Series WX1YZ/C

SET~1

प्रश्न–पत्र कोड
Q.P. Code 430/C/1

रोल नं.

Roll No.

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

गणित (बुनियादी)

MATHEMATICS (BASIC)

*

निर्धारित समय : 3 घण्टे — *अधिकतम अंक : 80*

Time allowed : 3 hours — *Maximum Marks : 80*

नोट / NOTE :

(i) *कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं ।*
*Please check that this question paper contains **27** printed pages.*

(ii) *प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।*
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

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

(iv) ***कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।***
Please write down the serial number of the question in the answer-book before attempting it.

(v) *इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक 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 सख़्ती से पालन कीजिए :

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

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

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

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

(vii) ***खण्ड ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **चार-चार** अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **दो-दो** अंकों के प्रश्न में दिया गया है ।*

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

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए । जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो ।*

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

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है ।

1. यदि एक A.P. का सार्व अन्तर – 6 है, तो $a_{20} - a_{14}$ का मान है :

(a) 36

(b) 6

(c) – 36

(d) – 6

General Instructions :

Read the following instructions very carefully and strictly 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,** 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.*

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions 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 diagrams wherever required. Take* $\pi = \frac{22}{7}$ *wherever required, if not stated.*

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

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. If common difference of an A.P. is -6, then value of $a_{20} - a_{14}$ is :

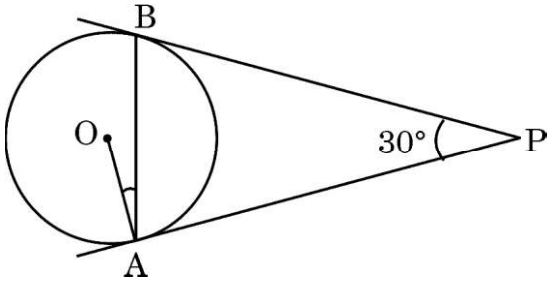
(a) 36

(b) 6

(c) – 36

(d) – 6

2. दी गई आकृति में, केंद्र O वाले वृत्त पर PA और PB स्पर्श-रेखाएँ हैं । यदि $\angle APB = 30°$ है, तो $\angle OAB$ बराबर है :



(a) 30° (b) 15°

(c) 45° (d) 10°

3. यदि $\text{cosec } A = \frac{7}{5}$ है, तो $\tan A \cdot \cos A$ का मान होगा :

(a) $\frac{7}{5}$ (b) $\frac{2\sqrt{6}}{5}$

(c) $\frac{24}{49}$ (d) $\frac{5}{7}$

4. निम्नलिखित बंटन के लिए

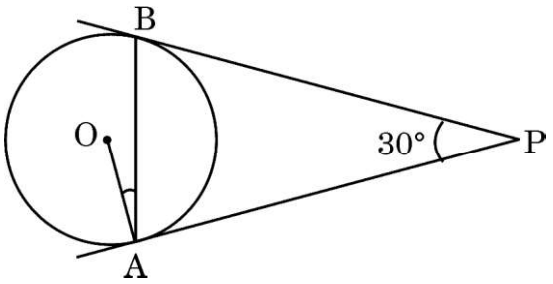
से कम अंक	छात्रों की संख्या
10	1
20	5
30	13
40	15
50	16

बहुलक वर्ग है :

(a) 30 – 40 (b) 40 – 50

(c) 20 – 30 (d) 10 – 20

2. In the given figure, PA and PB are tangents to a circle centred at O. If $\angle APB = 30°$, then $\angle OAB$ equals :



(a) 30° (b) 15°

(c) 45° (d) 10°

3. If $\text{cosec } A = \frac{7}{5}$, then value of $\tan A \cdot \cos A$ is :

(a) $\frac{7}{5}$ (b) $\frac{2\sqrt{6}}{5}$

(c) $\frac{24}{49}$ (d) $\frac{5}{7}$

4. For the following distribution

Marks below	Number of Students
10	1
20	5
30	13
40	15
50	16

the modal class is :

(a) 30 – 40 (b) 40 – 50

(c) 20 – 30 (d) 10 – 20

5. रैखिक समीकरण युग्म $5x + 4y = 20$ और $10x + 8y = 16$:

(a) का कोई हल नहीं है

(b) के अपरिमित रूप से अनेक हल हैं

(c) का अद्वितीय हल है

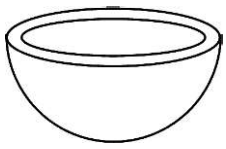
(d) के दो हल हैं

6. यदि $x = a \sin \theta$ और $y = b \cos \theta$ है, तो $b^2x^2 + a^2y^2$ बराबर है :

(a) 1 (b) a^2b^2

(c) $\frac{a^2 + b^2}{a^2b^2}$ (d) $a^2 + b^2$

7. त्रिज्याओं r_1 और r_2 $(r_2 > r_1)$ वाले अर्धगोलाकार कटोरे का कुल पृष्ठीय क्षेत्रफल (आंतरिक तथा बाह्य) है :



(a) $2\pi (r_1^2 + r_2^2)$ (b) $\pi (r_1^2 + r_2^2)$

(c) $3\pi r_2^2 + \pi r_1^2$ (d) $3\pi r_1^2 + \pi r_2^2$

8. शून्य बहुपद की घात :

(a) 0 होती है (b) 1 होती है

(c) कोई वास्तविक संख्या होती है (d) परिभाषित नहीं है

9. निम्नलिखित में से कौन-सी संख्या एक अपरिमेय संख्या है ?

(a) $\left(2\sqrt{3} - \frac{1}{\sqrt{3}}\right)^2$ (b) $(\sqrt{2} - 1)^2$

(c) $\sqrt{2} - (2 + \sqrt{2})$ (d) $\frac{(\sqrt{2} + 5\sqrt{2})}{\sqrt{2}}$

10. द्विघात समीकरण $x^2 + px - q = 0$ के मूल बराबर होंगे, यदि :

(a) $p^2 = 4q$ (b) $p^2 = -4q$

(c) $p^2 = 2q$ (d) $p^2 = -2q$

5. The pair of linear equations $5x + 4y = 20$ and $10x + 8y = 16$ has :

(a) no solution

(b) infinite number of solutions

(c) a unique solution

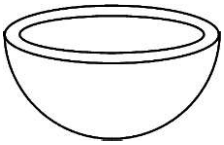
(d) two solutions

6. If $x = a \sin \theta$ and $y = b \cos \theta$, then $b^2x^2 + a^2y^2$ is equal to :

(a) 1 (b) a^2b^2

(c) $\dfrac{a^2 + b^2}{a^2b^2}$ (d) $a^2 + b^2$

7. Total surface area (internal and external) of a hemispherical bowl having radii r_1 and r_2 $(r_2 > r_1)$ is :



(a) $2\pi (r_1^2 + r_2^2)$ (b) $\pi (r_1^2 + r_2^2)$

(c) $3\pi r_2^2 + \pi r_1^2$ (d) $3\pi r_1^2 + \pi r_2^2$

8. Degree of a zero polynomial is :

(a) 0 (b) 1

(c) any real number (d) not defined

9. Which of the following is an irrational number ?

(a) $\left(2\sqrt{3} - \dfrac{1}{\sqrt{3}}\right)^2$ (b) $(\sqrt{2} - 1)^2$

(c) $\sqrt{2} - (2 + \sqrt{2})$ (d) $\dfrac{(\sqrt{2} + 5\sqrt{2})}{\sqrt{2}}$

10. The roots of the quadratic equation $x^2 + px - q = 0$ are equal, if :

(a) $p^2 = 4q$ (b) $p^2 = -4q$

(c) $p^2 = 2q$ (d) $p^2 = -2q$

11. बिंदुओं (c, 0) और (0, – c) के बीच की दूरी है :

