (b) 1 : 4 (c) 2 : 3 (d) 3 : 2

6. The centre of a circle is at (2, 0). If one end of a diameter is at (6, 0), then the other end is at : **1**

(a) (0, 0) (b) (4, 0) (c) (– 2, 0) (d) (– 6, 0)

7. One card is drawn at random from a well shuffled deck of 52 playing cards. The probability that it is a red ace card, is : **1**

(a) $\frac{1}{13}$ (b) $\frac{1}{26}$ (c) $\frac{1}{52}$ (d) $\frac{1}{2}$

8. The middle most observation of every data arranged in order is called : **1**

(a) mode (b) median (c) mean (d) deviation

9. For $\theta = 30^{o}$, the value of $(2 \sin \theta \cos \theta)$ is : **1**

(a) 1 (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{\sqrt{3}}{4}$ (d) $\frac{3}{2}$

10 If the roots of equation $ax^2 + bx + c = 0$, $a \neq 0$ are real and equal, then which of the following relation is true ? **1**

(a) $a = \frac{b^2}{c}$ (b) $b^2 = ac$ (c) $ac = \frac{b^2}{4}$ (d) $c = \frac{b^2}{a}$

11. From the data 1, 4, 7, 9, 16, 21, 25, if all the even numbers are removed, then the probability of getting at random a prime number from the remaining is : **1**

(a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

12. AD is a median of ΔABC with vertices A(5, – 6), B(6, 4) and C(0, 0). Length AD is equal to : **1**

(a) $\sqrt{68}$ units (b) $2\sqrt{15}$ units (c) $\sqrt{101}$ units (d) 10 units

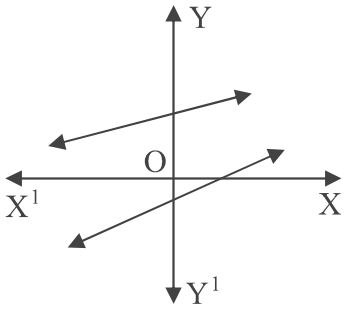
13. Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5, is : **1**

(a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$

14. If the distance between the points (3, – 5) and $(x, -5)$ is 15 units, then the values of x are : **1**

(a) 12, – 18 (b) – 12, 18 (c) 18, 5 (d) – 9, – 12

15. दी गई आकृति में दो रैखिक समीकरणों का ग्राफ दर्शाया गया है। इन रैखिक समीकरणों का युग्म : **1**



(a) अद्वितीय हल के साथ संगत है।

(b) अपरिमित रूप से अनेक हलों के साथ संगत है।

(c) असंगत है।

(d) असंगत है परन्तु रेखाओं को बढ़ाने पर संगत बनाया जा सकता है।

16. यदि α, β बहुपद $6x^2 - 5x - 4$ के शून्यक हैं, तो $\frac{1}{\alpha} + \frac{1}{\beta}$ का मान है : **1**

(a) $\frac{5}{4}$ (b) $-\frac{5}{4}$ (c) $\frac{4}{5}$ (d) $\frac{5}{24}$

17. यदि $\sec\theta - \tan\theta = m$ है, तो $\sec\theta + \tan\theta$ का मान है : **1**

(a) $1-\frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) $-m$

18. यदि बहुपद $x^2 + px + q$ के शून्यक, बहुपद $4x^2 - 5x - 6$ के शून्यकों के दुगने के बराबर हैं, तो p का मान है : **1**

(a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) -5 (d) 10

निर्देश :

प्रश्न संख्या 19 तथा 20 में एक अभिकथन (A) के बाद एक तर्क (R), कथन दिया गया है। सही विकल्प चुनिए।

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

(b) दोनों, अभिकथन (A) तथा तर्क (R) सही हैं परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या नहीं करता।

(c) अभिकथन (A) सही है परन्तु तर्क (R) गलत है।

(d) अभिकथन (A) गलत है जबकि तर्क (R) सही है।

19. **अभिकथन (A) :** वृत्त के किसी व्यास के सिरों पर खींची गई स्पर्श रेखाएँ परस्पर समांतर होती हैं।

तर्क (R) : एक वृत्त का व्यास इसकी सबसे लम्बी जीवा होती है। **1**

20. **अभिकथन (A) :** यदि किसी बहुपद का ग्राफ x-अक्ष को केवल एक बिंदु पर स्पर्श करता है, तो यह द्विघात बहुपद नहीं हो सकता।

तर्क (R) : घात $n (n > 1)$ के बहुपद के अधिकतम शून्यक n होते हैं। **1**

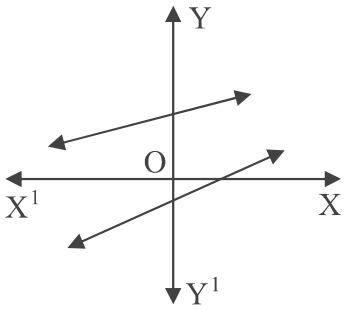
15. In the given figure, graphs of two linear equations are shown. The pair of these linear equations is : **1**

(a) consistent with unique solution.

(b) consistent with infinitely many solutions.

(c) inconsistent.

(d) inconsistent but can be made consistent by extending these lines.



16. If α, β are the zeroes of the polynomial $6x^2 - 5x - 4$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to : **1**

(a) $\frac{5}{4}$ (b) $-\frac{5}{4}$ (c) $\frac{4}{5}$ (d) $\frac{5}{24}$

17. If $\sec\theta - \tan\theta = m$, then the value of $\sec\theta + \tan\theta$ is : **1**

(a) $1-\frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) $-m$

18. The zeroes of a polynomial $x^2 + px + q$ are twice the zeroes of the polynomial $4x^2 - 5x - 6$. The value of p is : **1**

(a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) -5 (d) 10

Directions :

In Q. No. 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 correct explanation of Assertion (A).

(b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not correct explanation for 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 tangents drawn at the end points of a diameter of a circle, are parallel.

Reason (R) : Diameter of a circle is the longest chord. **1**

20. **Assertion (A) :** If the graph of a polynomial touches x-axis at only one point, then the polynomial cannot be a quadratic polynomial.