(a) $c\sqrt{2}$ इकाई

(b) 2c इकाई

(c) $2\sqrt{c}$ इकाई

(d) c इकाई

12. दो घनों, जिनमें से प्रत्येक का किनारा 5 cm है, के संलग्न फलकों को मिलाकर जोड़ा गया है । इससे प्राप्त घनाभ का पृष्ठीय क्षेत्रफल है :

(a) 200 cm^2

(b) 300 cm^2

(c) 125 cm^2

(d) 250 cm^2

13. एक पासा एक बार फेंका गया है । 5 से अधिक संख्या प्राप्त होने की प्रायिकता है :

(a) $\frac{5}{6}$ (b) $\frac{1}{6}$

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

14. यदि किसी बंटन के माध्य और बहुलक क्रमश: 17 और 20 हैं, तो मूलानुपाती सूत्र का उपयोग करके इस बंटन का माध्यक होगा :

(a) 20 (b) $\frac{31}{3}$

(c) 18 (d) 17

11. The distance between the points (c, 0) and (0, – c) is :

(a) $c\sqrt{2}$ units

(b) 2c units

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

(d) c units

12. Two cubes each of 5 cm edge are joined end to end. The surface area of the resulting cuboid is :

(a) 200 cm^2

(b) 300 cm^2

(c) 125 cm^2

(d) 250 cm^2

13. A die is rolled once. The probability that the obtained number is more than 5, is :

(a) $\frac{5}{6}$ (b) $\frac{1}{6}$

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

14. If the mean and the mode of a distribution are 17 and 20 respectively, then the median of the distribution, using empirical formula, is :

(a) 20 (b) $\frac{31}{3}$

(c) 18 (d) 17

15. त्रिज्या r वाले उस वृत्तखंड, जिसका केंद्रीय कोण 90° है, का क्षेत्रफल है :

(a) $\frac{\pi r^2}{2} - \frac{1}{2} r^2$

(b) $\frac{2\pi r}{4} - \frac{1}{2} r^2$

(c) $\frac{\pi r^2}{4} - \frac{1}{2} r^2$

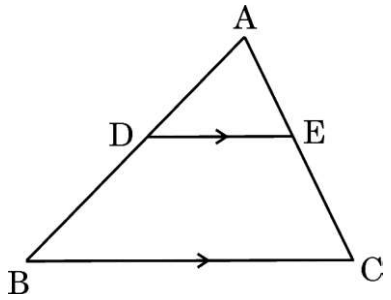
(d) $\frac{2\pi r}{4} - r^2 \sin 90^\circ$

16. एक द्विघात बहुपद जिसके शून्यक 7 और 0 हों, है :

(a) $x(x^2 - 7)$ (b) $7x^2 - 1$

(c) $\frac{1}{7}(x^2 - x)$ (d) $7(x^2 - 7x)$

17. त्रिभुज ABC में, DE ∥ BC है । यदि AD : DB = 2 : 3 हो, तो DE : BC बराबर है :



(a) 2 : 3 (b) 3 : 5

(c) 2 : 5 (d) 3 : 2

18. दिन के किसी समय, एक व्यक्ति की ऊँचाई और उसकी छाया की लम्बाई एकसमान हैं । सूर्य का उन्नतांश (altitude) है :

(a) 30° (b) 45°

(c) 60° (d) 90°

15. Area of a segment of a circle of radius r and central angle 90° is :

(a) $\frac{\pi r^2}{2} - \frac{1}{2} r^2$

(b) $\frac{2\pi r}{4} - \frac{1}{2} r^2$

(c) $\frac{\pi r^2}{4} - \frac{1}{2} r^2$

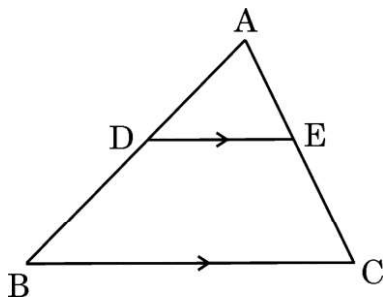
(d) $\frac{2\pi r}{4} - r^2 \sin 90^\circ$

16. A quadratic polynomial having zeroes 7 and 0 is :

(a) $x(x^2 - 7)$ (b) $7x^2 - 1$

(c) $\frac{1}{7}(x^2 - x)$ (d) $7(x^2 - 7x)$

17. In Δ ABC, DE $\parallel$ BC. If AD : DB = 2 : 3, then DE : BC is equal to :



(a) 2 : 3 (b) 3 : 5

(c) 2 : 5 (d) 3 : 2

18. At some time of the day, the height and length of the shadow of a man are equal. The sun's altitude is :

(a) 30° (b) 45°

(c) 60° (d) 90°

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं और प्रत्येक प्रश्न का 1 अंक है । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (a), (b), (c) और (d) में से चुनकर दीजिए ।*

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

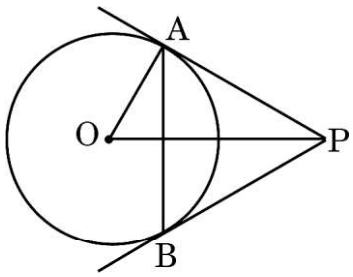
(b) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(c) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है ।

(d) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है ।

19. *अभिकथन (A) :* केंद्र O वाले वृत्त पर PA और PB स्पर्श-रेखाएँ हैं और $\angle$ OPA = 30° है । तब, Δ PAB एक समबाहु त्रिभुज है ।

तर्क (R) : बाह्य बिंदु से वृत्त पर खींची गई स्पर्श-रेखाओं की लम्बाइयाँ बराबर होती हैं ।



20. *अभिकथन (A) :* एक घटना होने की बहुत संभावना है यदि इसके घटने की प्रायिकता 0·9999 है ।

तर्क (R) : उस घटना, जिसका घटित होना निश्चित है, की प्रायिकता सदैव 1 होती है ।

*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.*

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

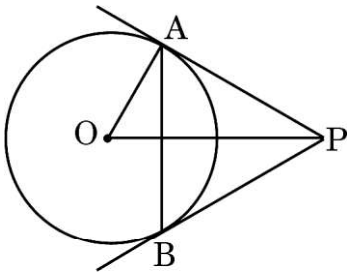
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

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

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

19. *Assertion (A) :* PA and PB are tangents to the circle centred at O and $\angle$ OPA = 30°. Then, Δ PAB is an equilateral triangle.

Reason (R) : Lengths of tangents from an external point to a circle are equal in length.



20. *Assertion (A) :* An event is very likely to happen if its probability is 0·9999.

Reason (R) : Probability of a sure event is always 1.