Reason (R) : A polynomial of degree $n(n > 1)$ can have at most n zeroes. **1**

खण्ड – ख

इस खण्ड में 5 प्रश्न हैं जिनमें प्रत्येक के 2 अंक हैं।

21. एक अच्छी प्रकार से फेंटी गई 52 पत्तों की ताश की गड्डी में से यादृच्छया एक पत्ता निकाला गया। यदि यह एक काले रंग का पत्ता है, तो इसे अलग रखकर शेष पत्तों में से एक पत्ता यादृच्छया निकाला गया। इस पत्ते के पान की बेगम वाला पत्ता आने की प्रायिकता ज्ञात कीजिए। **2**

22. **(A)** मान ज्ञात कीजिए : $2\sqrt{2}\ \cos 45^\circ \sin 30^\circ + 2\sqrt{3}\ \cos 30^\circ$ **2**

अथवा

(B) यदि $A = 60^\circ$ तथा $B = 30^\circ$ है, तो सत्यापित कीजिए कि :
$\sin (A + B) = \sin A \cos B + \cos A \sin B$ **2**

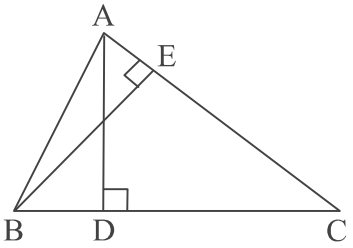
23. **(A)** सिद्ध कीजिए कि $5 - 2\sqrt{3}$ एक अपरिमेय संख्या है जब यह दिया है कि $\sqrt{3}$ अपरिमेय संख्या है। **2**

अथवा

(B) दर्शाइए कि संख्या $5\times11\times17+3\times11$ एक भाज्य संख्या (समग्र संख्या) है। **2**

24. निम्न रैखिक समीकरण निकाय को बीजगणित विधि से हल कीजिए :
$2x + 5y = -4;\ 4x - 3y = 5$ **2**

25. ΔABC में AD तथा BE त्रिभुज के शीर्ष लंब हैं। यदि AD = 7 सेमी, BE = 9 सेमी तथा EC = 12 सेमी है तो CD की लंबाई ज्ञात कीजिए। **2**



खण्ड – ग

इस खण्ड में 6 प्रश्न हैं जिनमें प्रत्येक के 3 अंक हैं।

26. दो अंकों की एक संख्या के अंकों का योगफल 14 है। अंकों के स्थान पलटने पर प्राप्त संख्या, मूल संख्या से 18 अधिक है, तो संख्या ज्ञात कीजिए। **3**

27. एक खोखला बेलन उसी अन्तः तथा बाह्य त्रिज्या के खोखले अर्धगोले पर रखा है। यदि बेलन की अन्तः तथा बाह्य त्रिज्याएँ क्रमशः 3 सेमी तथा 4 सेमी हैं तथा ऊँचाई 14 सेमी है तो इसका सम्पूर्ण पृष्ठ क्षेत्रफल (अन्तः तथा बाह्य) ज्ञात कीजिए। **3**

28. अध्यापकों की एक कार्यशाला में फ्रेंच, हिन्दी तथा अंग्रेजी के क्रमशः 48, 80 तथा 144 अध्यापक हैं। यदि प्रत्येक कमरे में एक ही विषय के अध्यापकों की समान संख्या रखनी हो, तो कम से कम कितने कमरों की आवश्यकता होगी? **3**

SECTION - B

This section consists of 5 questions of 2 marks each.

21. In a pack of 52 playing cards one card is lost. From the remaining cards, a card is drawn at random. Find the probability that the drawn card is queen of heart, if the lost card is a black card. **2**

22. **(A)** Evaluate : $2\sqrt{2}\ \cos 45^{o} \sin 30^{o} + 2\sqrt{3}\ \cos 30^{o}$ **2**

OR

(B) If $A = 60^{o}$ and $B = 30^{o}$, verify that :
$\sin (A + B) = \sin A \cos B + \cos A \sin B$ **2**

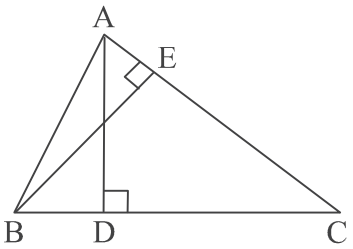
23. **(A)** Prove that $5 - 2\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number. **2**

OR

(B) Show that the number $5 \times 11 \times 17 + 3 \times 11$ is a composite number. **2**

24. Solve the following system of linear equations algebraically :
$2x + 5y = -4$; $4x - 3y = 5$ **2**

25. In ΔABC, altitudes AD and BE are drawn. If AD = 7 cm, BE = 9 cm and EC = 12 cm then, find the length of CD. **2**



SECTION - C

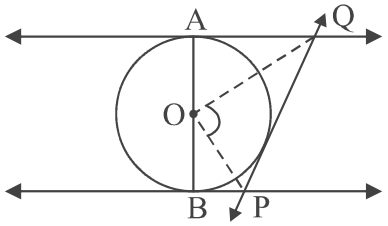
This section consists of 6 questions of 3 marks each.

26. The sum of the digits of a 2-digit number is 14. The number obtained by interchanging its digits exceeds the given number by 18. Find the number. **3**

27. The inner and outer radii of a hollow cylinder surmounted on a hollow hemisphere of same radii are 3 cm and 4 cm respectively. If height of the cylinder is 14 cm, then find its total surface area (inner and outer). **3**

28. In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject. **3**

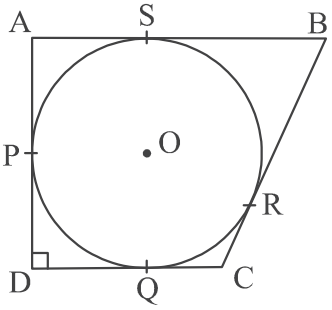
29. **(A)** दी गई आकृति में, AB वृत्त का व्यास है तथा O वृत्त का केंद्र है। AQ, BP तथा PQ वृत्त पर खींची गई स्पर्श रेखाएँ हैं। सिद्ध कीजिए कि $\angle POQ = 90^o$ है।



3

अथवा

(B) एक चतुर्भुज ABCD के अंतर्गत एक 8 सेमी त्रिज्या वाला वृत्त इस प्रकार खींचा गया कि P, Q, R, S स्पर्श बिंदु हैं, जैसा आकृति में दर्शाया गया है। यदि AD ⊥ DC है तथा BC = 30 सेमी और BS = 24 सेमी है तो DC की लंबाई ज्ञात कीजिए।