खण्ड ख

इस खण्ड में अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 2 अंक हैं ।

21. बिंदुओं (1, – 4) और (6, 5) को जोड़ने वाले रेखाखण्ड को x-अक्ष जिस अनुपात में विभाजित करता है, उसे ज्ञात कीजिए ।

22. (क) दर्शाइए कि किसी भी प्राकृत संख्या n के लिए, संख्या 8^n, अंक 0 पर कभी भी समाप्त नहीं हो सकती है ।

अथवा

(ख) अभाज्य गुणनखण्डन विधि के प्रयोग से, संख्याओं 96 और 160 का LCM और HCF ज्ञात कीजिए ।

23. तीन सिक्के एक साथ उछाले जाते हैं ।

(i) सभी संभव परिणामों को लिखिए ।

(ii) अधिक-से-अधिक 2 चित प्राप्त करने की प्रायिकता ज्ञात कीजिए ।

24. (क) A = 30° और B = 60° के लिए, निम्नलिखित को सत्यापित कीजिए :

$$\tan (B - A) = \frac{\tan B - \tan A}{1 + \tan A \tan B}$$

अथवा

(ख) मान ज्ञात कीजिए :

$$\sin^2 60° - 2 \cos^2 45° + \frac{1}{2} \operatorname{cosec}^2 30°$$

25. एक वृत्त का केंद्र और त्रिज्या ज्ञात कीजिए जिसके व्यास के अंत्य बिंदु (3, –10) और (1, 4) हैं ।

SECTION B

This section comprises very short answer (VSA) type questions of 2 marks each.

21. Find the ratio in which a line segment joining points (1, – 4) and (6, 5) is divided by the x-axis.

22. (a) Show that 8^n can never end with the digit 0 for any natural number n.

OR

(b) Find LCM and HCF of 96 and 160, using prime factorisation method.

23. Three coins are tossed together.

(i) Write all possible outcomes.

(ii) Find the probability of having at most 2 heads.

24. (a) For A = 30° and B = 60°, verify that

$$\tan (B - A) = \frac{\tan B - \tan A}{1 + \tan A \tan B}$$

OR

(b) Evaluate :

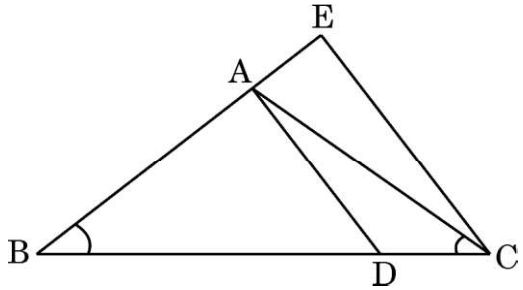
$$\sin^2 60° - 2 \cos^2 45° + \frac{1}{2} \operatorname{cosec}^2 30°$$

25. Find the centre and radius of a circle having end points of its diameter as (3, –10) and (1, 4).

खण्ड ग

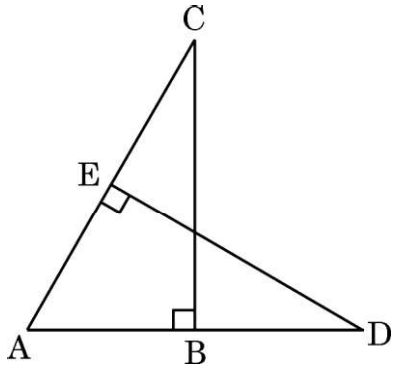
इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं ।

26. (क) दी गई आकृति में, $\frac{BC}{BD} = \frac{BE}{AC}$ और $\angle ABD = \angle ACD$ है । दर्शाइए कि $\Delta ABD \sim \Delta EBC$.



अथवा

(ख) दी गई आकृति में, ABC और AED दो समकोण त्रिभुज हैं, जिनके कोण B और E क्रमश: समकोण हैं । सिद्ध कीजिए कि :



(i) $\Delta ABC \sim \Delta AED$

(ii) $AB \times AD = AC \times AE$

27. बहुपद $x^2 - 11x + 18$ के शून्यक ज्ञात कीजिए तथा प्राप्त शून्यकों और गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिए ।

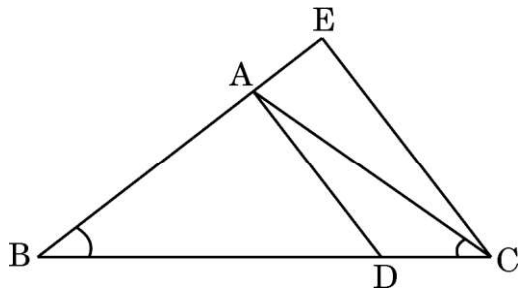
28. सिद्ध कीजिए :

$$\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$$

SECTION C

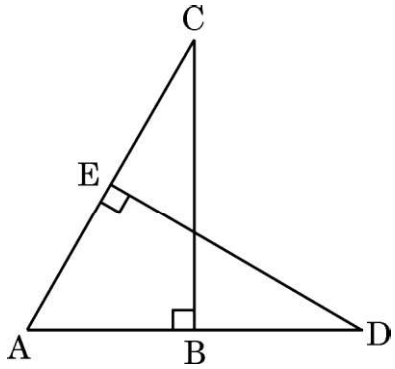
This section comprises short answer (SA) type questions of 3 marks each.

26. (a) In the given figure, $\frac{BC}{BD} = \frac{BE}{AC}$ and $\angle ABD = \angle ACD$. Show that $\Delta ABD \sim \Delta EBC$.



OR

(b) In the given figure, ABC and AED are two right triangles, right angled at B and E respectively. Prove that :



(i) $\Delta ABC \sim \Delta AED$

(ii) $AB \times AD = AC \times AE$

27. Find the zeroes of the polynomial $x^2 - 11x + 18$ and verify the relationship between the zeroes and the coefficients.

28. Prove that :

$$\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$$

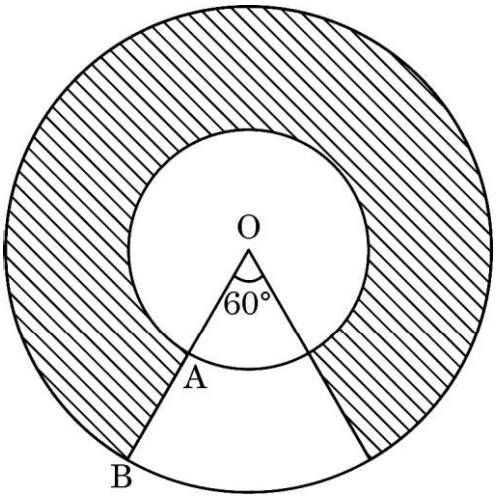
29. (क) सिद्ध कीजिए कि $2 + 3\sqrt{3}$ एक अपरिमेय संख्या है । यह दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

अथवा

(ख) सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है ।

30. दो वर्गों के क्षेत्रफलों का योगफल 468 m^2 है । यदि इन वर्गों की भुजाओं की लम्बाइयों का अन्तर 6 m हो, तो दोनों वर्गों की भुजाओं की लम्बाइयाँ ज्ञात कीजिए ।

31. दी गई आकृति में, केंद्र O वाले दो संकेंद्रीय वृत्त दर्शाए गए हैं । इन वृत्तों की त्रिज्याएँ OA = 3 cm और OB = 6 cm हैं ।



छायांकित भाग का परिमाप ज्ञात कीजिए ($\pi = 3{\cdot}14$ का प्रयोग कीजिए)

खण्ड घ

इस खण्ड में दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं ।

32. (क) रैखिक समीकरणों के युग्म : $2x - y = 2$ और $4x - y = 4$ का हल, ग्राफीय विधि से ज्ञात कीजिए ।

अथवा

(ख) 5 कुर्सियों और 1 मेज का कुल मूल्य ₹ 1,750 है; जबकि 4 कुर्सियों और 3 मेजों का कुल मूल्य ₹ 1,950 है । 1 कुर्सी और 1 मेज का मूल्य ज्ञात कीजिए । 10 कुर्सियों और 10 मेजों का कुल मूल्य कितना होगा ?