3

30. **(A)** वह अनुपात ज्ञात कीजिए जिसमें बिंदु $\left(\frac{8}{5}, y\right)$ बिंदुओं (1, 2) तथा (2, 3) को मिलाने वाले रेखाखण्ड को विभाजित करता है। y का मान भी ज्ञात कीजिए। **3**

अथवा

(B) बिंदु A (–1, –1), B (–1, 6), C (3, 6) तथा D (3, –1) एक आयत ABCD बनाते हैं। यदि P, Q, R तथा S क्रमशः भुजाओं AB, BC, CD तथा DA के मध्य बिंदु हैं तो सिद्ध कीजिए कि चतुर्भुज PQRS के विकर्ण एक-दूसरे का समद्विभाजन करते हैं। **3**

31. सिद्ध कीजिए : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\text{cosec}\,\theta$ **3**

खण्ड – घ

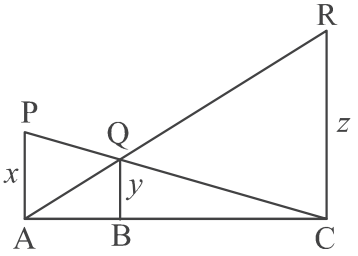
इस खण्ड में 4 प्रश्न हैं जिनमें प्रत्येक के 5 अंक हैं।

32. 15 मी. ऊँचाई वाले एक भवन के शिखर से एक मीनार के शिखर का उन्नयन कोण 30^o है। भवन के पाद से मीनार के शिखर का उन्नयन कोण 60^o है। मीनार की ऊँचाई तथा मीनार और भवन के बीच की दूरी ज्ञात कीजिए। **5**

33. **(A)** यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि यह भुजा अन्य भुजाओं को एक ही अनुपात में विभाजित करती है। **5**

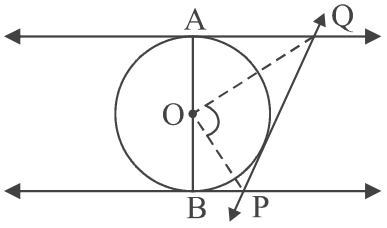
अथवा

(B) दी गई आकृति में PA, QB तथा RC प्रत्येक AC पर लंब हैं। यदि AP = x, BQ = y तथा CR = z हैं, तो सिद्ध कीजिए कि $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$



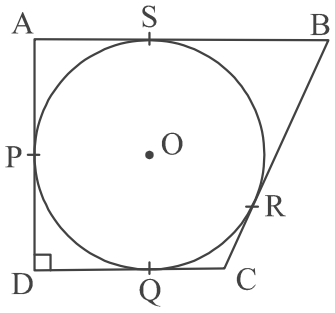
5

29. **(A)** In the given figure, AB is a diameter of the circle with centre O. AQ, BP and PQ are tangents to the circle. Prove that $\angle POQ = 90^o$. **3**



OR

(B) A circle with centre O and radius 8 cm is inscribed in a quadrilateral ABCD in which P, Q, R, S are the points of contact as shown. If AD is perpendicular to DC, BC = 30 cm and BS = 24 cm, then find the length DC. **3**



30. **(A)** Find the ratio in which the point $\left(\frac{8}{5}, y\right)$ divides the line segment joining the points (1, 2) and (2, 3). Also, find the value of y. **3**

OR

(B) ABCD is a rectangle formed by the points A (–1, –1), B (–1, 6), C (3, 6) and D (3, –1). P, Q, R and S are mid–points of sides AB, BC, CD and DA respectively. Show that diagonals of the quadrilateral PQRS bisect each other. **3**

31. Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$ **3**

SECTION - D

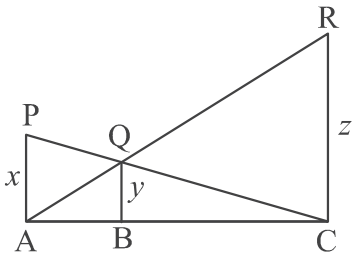
This section consists of 4 questions of 5 marks each.

32. From the top of a 15 m high building, the angle of elevation of the top of a tower is found to be 30^o. From the bottom of the same building, the angle of elevation of the top of the tower is found to be 60^o. Find the height of the tower and the distance between tower and the building. **5**

33. **(A)** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio. **5**

OR

(B) In the given figure PA, QB and RC are each perpendicular to AC. If AP = x, BQ = y and CR = z, then prove that $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$ **5**

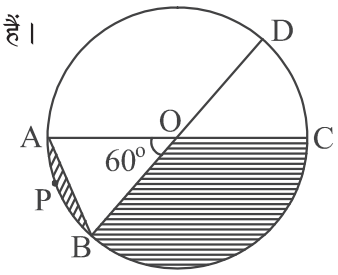


34. **(A)** एक समांतर श्रेढ़ी (A.P.) के प्रथम तथा आठवें पदों का योगफल 32 है तथा गुणनफल 60 है। इस श्रेढ़ी का प्रथम पद तथा सार्वअंतर ज्ञात कीजिए। इस श्रेढ़ी के प्रथम 20 पदों का योग भी ज्ञात कीजिए। **5**

अथवा

(B) 40 पदों की एक समांतर श्रेढ़ी के प्रथम 9 पदों का योगफल 153 है तथा इसके आखिरी छः पदों का योग 687 है। इस श्रेढ़ी का प्रथम पद तथा सार्वअन्तर ज्ञात कीजिए। इस श्रेढ़ी के सभी पदों का योगफल भी ज्ञात कीजिए। **5**

35. दी गई आकृति में, वृत्त के व्यास AC तथा BD; O पर काटते हैं। यदि $\angle AOB = 60^o$ तथा OA = 10 सेमी है, तो : **5**



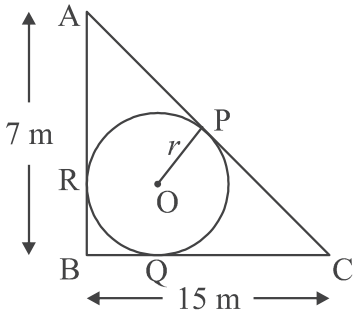
(i) जीवा AB की लंबाई ज्ञात कीजिए।

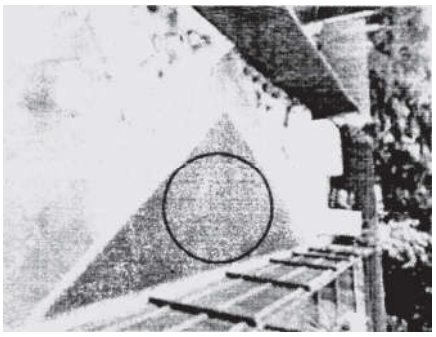
(ii) छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए।
($\pi = 3.14$ तथा $\sqrt{3} = 1.73$ लीजिए)

खण्ड – ड़

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं। प्रत्येक प्रश्न के 4 अंक हैं।

36. एक भवन के पीछे का हिस्सा एक त्रिभुज ABC के आकार का है जिसका कोण B समकोण है। AB = 7 मी. तथा BC = 15 मी. है। इसके अंदर एक वृत्ताकार खड्डा इस प्रकार खोदा गया कि यह भुजाओं AC, BC तथा AB को क्रमशः P, Q तथा R पर स्पर्श करता है तथा AP = x मी. है।





उपरोक्त जानकारी के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) x के पदों में AR की लंबाई ज्ञात कीजिए। **1**

(ii) चतुर्भुज BQOR किस प्रकार का चतुर्भुज है? **1**

(iii) (a) PC की लंबाई x के पदों में ज्ञात कीजिए और x का मान ज्ञात कीजिए। **2**

अथवा

(b) x का मान ज्ञात कीजिए और वृत्त की त्रिज्या r का मान ज्ञात कीजिए। **2**

34. **(A)** The sum of first and eighth terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms. **5**

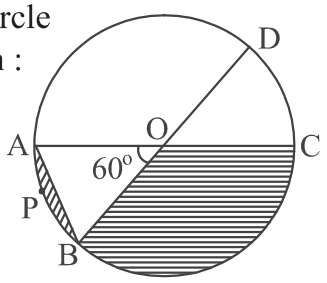
OR

(B) In an A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P. **5**

35. In the given figure, diameters AC and BD of the circle intersect at O. If $\angle AOB = 60^o$ and OA = 10 cm, then : **5**

(i) find the length of the chord AB.

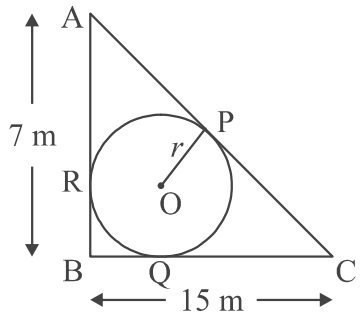
(ii) find the area of shaded region.
(Take $\pi = 3.14$ and $\sqrt{3} = 1.73$)

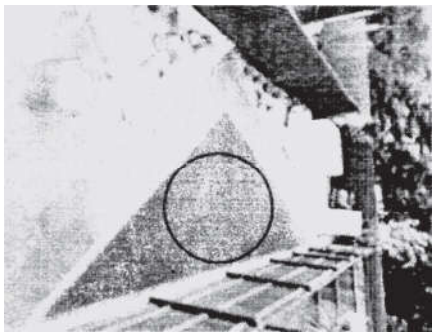


SECTION - E

This section consists of 3 Case-Study Based Questions of 4 marks each.

36. A backyard is in the shape of a triangle ABC with right angle at B. AB = 7 m and BC = 15 m. A circular pit was dug inside it such that it touches the walls AC, BC and AB at P, Q and R respectively such that AP = x m.





Based on the above information, answer the following questions :

(i) Find the length of AR in terms of x. **1**

(ii) Write the type of quadrilateral BQOR. **1**

(iii) (a) Find the length PC in terms of x and hence find the value of x. **2**

OR

(b) Find x and hence find the radius r of circle. **2**

37. एक आयताकार क्षेत्र के फर्श को 200 वर्गाकार टाइलों द्वारा पूरा ढका (भरा) जा सकता है। यदि प्रत्येक टाइल की भुजा 1 इकाई बढ़ा दी जाए तो फर्श केवल 128 टाइलों से ही ढक जाता है।

(i) यह मानते हुए कि टाइल की प्रत्येक भुजा की मूल लंबाई x इकाई है, उपरोक्त सूचना को द्विघात समीकरण द्वारा निरूपित कीजिए। **1**

(ii) संगत द्विघात समीकरण को मानक रूप में लिखिए। **1**

(iii) (a) गुणनखण्डन से x का मान ज्ञात कीजिए। **2**

अथवा

(b) द्विघात समीकरण को द्विघात सूत्र से हल कीजिए। **2**

38. **बिंगो** एक संयोग का खेल है। मेजबान के पास 1 से 75 तक क्रमांकित 75 गेंदें हैं। प्रत्येक खिलाड़ी के पास एक **बिंगो** कार्ड है जिस पर कुछ संख्याएँ अंकित हैं। एक गेंद यादृच्छया चुनकर उस पर लिखी संख्या बोले जाने पर प्रतिभागी कार्ड पर वह संख्या रद्द कर देता है। जो भी कार्ड की सारी संख्याएँ रद्द कर पाता है तो वह **बिंगो** बोल कर खेल जीत जाता/जाती है।

नीचे दिए आँकड़े, एक ऐसा खेल दर्शाते हैं जिसमें तारा के '**बिंगो**' कहने से पहले 48 गेंद प्रयोग में लाई गईं।

बोली गई संख्या	कितनी बार
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

उपरोक्त जानकारी के आधार पर निम्न के उत्तर दीजिए :

(i) माध्यक वर्ग लिखिए। **1**

(ii) जब पहली गेंद निकाली गई थी उस समय एक सम संख्या के बोलने की क्या प्रायिकता थी ? **1**

(iii) (a) दिए गए आँकड़ों का माध्यक ज्ञात कीजिए। **2**

अथवा

(b) दिए गए आँकड़ों का बहुलक ज्ञात कीजिए। **2**

37. A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor.

(i) Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information. **1**

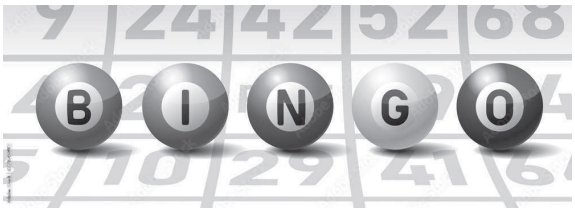
(ii) Write the corresponding quadratic equation in standard form. **1**

(iii) (a) Find the value of x, the length of side of a tile by factorisation. **2**

OR

(b) Solve the quadratic equation for x, using quadratic formula. **2**

38. BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it.



The participant cancels the number on the card when called out a number written on the ball selected at random. Whosoever cancels all the numbers on his/her card, says BINGO and wins the game.