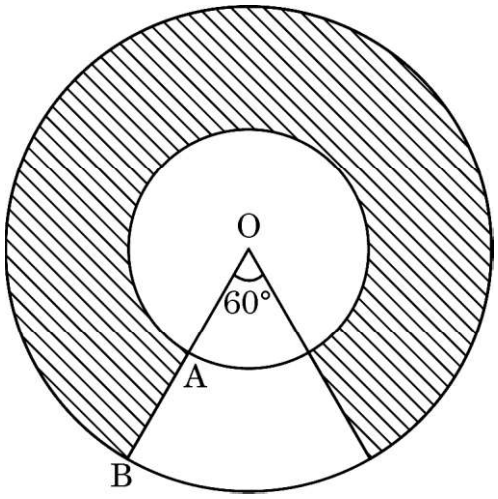
29. (a) Prove that $2 + 3\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number.

OR

(b) Prove that $\sqrt{5}$ an irrational number.

30. Sum of the areas of two squares is 468 m^2. If the difference between their sides is 6 m, then find the sides of the two squares.

31. In the given figure, two concentric circles are shown, centred at O. The radii of the circles are OA = 3 cm and OB = 6 cm.



Find perimeter of the shaded region. (Use $\pi = 3{\cdot}14$)

SECTION D

This section comprises long answer (LA) type questions of 5 marks each.

32. (a) Solve the pair of linear equations, $2x - y = 2$ and $4x - y = 4$, graphically.

OR

(b) 5 chairs and 1 table together cost ₹ 1,750; while 4 chairs and 3 tables together cost ₹ 1,950. Find the cost of one chair and of one table. What would be the total cost of 10 chairs and 10 tables ?

33. सिद्ध कीजिए कि एक बाह्य बिंदु से वृत्त पर खींची गई स्पर्श-रेखाओं की लम्बाइयाँ बराबर होती हैं ।

34. यदि AD तथा PM त्रिभुजों ABC और PQR की क्रमश: माध्यिकाएँ हैं, जहाँ $\Delta ABC \sim \Delta PQR$ है, तो सिद्ध कीजिए कि $\frac{AB}{PQ} = \frac{AD}{PM}$.

35. (क) निम्नलिखित सारणी किसी गाँव के 100 फार्मों में हुआ प्रति हेक्टेयर (ha) गेहूँ का उत्पादन दर्शाती है :

उत्पादन (kg/ha में)	फार्मों की संख्या
50 – 55	2
55 – 60	8
60 – 65	12
65 – 70	24
70 – 75	38
75 – 80	16

इन आँकड़ों का माध्य और माध्यक ज्ञात कीजिए ।

अथवा

(ख) नीचे दिए गए आँकड़ों का माध्य और बहुलक ज्ञात कीजिए ।

भार (kg में)	छात्रों की संख्या
40 – 45	5
45 – 50	11
50 – 55	20
55 – 60	24
60 – 65	28
65 – 70	12

33. Prove that the lengths of the tangents drawn from an external point to a circle are equal.

34. If AD and PM are medians of triangles ABC and PQR respectively, where $\Delta ABC \sim \Delta PQR$, prove that $\frac{AB}{PQ} = \frac{AD}{PM}$.

35. (a) The following table gives production yield per hectare of wheat of 100 farms of a village :

Production yield (in kg/ha)	Number of farms
50 – 55	2
55 – 60	8
60 – 65	12
65 – 70	24
70 – 75	38
75 – 80	16

Find the mean and median of the data.

OR

(b) Find the mean and the mode of the data given below :

Weight (in kg)	Number of students
40 – 45	5
45 – 50	11
50 – 55	20
55 – 60	24
60 – 65	28
65 – 70	12

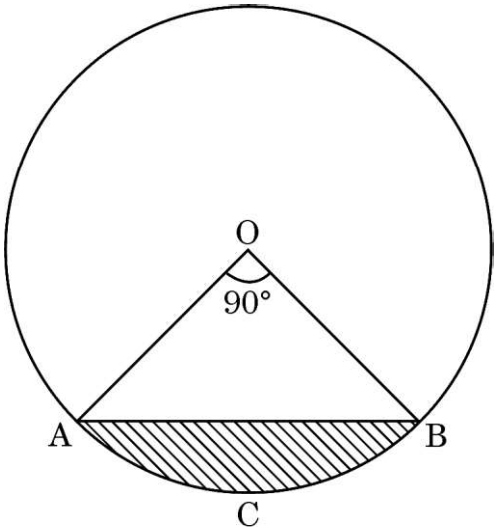
खण्ड ङ

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

प्रकरण अध्ययन – 1

36. **एक पेड़ की उम्र** : एक पेड़ की उम्र निर्धारित करने का सबसे सटीक तरीका लकड़ी के विकास के वार्षिक छल्लों की गणना करना है । ऐसा ही एक ट्रंक यहाँ दिखाया गया है ।

एक पहचान चिह्न बनाने के लिए, वन विभाग ने खण्ड ACBA (चित्र देखें) चित्रित किया है । यदि जीवा AB केंद्र पर 90° का कोण बनाती है और ट्रंक की त्रिज्या 21 cm है, तो ज्ञात कीजिए :



(i) जीवा AB की लम्बाई । *1*

(ii) Δ OAB का क्षेत्रफल । *1*

(iii) (क) वृत्तखंड ACBA का क्षेत्रफल । *2*

अथवा

(iii) (ख) त्रिज्यखंड OACBO का परिमाप । *2*

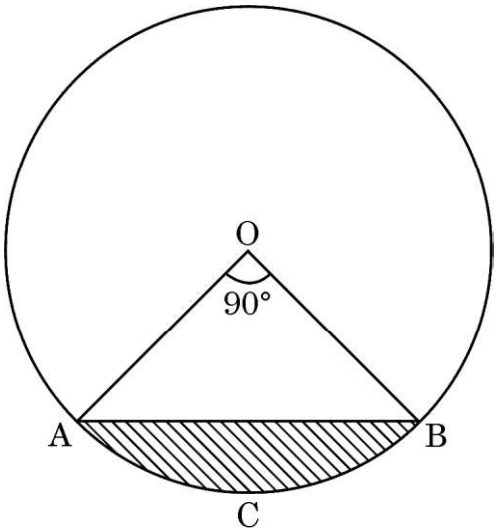
SECTION E

This section comprises 3 case study based questions of 4 marks each.

Case Study – 1

36. **Age of a tree** : The most accurate way to determine the age of a tree is to count the annual rings of wood growth. One such trunk has been shown here.

To make an identification mark, the forest department has painted segment ACBA. (See diagram) If chord AB makes an angle 90° at the centre and radius of the trunk is 21 cm, then find the :



(i) length of chord AB. *1*

(ii) area of Δ OAB. *1*

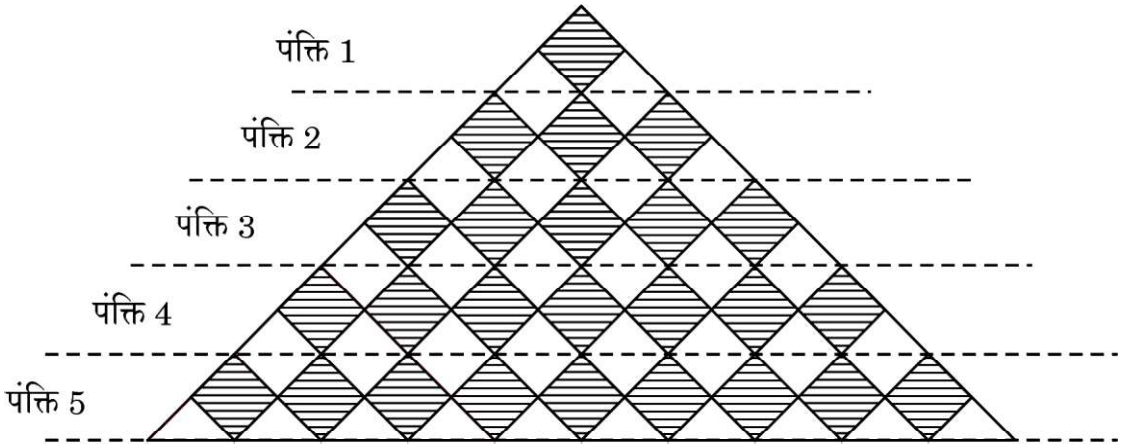
(iii) (a) area of segment ACBA. *2*

OR

(iii) (b) perimeter of sector OACBO. *2*

प्रकरण अध्ययन – 2

37. एक फ़ैशन डिज़ाइनर फैब्रिक पैटर्न डिज़ाइन कर रहा है । प्रत्येक पंक्ति में कुछ छायांकित वर्ग और छायारहित त्रिभुजें हैं ।



उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) प्रत्येक पंक्ति में वर्गों की संख्या के लिए A.P. ज्ञात कीजिए । *1*

(ii) प्रत्येक पंक्ति में त्रिभुजों की संख्या के लिए A.P. ज्ञात कीजिए । *1*

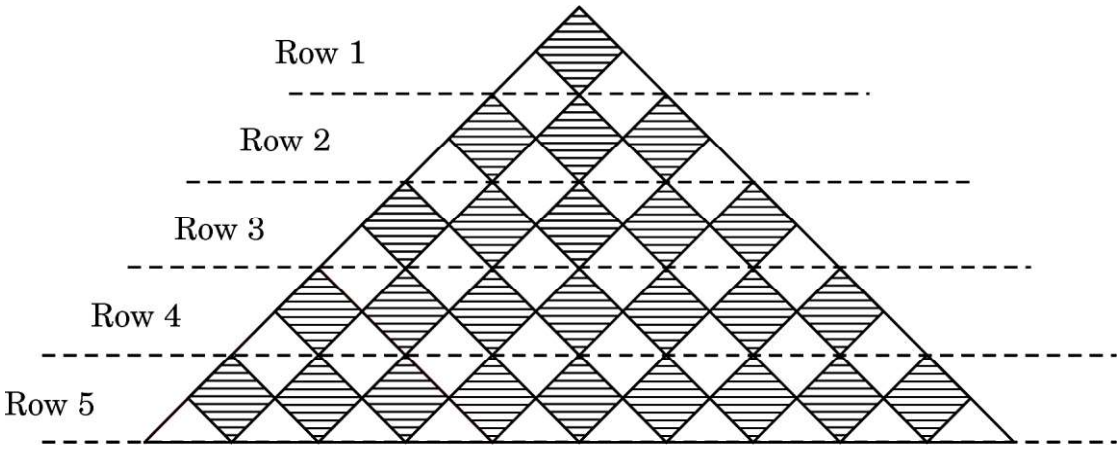
(iii) (क) यदि प्रत्येक छायांकित वर्ग की भुजा 2 cm है, तो छायांकित क्षेत्रफल ज्ञात कीजिए, जब 15 पंक्तियों को डिज़ाइन किया गया हो । *2*

अथवा

(iii) (ख) 'n' पंक्तियों की संख्या में त्रिभुजों की कुल संख्या ज्ञात करने का सूत्र लिखिए । अत: S_{10} ज्ञात कीजिए । *2*

Case Study – 2

37. A fashion designer is designing a fabric pattern. In each row, there are some shaded squares and unshaded triangles.



Based on the above, answer the following questions :

(i) Identify A.P. for the number of squares in each row. *1*

(ii) Identify A.P. for the number of triangles in each row. *1*

(iii) (a) If each shaded square is of side 2 cm, then find the shaded area when 15 rows have been designed. *2*

OR

(iii) (b) Write a formula for finding total number of triangles in 'n' number of rows. Hence, find S_{10}. *2*

प्रकरण अध्ययन – 3

38. टोटेम पोल बड़े पेड़ों से बनाए जाते हैं । इन खंभों (पोलों) को प्रतीकों या आकृतियों के साथ उकेरा गया है और ज्यादातर पश्चिमी कनाडा और उत्तर-पश्चिम संयुक्त राज्य अमेरिका में पाए जाते हैं ।

दिए गए चित्र में, समान ऊँचाई के दो खंभे 28 m की दूरी पर खड़े हैं । इन दोनों के बीच एक ही रेखा के एक बिंदु से, दोनों खंभों के शीर्ष के उन्नयन कोण क्रमश: 60° और 30° हैं ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) एक साफ नामांकित चित्र बनाइए । *1*

(ii) (क) खंभों की ऊँचाई ज्ञात कीजिए । *2*

अथवा

(ii) (ख) यदि प्रेक्षणों के बिंदु से खंभों के शीर्ष की दूरियों को p तथा q के रूप में लिया जाता है, तो p और q के बीच संबंध ज्ञात कीजिए । *2*

(iii) प्रेक्षण बिंदु का स्थान ज्ञात कीजिए । *1*

Case Study – 3

38. Totem poles are made from large trees. These poles are carved with symbols or figures and mostly found in western Canada and northwestern United States.

In the given picture, two such poles of equal heights are standing 28 m apart. From a point somewhere between them in the same line, the angles of elevation of the top of the two poles are 60° and 30° respectively.