The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Numbers announced	Number of times
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

Based on the above information, answer the following :

(i) Write the median class. **1**

(ii) When first ball was picked up, what was the probability of calling out an even number ? **1**

(iii) (a) Find median of the given data. **2**

OR

(b) Find mode of the given data. **2**

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/1/3

General Instructions: -

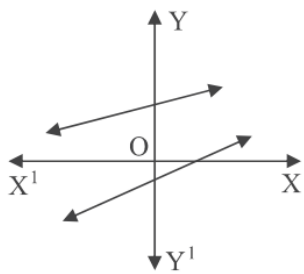
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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. It's 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 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 totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on 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 cancelling 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 totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/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 totalled 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: 30/1/3)

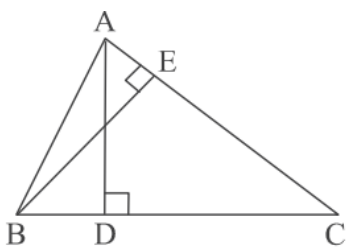
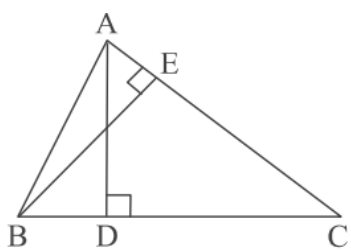
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section consists of 20 questions of 1 mark each.	
1.	If two positive integers p and q can be expressed as $p = 18\ a^2b^4$ and $q = 20\ a^3b^2$, where a and b are prime numbers, then LCM (p, q) is : (a) $2\ a^2b^2$ (b) $180\ a^2b^2$ (c) $12\ a^2b^2$ (d) $180\ a^3b^4$	
Sol.	(d) $180\ a^3b^4$	1
2.	In an A.P., if the first term $(a) = -16$ and the common difference $(d) = -2$, then the sum of first 10 terms is : (a) -200 (b) -70 (c) -250 (d) 250	
Sol.	(c) -250	1
3.	For some data $x_1, x_2, \ldots\ldots x_n$ with respective frequencies $f_1, f_2, \ldots\ldots f_n$, the value of $\sum_1^n f_i \left(x_i - \bar{x} \right)$ is equal to : (a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0	
Sol.	(d) 0	1
4.	The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is : (a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm	
Sol.	(d) $\frac{2\pi}{3}$ cu cm	1
5.	A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is : (a) 1 : 1 (b) 1 : 4 (c) 2 : 3 (d) 3 : 2	
Sol.	(c) 2 : 3	1

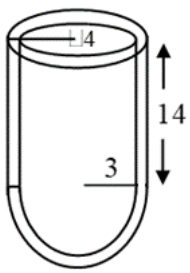
6.	The centre of a circle is at (2, 0). If one end of a diameter is at (6, 0), then the other end is at : (a) (0, 0) (b) (4, 0) (c) (– 2, 0) (d) (– 6, 0)	
Sol.	(c) (– 2, 0)	1
7.	One card is drawn at random from a well shuffled deck of 52 playing cards. The probability that it is a red ace card, is : (a) $\frac{1}{13}$ (b) $\frac{1}{26}$ (c) $\frac{1}{52}$ (d) $\frac{1}{2}$	
Sol.	(b) $\frac{1}{26}$	1
8.	The middle most observation of every data arranged in order is called : (a) mode (b) median (c) mean (d) deviation	
Sol.	(b) median	1
9.	For $\theta = 30^{\circ}$, the value of $(2 \sin \theta \cos \theta)$ is : (a) 1 (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{\sqrt{3}}{4}$ (d) $\frac{3}{2}$	
Sol.	(b) $\frac{\sqrt{3}}{2}$	1
10.	If the roots of equation $ax^2 + bx + c = 0$, $a \neq 0$ are real and equal, then which of the following relation is true ? (a) $a = \frac{b^2}{c}$ (b) $b^2 = ac$ (c) $ac = \frac{b^2}{4}$ (d) $c = \frac{b^2}{a}$	
Sol.	(c) ac = $\frac{b^2}{4}$	1
11.	From the data 1, 4, 7, 9, 16, 21, 25, if all the even numbers are removed, then the probability of getting at random a prime number from the remaining is : (a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$	
Sol.	(b) $\frac{1}{5}$	1

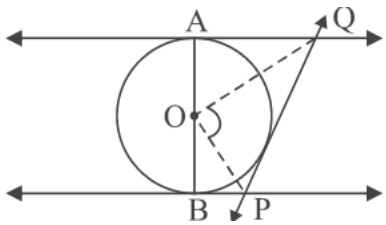
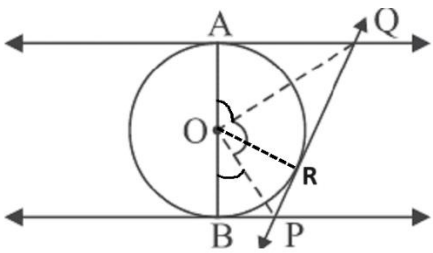
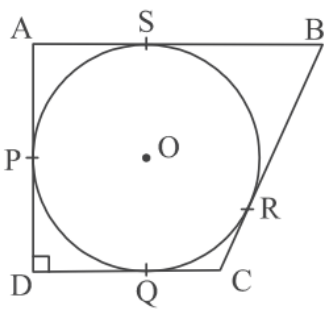
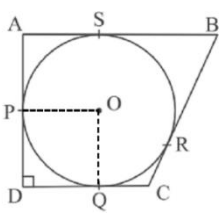
12.	AD is a median of ΔABC with vertices A(5, – 6), B(6, 4) and C(0, 0). Length AD is equal to : (a) $\sqrt{68}$ units (b) $2\sqrt{15}$ units (c) $\sqrt{101}$ units (d) 10 units	
Sol.	(a) $\sqrt{68}$ units	1
13.	Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5, is : (a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$	
Sol.	(a) $\frac{7}{36}$	1
14.	If the distance between the points (3, – 5) and (x, – 5) is 15 units, then the values of x are : (a) 12, – 18 (b) – 12, 18 (c) 18, 5 (d) – 9, – 12	
Sol.	(b) – 12, 18	1
15.	In the given figure, graphs of two linear equations are shown. The pair of these linear equations is : (a) consistent with unique solution. (b) consistent with infinitely many solutions. (c) inconsistent. (d) inconsistent but can be made consistent by extending these lines. 	
Sol.	(a) consistent with unique solution	1
16.	If α, β are the zeroes of the polynomial $6x^2 - 5x - 4$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to : (a) $\frac{5}{4}$ (b) $-\frac{5}{4}$ (c) $\frac{4}{5}$ (d) $\frac{5}{24}$	
Sol.	(b) $-\frac{5}{4}$	1
17.	If $\sec\theta - \tan\theta = m$, then the value of $\sec\theta + \tan\theta$ is : (a) $1-\frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) $-m$	
Sol.	(c) $\frac{1}{m}$	1

18.	The zeroes of a polynomial $x^2 + px + q$ are twice the zeroes of the polynomial $4x^2 - 5x - 6$. The value of p is : (a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) -5 (d) 10	
Sol.	(a) $-\frac{5}{2}$	1
	Directions : **In Q. No. 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 correct explanation of Assertion (A). (b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not correct explanation for 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 tangents drawn at the end points of a diameter of a circle, are parallel. **Reason (R) :** Diameter of a circle is the longest chord.	
Sol.	(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation for Assertion (A).	1
20.	**Assertion (A) :** If the graph of a polynomial touches x-axis at only one point, then the polynomial cannot be a quadratic polynomial. **Reason (R) :** A polynomial of degree $n(n > 1)$ can have at most n zeroes.	
Sol.	(d) Assertion (A) is false but Reason (R) is true.	1

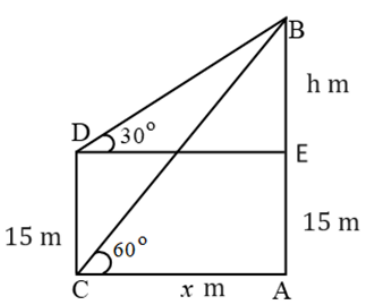
	SECTION B This section consists of 5 questions of 2 marks each.	
21.	In a pack of 52 playing cards one card is lost. From the remaining cards, a card is drawn at random. Find the probability that the drawn card is queen of heart, if the lost card is a black card.	
Sol.	Total number of remaining cards = 51 P (getting queen of heart) = $\frac{1}{51}$	1 1
22. (A)	Evaluate : $2\sqrt{2}\ \cos 45^\circ \sin 30^\circ + 2\sqrt{3}\ \cos 30^\circ$	
Sol.	$2\sqrt{2} \times \frac{1}{\sqrt{2}} \times \frac{1}{2} + 2\sqrt{3} \times \frac{\sqrt{3}}{2}$ $= 4$	½+½ + ½ ½
	OR	
22. (B)	If A = 60° and B = 30°, verify that : sin (A + B) = sin A cos B + cos A sin B	
Sol.	LHS = sin (60° + 30°) = sin 90° = 1 RHS = sin 60° cos 30° + cos 60° sin 30° $= \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} + \frac{1}{2} \times \frac{1}{2} = 1$ ∴ LHS = RHS	1 1
23. (A)	Prove that $5-2\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number.	
Sol.	Assuming $5 - 2\sqrt{3}$ to be a rational number. Let $5 - 2\sqrt{3} = \frac{a}{b}$ where a and b are integers & $b \neq 0$ $\Rightarrow \sqrt{3} = \frac{5b-a}{2b}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong. Hence, $5 - 2\sqrt{3}$ is an irrational number.	 ½ ½ ½ ½
	OR	

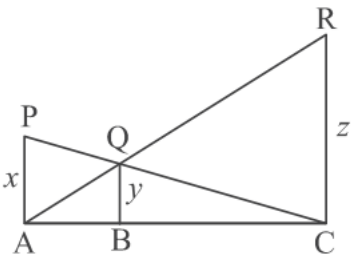
23. (B)	Show that the number $5\times11\times17+3\times11$ is a composite number.	
Sol.	$5 \times 11 \times 17 + 3 \times 11 = 11 \times (5 \times 17 + 3)$ $= 11\times 88$ or $11 \times 11 \times 2^3$ It means the number can be expressed as a product of two factors other than 1, therefore the given number is a composite number.	1 ½ ½
24.	Solve the following system of linear equations algebraically : $2x + 5y = -4$; $4x - 3y = 5$	
Sol.	$2x + 5y = -4$ $4x - 3y = 5$ Solving equations to get $x = \frac{1}{2}$, $y = -1$	1 + 1
25.	In ΔABC, altitudes AD and BE are drawn. If AD = 7 cm, BE = 9 cm and EC = 12 cm then, find the length of CD. 	
Sol.	$\Delta BEC \sim \Delta ADC$ $\Rightarrow \frac{BE}{AD} = \frac{EC}{CD}$ $\Rightarrow CD = \frac{12\times7}{9} = \frac{28}{3}$ or 9.33 cm 	1 1
	SECTION C This section consists of 6 questions of 3 marks each.	
26.	The sum of the digits of a 2-digit number is 14. The number obtained by interchanging its digits exceeds the given number by 18. Find the number.	
Sol.	Let the required number be 10x + y Here x + y = 14 ---- (i)	½

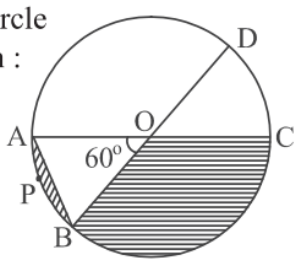
	and $10y + x = 18 + 10x + y$	½
	$\Rightarrow y - x = 2$ ---- (ii)	½
	Solving (i) and (ii) to get $x = 6, y = 8$	1
	$\therefore$ required number is 68.	½
27.	The inner and outer radii of a hollow cylinder surmounted on a hollow hemisphere of same radii are 3 cm and 4 cm respectively. If height of the cylinder is 14 cm, then find its total surface area (inner and outer).	
Sol.	 Total surface Area = Inner CSA + Outer CSA + Area of ring	
	$= \left[2 \times \frac{22}{7} \times 3 \times (3 + 14)\right] + \left[2 \times \frac{22}{7} \times 4 \times (4 + 14)\right] + \left[\frac{22}{7} \times (16 - 9)\right]$	2
	$= \frac{2244}{7} + \frac{3168}{7} + 22$	
	$= \frac{5566}{7}$ cm^2 or 795.14 cm^2 approx.	1
28.	In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject.	
Sol.	Minimum number of rooms required means there should be maximum number of teachers in a room. We have to find HCF of 48, 80 and 144.	
	$48 = 2^4 \times 3$	½
	$80 = 2^4 \times 5$	½
	$144 = 2^4 \times 3^2$	½
	HCF (48, 80, 144) $= 2^4 = 16$	½