Based on the above, answer the following questions :

(i) Draw a neat labelled diagram. *1*

(ii) (a) Find the height of the poles. *2*

OR

(ii) (b) If the distances of the top of the poles from the point of observation are taken as p and q, then find a relation between p and q. *2*

(iii) Find the location of the point of observation. *1*

Marking Scheme

Strictly Confidential

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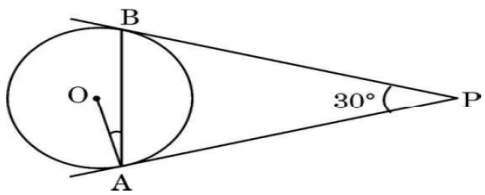
Secondary School Supplementary Examination, July- 2023

SUBJECT NAME: Mathematics (Basic) SUBJECT CODE: 241 PAPER CODE: 430/C/1

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its' leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the 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 delibration and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark(√) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _____80_____(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- 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. ● Leaving answer or part thereof unassessed in an answer book. ● ● 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.
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
15	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

	MARKING SCHEME **MATHEMATICS (BASIC) 430/C/1**	
Q.NO	**Expected Answer/Value Points**	**Distribution of Marks**
	SECTION A *This section comprises multiple choice questions (MCQs) of 1 mark each.*	
1	If common difference of an A.P. is -6, then value of $a_{20} - a_{14}$ is : (a) 36 (b) 6 (c) -36 (d) -6	
Ans	(c) -36	1
2	In the given figure, PA and PB are tangents to a circle centred at O. If $\angle APB = 30°$, then $\angle OAB$ equals :  (a) 30° (b) 15° (c) 45° (d) 10°	
Ans	(b) 15^0	1
3	If $\text{cosec } A = \frac{7}{5}$, then value of $\tan A \cdot \cos A$ is : (a) $\frac{7}{5}$ (b) $\frac{2\sqrt{6}}{5}$ (c) $\frac{24}{49}$ (d) $\frac{5}{7}$	
Ans	(d) 5/7	1

4

For the following distribution

Marks below	Number of Students
10	1
20	5
30	13
40	15
50	16

the modal class is :

(a) 30 – 40 (b) 40 – 50

(c) 20 – 30 (d) 10 – 20

Ans (c) 20-30 1

5

The pair of linear equations $5x + 4y = 20$ and $10x + 8y = 16$ has :

(a) no solution

(b) infinite number of solutions

(c) a unique solution

(d) two solutions

Ans (a) no solution 1

6

If $x = a \sin \theta$ and $y = b \cos \theta$, then $b^2x^2 + a^2y^2$ is equal to :

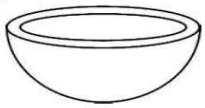
(a) 1 (b) a^2b^2

(c) $\frac{a^2 + b^2}{a^2b^2}$ (d) $a^2 + b^2$

Ans (b) a^2b^2 1

7

Total surface area (internal and external) of a hemispherical bowl having radii r_1 and r_2 ($r_2 > r_1$) is :



(a) $2\pi (r_1^2 + r_2^2)$ (b) $\pi (r_1^2 + r_2^2)$

(c) $3\pi r_2^2 + \pi r_1^2$ (d) $3\pi r_1^2 + \pi r_2^2$

Ans (c) $3\pi r_2^2 + \pi r_1^2$ 1

8

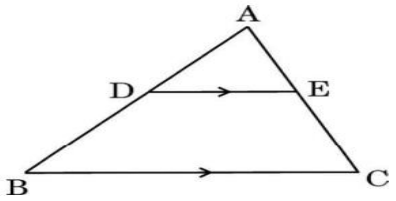
Degree of a zero polynomial is :

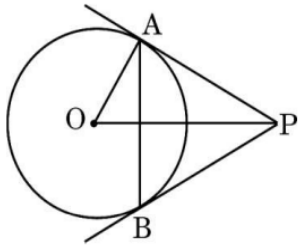
(a) 0 (b) 1

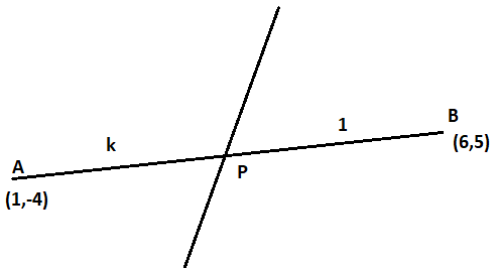
(c) any real number (d) not defined

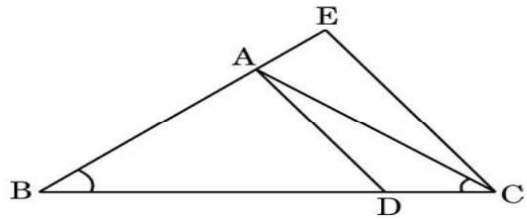
Ans (d) not defined 1

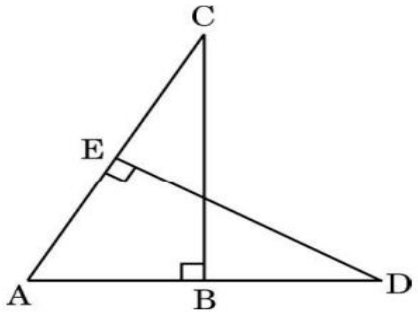
9	Which of the following is an irrational number ? (a) $\left(2\sqrt{3}-\frac{1}{\sqrt{3}}\right)^2$ (b) $(\sqrt{2}-1)^2$ (c) $\sqrt{2}-(2+\sqrt{2})$ (d) $\frac{(\sqrt{2}+5\sqrt{2})}{\sqrt{2}}$	
Ans	(b) $(\sqrt{2}-1)^2$	1
10	The roots of the quadratic equation $x^2+px-q=0$ are equal, if : (a) $p^2=4q$ (b) $p^2=-4q$ (c) $p^2=2q$ (d) $p^2=-2q$	
Ans	(b) $p^2 = -4q$	1
11	The distance between the points (c, 0) and (0, – c) is : (a) $c\sqrt{2}$ units (b) 2c units (c) $2\sqrt{c}$ units (d) c units	
Ans	(a) $c\sqrt{2}$ units	1
12	Two cubes each of 5 cm edge are joined end to end. The surface area of the resulting cuboid is : (a) 200 cm^2 (b) 300 cm^2 (c) 125 cm^2 (d) 250 cm^2	
Ans	(d) 250 cm^2	1
13	A die is rolled once. The probability that the obtained number is more than 5, is : (a) $\frac{5}{6}$ (b) $\frac{1}{6}$ (c) $\frac{2}{3}$ (d) $\frac{1}{3}$	
Ans	(b) 1/6	1

14	If the mean and the mode of a distribution are 17 and 20 respectively, then the median of the distribution, using empirical formula, is : (a) 20 (b) $\frac{31}{3}$ (c) 18 (d) 17	
Ans	(c) 18	1
15	Area of a segment of a circle of radius r and central angle 90° is : (a) $\frac{\pi r^2}{2} - \frac{1}{2} r^2$ (b) $\frac{2\pi r}{4} - \frac{1}{2} r^2$ (c) $\frac{\pi r^2}{4} - \frac{1}{2} r^2$ (d) $\frac{2\pi r}{4} - r^2 \sin 90°$	
Ans	(c) $\frac{\pi r^2}{4} - \frac{1}{2} r^2$	1
16	A quadratic polynomial having zeroes 7 and 0 is : (a) $x(x^2 - 7)$ (b) $7x^2 - 1$ (c) $\frac{1}{7}(x^2 - x)$ (d) $7(x^2 - 7x)$	
Ans	(d) $7(x^2 - 7x)$	1
17	In $\triangle ABC$, DE ∥ BC. If AD : DB = 2 : 3, then DE : BC is equal to :  (a) 2 : 3 (b) 3 : 5 (c) 2 : 5 (d) 3 : 2	
Ans	(c) 2 : 5	1
18	At some time of the day, the height and length of the shadow of a man are equal. The sun's altitude is : (a) 30° (b) 45° (c) 60° (d) 90°	
Ans	(b) 45^0	1

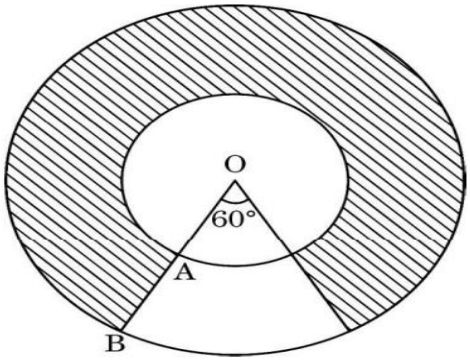
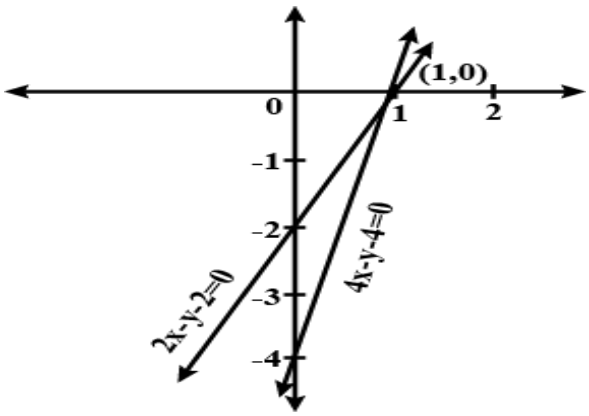
	*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.* (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the 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) :* PA and PB are tangents to the circle centred at O and $\angle$ OPA = 30°. Then, Δ PAB is an equilateral triangle. *Reason (R) :* Lengths of tangents from an external point to a circle are equal in length.  	
Ans	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
20	*Assertion (A) :* An event is very likely to happen if its probability is 0·9999. *Reason (R) :* Probability of a sure event is always 1.	
Ans	(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).	1

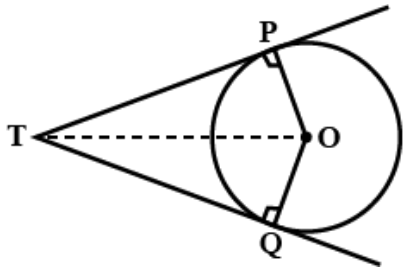
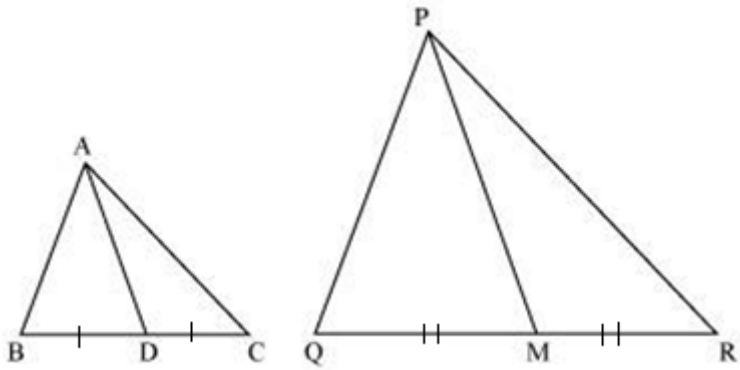
	SECTION B *This section comprises very short answer (VSA) type questions of 2 marks each.*	
21	Find the ratio in which a line segment joining points (1, – 4) and (6, 5) is divided by the x-axis.	
Soln	 Let the ratio be k:1 Point P is $\left(\frac{6k+1}{k+1}, \frac{5k-4}{k+1}\right)$ P lies on x- axis so y = 0 $\frac{5k-4}{k+1} = 0$ $\Rightarrow$ k= 4/5 $\therefore$ P divides AB in the ratio 4:5	1+ ½ ½
22(a)	Show that 8^n can never end with the digit 0 for any natural number n.	
Soln	$8^n = (2\times2\times2)^n$ For a number to end with zero it should have both 2 and 5 as its prime factors but 8^n has only 2 as its prime factor. So, it can not end with zero.	1 1
22(b)	**OR** Find LCM and HCF of 96 and 160, using prime factorisation method.	
Soln	$96 = 2\times2\times2\times2\times2\times3$ $160 = 2\times2\times2\times2\times2\times5$ HCF = 32 LCM = 480	$^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$
23	Three coins are tossed together. (i) Write all possible outcomes. (ii) Find the probability of having at most 2 heads.	
Soln	i) HHH, HHT, HTH, THH, HTT, THT, TTH, TTT ii) P (at most 2 heads) = 7/8	1 1
24(a)	For A = 30° and B = 60°, verify that $\tan(B-A) = \frac{\tan B - \tan A}{1 + \tan A \tan B}$	

Soln	LHS= tan $(60^0 - 30^0)$ = tan $30^0 = 1/\sqrt{3}$ RHS $= \dfrac{\tan 60^0 - \tan 30^0}{1+\tan 60^0 \tan 30^0}$ $= \dfrac{\sqrt{3}-\frac{1}{\sqrt{3}}}{1+\sqrt{3}\left(\frac{1}{\sqrt{3}}\right)} = \frac{1}{\sqrt{3}}$ $\therefore$ LHS = RHS	$^1/_2$ $1 + {}^1/_2$
(b)	**OR** **Evaluate :** $\sin^2 60° - 2\cos^2 45° + \frac{1}{2}\operatorname{cosec}^2 30°$	
Soln	$\sin^2 60^0 - 2\cos^2 45^0 + \frac{1}{2}\operatorname{cosec}^2 30^0 = \left(\frac{\sqrt{3}}{2}\right)^2 - 2\left(\frac{1}{\sqrt{2}}\right)^2 + \frac{1}{2}(2)^2$ $= 7/4$	$1^1/_2$ $^1/_2$
25	Find the centre and radius of a circle having end points of its diameter as $(3, -10)$ and $(1, 4)$.	
Soln	Centre $= \left(\frac{3+1}{2}, \frac{-10+4}{2}\right) = (2, -3)$ Radius $= \sqrt{(2-1)^2+(-3-4)^2} = \sqrt{50} = 5\sqrt{2}$ units.	1 1
	SECTION C *This section comprises short answer (SA) type questions of 3 marks each.*	
26(a)	In the given figure, $\frac{BC}{BD} = \frac{BE}{AC}$ and $\angle ABD = \angle ACD$. Show that $\Delta ABD \sim \Delta EBC$.  	
Soln	$\angle ABD = \angle ACD \Rightarrow$ AB = AC $\therefore \frac{BC}{BD} = \frac{BE}{AC} \Rightarrow \frac{BC}{BD} = \frac{BE}{BA}$	1 1