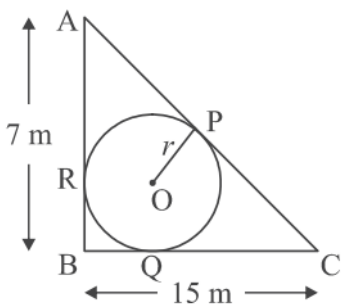
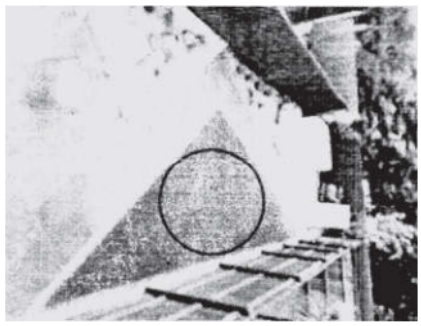
	Therefore, total number of rooms required = $\frac{48}{16} + \frac{80}{16} + \frac{144}{16} = 17$	1
29. (A)	In the given figure, AB is a diameter of the circle with centre O. AQ, BP and PQ are tangents to the circle. Prove that $\angle POQ = 90^o$. 	
Sol.		
	Join OR.	½
	$\Delta AOQ \cong \Delta ROQ \Rightarrow \angle AOQ = \angle ROQ$ ----- (i)	1
	$\Delta BOP \cong \Delta ROP \Rightarrow \angle BOP = \angle ROP$ ----- (ii)	½
	Since $\angle AOR + \angle ROB = 180°$	½
	$\Rightarrow 2\angle QOR + 2\angle ROP = 180°$	
	$\Rightarrow \angle QOR + \angle ROP = \angle POQ = 90°$	½
	OR	
29. (B)	A circle with centre O and radius 8 cm is inscribed in a quadrilateral ABCD in which P, Q, R, S are the points of contact as shown. If AD is perpendicular to DC, BC = 30 cm and BS = 24 cm, then find the length DC. 	
Sol.	Join OP and OQ. 	
	BR = BS = 24 cm	½
	∴ CR = 6 cm	½
	⇒ CQ = 6 cm	½

	Also, DQ = OP = 8 cm Hence, DC = 8 + 6 = 14 cm	½ 1
30. (A)	Find the ratio in which the point $\left(\frac{8}{5}, y\right)$ divides the line segment joining the points (1, 2) and (2, 3). Also, find the value of y.	
Sol.	Let AP: PB = k : 1 $\therefore \frac{2k+1}{k+1} = \frac{8}{5}$ $\Rightarrow k = \frac{3}{2}$ $\therefore$ required ratio is 3: 2. $y = \frac{3\times3+2\times2}{3+2} = \frac{13}{5}$	1 ½ ½ 1
	OR	
30. (B)	ABCD is a rectangle formed by the points A (–1, –1), B (–1, 6), C (3, 6) and D (3, –1). P, Q, R and S are mid–points of sides AB, BC, CD and DA respectively. Show that diagonals of the quadrilateral PQRS bisect each other.	
Sol.	Co-ordinates of point P are $\left(\frac{-1-1}{2}, \frac{-1+6}{2}\right)$ i.e. $\left(-1, \frac{5}{2}\right)$ Co-ordinates of point Q are $\left(\frac{-1+3}{2}, \frac{6+6}{2}\right)$ i.e. $(1, 6)$ Co-ordinates of point R are $\left(\frac{3+3}{2}, \frac{6-1}{2}\right)$ i.e. $\left(3, \frac{5}{2}\right)$ Co-ordinates of point S are $\left(\frac{-1+3}{2}, \frac{-1-1}{2}\right)$ i.e. $(1, -1)$ Co-ordinates of mid point of diagonal QS are $\left(\frac{1+1}{2}, \frac{6-1}{2}\right)$ i.e. $\left(1, \frac{5}{2}\right)$ Co-ordinates of mid point of diagonal PR are $\left(\frac{-1+3}{2}, \frac{\frac{5}{2}+\frac{5}{2}}{2}\right)$ i.e. $\left(1, \frac{5}{2}\right)$ Since coordinates of mid point of QS = coordinates of mid point of PR Therefore, diagonals PR and QS bisect each other.	½ ½ ½ ½ ½ ½

31.	Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\text{cosec}\,\theta$	
Sol.	LHS = $\frac{\frac{sin\theta}{cos\theta}}{\frac{(\sin\theta - cos\theta)}{sin\theta}} + \frac{\frac{cos\theta}{sin\theta}}{\frac{(\cos\theta - sin\theta)}{cos\theta}}$ $= \frac{1}{(sin\theta - cos\theta)}\left[\frac{sin^2\theta}{cos\theta} - \frac{cos^2\theta}{sin\theta}\right]$ $= \frac{1}{(sin\theta - cos\theta)} \times \frac{(sin\theta - cos\theta)(sin^2\theta + cos^2\theta + sin\theta cos\theta)}{sin\theta cos\theta}$ $= \frac{1}{sin\theta cos\theta} + 1$ $= 1 + sec\theta\ cosec\theta$ = RHS	½ 1 1 ½
	SECTION D This section consists of 4 questions of 5 marks each.	
32.	From the top of a 15 m high building, the angle of elevation of the top of a tower is found to be 30°. From the bottom of the same building, the angle of elevation of the top of the tower is found to be 60°. Find the height of the tower and the distance between tower and the building.	
Sol.	Correct figure  Let CD be the building and AB be the tower. $tan30° = \frac{1}{\sqrt{3}} = \frac{h}{DE} = \frac{h}{x}$ $\Rightarrow x = h\sqrt{3}$ ---- (i) $tan60° = \sqrt{3} = \frac{h+15}{x}$ $\Rightarrow h + 15 = x\sqrt{3}$ ---- (ii)	1 1 ½ 1 ½

	Solving (i) and (ii) to get $x = 7.5\sqrt{3}$ m or $\frac{15\sqrt{3}}{2}$ m and h = $\frac{15}{2}$ = 7.5 m Hence height of the tower is 7.5 + 15 = 22.5 m	½ ½
33. (A)	If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.	
Sol.	Correct figure, given, to prove and construction Correct proof	½×4 = 2 3
	OR	
33. (B)	In the given figure PA, QB and RC are each perpendicular to AC. If AP = x, BQ = y and CR = z, then prove that $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$  	
Sol.	$\Delta PAC \sim \Delta QBC$ $\therefore \frac{x}{y} = \frac{AC}{BC}$ or $\frac{y}{x} = \frac{BC}{AC}$ ---- (i) $\Delta RCA \sim \Delta QBA$ $\therefore \frac{z}{y} = \frac{AC}{AB}$ or $\frac{y}{z} = \frac{AB}{AC}$ ---- (ii) Adding (i) and (ii) $\frac{y}{x} + \frac{y}{z} = \frac{BC+AB}{AC}$ $\Longrightarrow \frac{1}{x} + \frac{1}{z} = \frac{1}{y}$	1 1 1 1 ½ ½
34. (A)	The sum of first and eighth terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms.	
Sol.	$a + a_8 = 32 \Longrightarrow 2a + 7d = 32$ ----- (i) $a \times a_8 = 60 \Longrightarrow a(a + 7d) = 60$ ----- (ii)	1 1

	Solving (i) & (ii), we get a = 2 or a = 30 and d = 4 or d = – 4 First term and common difference of A.P. are 2 and 4 or 30 and – 4 respectively. Now, for a = 2 & d = 4 S_{20} = 10 (4 + 76) = 800 and for a = 30 & d = – 4 S_{20} = 10 (60 – 76) = – 160	2 ½ ½
	OR	
34. (B)	In an A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P.	
Sol.	Here n = 40, $S_9 = \frac{9}{2}[2a + 8d] = 153 \Rightarrow a + 4d = 17$ ---- (i) and $S_{40} - S_{34} = 687$ or $a_{35} + a_{36} + a_{37} + a_{38} + a_{39} + a_{40} = 687$ $\Rightarrow 6a + 219d = 687$ or $2a + 73d = 229$ ---- (ii) solving (i) and (ii) to get a = 5, d = 3 Also, $S_{40} = \frac{40}{2}(10 + 39 \times 3) = 2540$	1 2 1 1
35.	In the given figure, diameters AC and BD of the circle intersect at O. If $\angle AOB = 60^o$ and OA = 10 cm, then : (i) find the length of the chord AB. (ii) find the area of shaded region. (Take π = 3.14 and $\sqrt{3}$ = 1.73) 	
Sol.	(i) Δ OAB is an equilateral triangle. ∴ AB = OA = 10 cm	1

	(ii) Area of segment APB (A_1) = $3.14 \times 100 \times \frac{60}{360} - \frac{1.73}{4} \times 100$	1
	= 9.08 cm^2 approx.	1
	Area of sector OBC (A_2) = $3.14 \times 100 \times \frac{120}{360}$	
	= 104.67 cm^2 approx.	1
	Area of shaded region = $A_1 + A_2$ = 113.75 cm^2 approx.	1
	SECTION E This section consists of 3 Case-Study Based Questions of 4 marks each.	
36.	A backyard is in the shape of a triangle ABC with right angle at B. AB = 7 m and BC = 15 m. A circular pit was dug inside it such that it touches the walls AC, BC and AB at P, Q and R respectively such that AP = x m.   Based on the above information, answer the following questions : (i) Find the length of AR in terms of x. (ii) Write the type of quadrilateral BQOR. (iii) (a) Find the length PC in terms of x and hence find the value of x. **OR** (b) Find x and hence find the radius r of circle.	
Sol.	(i) AR = x m	1
	(ii) Quad. ORBQ is a square.	1
	(iii) (a) PC = 8 + x	½
	$AC^2 = (8 + 2x)^2$ =49 + 225 =274	1
	$\Rightarrow$ $8 + 2x = \sqrt{274}$	

	$\Rightarrow x = \frac{-8+\sqrt{274}}{2}$ or 4.28 approx.	½
	OR	
	(iii) (b) $AC^2 = (8 + 2x)^2 = 49 + 225 = 274$	1
	$\Rightarrow 8 + 2x = \sqrt{274}$	
	$\Rightarrow x = \frac{-8+\sqrt{274}}{2}$ or 4.28 approx.	½
	Hence, radius $r = 7 - x = 7 - \left(-4 + \frac{\sqrt{274}}{2}\right)$	
	$= \left(11 - \frac{\sqrt{274}}{2}\right)$ or 2.72 approx.	½
	Therefore, radius of the circle is $\left(11 - \frac{\sqrt{274}}{2}\right)$ m or 2.72 m approx.	
37.	A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor. (i) Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information.  (ii) Write the corresponding quadratic equation in standard form. (iii) (a) Find the value of x, the length of side of a tile by factorisation. **OR** (b) Solve the quadratic equation for x, using quadratic formula.	
Sol.	(i) $200\,x^2 = 128\,(x + 1)^2$	1
	(ii) $25x^2 = 16x^2 + 32x + 16$	
	$\Rightarrow 9x^2 - 32x - 16 = 0$	1
	(iii) (a) $9x^2 - 32x - 16 = 0$	
	$\Rightarrow (9x + 4)(x - 4) = 0$	1
	$x \neq \frac{-4}{9}$ so, $x = 4$	1
	OR	

(iii) (b) $x = \frac{32 \pm \sqrt{1024+576}}{18} = \frac{32 \pm 40}{18}$ 1

$x \neq \frac{-4}{9}$ so, $x = 4$ 1

38. BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it.

The participant cancels the number on the card when called out a number written on the ball selected at random. Whosoever cancels all the numbers on his/her card, says BINGO and wins the game.

The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Numbers announced	Number of times
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

Based on the above information, answer the following :

(i) Write the median class.

(ii) When first ball was picked up, what was the probability of calling out an even number ?

(iii) (a) Find median of the given data.

OR

(b) Find mode of the given data.

Sol.

Number announced	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75
Number of times (f)	8	9	10	12	9
cf	8	17	27	39	48=N

(i) $\frac{N}{2} = 24$

$\therefore$ median class is 30 – 45 1

(ii) P (picking up an even number) = $\frac{37}{75}$ 1

(iii) (a) Median = $30 + \frac{\left(\frac{48}{2} - 17\right)}{10} \times 15$ 1

= 40.5 1

	OR	
	(iii) (b) Modal class is 45 – 60	½
	Mode = $45 + \frac{12-10}{2\times12-10-9} \times 15$	1
	= 51	½