	$\angle B = \angle B$ (common) $\therefore$ $\Delta ABD \backsim \Delta EBC$ [SAS similarity criterion]	1
(b)	**OR** **In the given figure, ABC and AED are two right triangles, right angled at B and E respectively. Prove that :**  **(i) $\Delta ABC \sim \Delta AED$** **(ii) $AB \times AD = AC \times AE$**	
Soln	(i) In ΔABC and ΔAED, $\angle ABC = \angle AED = 90^0$ [Given] $\angle BAC = \angle EAD$ [common angles] $\therefore$ $\Delta ABC \sim \Delta AED$ [AA similarity criterion] (ii) $\Delta ABC \sim \Delta AED$ $\Rightarrow$ $AB/AE = AC/AD$ (Corresponding sides of similar triangles are proportional) $\Rightarrow$ $AB \times AD = AC \times AE$	$1^1/_2$ 1 $^1/_2$
27	**Find the zeroes of the polynomial $x^2 - 11x + 18$ and verify the relationship between the zeroes and the coefficients.**	
Soln	$x^2 - 11x + 18 = (x-9)(x-2)$ $\Rightarrow$ $x = 9$ & $x = 2$ are the zeroes of the given polynomial Sum of zeroes $= 9 + 2 = \frac{11}{1} = -\frac{coefficient\ of\ x}{coefficient\ of\ x^2}$ Product of zeroes $= 9 \times 2 = \frac{18}{1} = \frac{constant\ term}{coefficient\ of\ x^2}$	1 1 $^1/_2$ $^1/_2$
28	**Prove that :** $$\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\mathrm{cosec}\,\theta$$	

Soln	$LHS = \dfrac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}} + \dfrac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\sin\theta}{\cos\theta}}$ $= \dfrac{\sin^2\theta}{(\sin\theta-\cos\theta)\cos\theta} + \dfrac{\cos^2\theta}{(\cos\theta-\sin\theta)\sin\theta}$ $= \dfrac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta(\sin\theta-\cos\theta)}$ $= \dfrac{\sin^2\theta+\cos^2\theta+\sin\theta\cos\theta}{\sin\theta\cos\theta}$ $= \sec\theta\,\mathrm{cosec}\theta+1$ $=$ RHS	1 1 ½ ½
29(a)	**Prove that $2 + 3\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number.**	
Soln	Let us assume that $2 + 3\sqrt{3}$ is a rational number $2 + 3\sqrt{3} = \frac{p}{q}$; p, q are integers and $q \neq 0$ $\Rightarrow \sqrt{3} = \dfrac{p-2q}{3q}$ RHS is rational but LHS is irrational $\therefore$ Our assumption is wrong. Hence $2 + 3\sqrt{3}$ is an irrational number	1 1 1
(b)	OR Prove that $\sqrt{5}$ is an irrational number	
Soln	Let us assume that $\sqrt{5}$ is a rational number $\sqrt{5} = \frac{p}{q}$; p, q are coprime and $q \neq 0$ $\sqrt{5}q = p \Rightarrow 5q^2 = p^2$ ----------(i) p^2 is divisible by 5. So, p is divisible by 5. $p = 5c$ (for some integer c) $\Rightarrow p^2 = 25c^2$ ----------(ii) Putting p^2 in eqn.(i) $\Rightarrow 5q^2 = 25c^2 \Rightarrow q^2 = 5c^2$. So, q is divisible by 5. Thus, p and q have a common factor 5, which is a contradiction $\therefore$ our assumption is incorrect. Therefore, $\sqrt{5}$ is an irrational number.	1 ½ 1 ½
30	**Sum of the areas of two squares is 468 m^2. If the difference between their sides is 6 m, then find the sides of the two squares.**	
Soln	Let the sides of the two squares be x and x+6. A.T.Q. $x^2 + (x+6)^2 = 468$ $\Rightarrow 2x^2 + 12x - 432 = 0$ or $x^2+6x-216 = 0$ $\Rightarrow (x+18)(x-12) = 0$ $\Rightarrow x = 12$ or $x = -18$ (rejecting) Sides of two squares are 12 m and 18 m.	1 $1\frac{1}{2}$ $\frac{1}{2}$

31	In the given figure, two concentric circles are shown, centred at O. The radii of the circles are OA = 3 cm and OB = 6 cm.  Find perimeter of the shaded region. (Use $\pi = 3{\cdot}14$)	
Soln	Let R and r be the radii of the outer and inner circles. Perimeter of the shaded region $= \frac{\theta 2\pi R}{360} + \frac{\theta 2\pi r}{360} + 2(R - r)$ $= \frac{300\times2\times3.14}{360} \times (6+3) + 2 \times (6-3)$ $= 47.10 + 6 \quad = 53.1$ cm	2 1
	SECTION D *This section comprises long answer (LA) type questions of 5 marks each.*	
32(a)	Solve the pair of linear equations, $2x - y = 2$ and $4x - y = 4$, graphically.	
Soln	 Plotting the graph of each line. The solution is x =1 and y = 0	2+2 1
32(b)	**OR** 5 chairs and 1 table together cost ₹ 1,750; while 4 chairs and 3 tables together cost ₹ 1,950. Find the cost of one chair and of one table. What would be the total cost of 10 chairs and 10 tables ?	
Soln	Let the cost of one chair be ₹ x and that of one table be ₹ y $5x + y = 1750$ ----------(i)	1

	$4x + 3y = 1950$ ----------(ii) Solving (i) and (ii) and getting $x = 300$ and $y = 250$ Total cost of 10 chairs and 10 tables = $10 \times (300 + 250)$ = ₹ 5500	1 1+1 1
33	**Prove that the lengths of the tangents drawn from an external point to a circle are equal.**	
Soln	 Given : TP and TQ are two tangents drawn from an external point T to the circle C(O,r) To prove: TP = TQ Proof : In Δ OPT and Δ OQT OT = OT (common) $\angle OPT = \angle OQT = 90^0$ (Tangent and radius are perpendicular at point of contact) OP = OQ (radii of the same circle) $\therefore \Delta OPT \cong \Delta OQT$ (RHS congruence) $\therefore$ TP = TQ (by c.p.c.t) So, length of the tangents drawn from an external point to circle are equal.	1 for figure 1 2 1
34	**If AD and PM are medians of triangles ABC and PQR respectively, where $\Delta ABC \sim \Delta PQR$, prove that $\frac{AB}{PQ} = \frac{AD}{PM}$.**	
Soln	 $\Delta ABC \sim \Delta PQR$ $\Rightarrow \angle ABC = \angle PQR$ (corresponding angles of similar triangles) --------- (i) and AB/PQ = BC/QR (corresponding sides of similar triangles) $\Rightarrow$ AB/PQ = (BC/2) / (QR/2)	1 for figure $^1/_2$

	⇒ AB/PQ = BD/QM (D and M are mid points of BC and QR) ---------- (ii) In ΔABD and ΔPQM, ∠ABD = ∠PQM (from i) AB/PQ = BD/QM (from ii) ⇒ ΔABD ~ ΔPQM [SAS similarity criterion] ⇒ AB/PQ = AD/PM (Corresponding sides of similar triangles are proportional) Hence proved.	1 1 ½ 1
35(a)	**The following table gives production yield per hectare of wheat of 100 farms of a village :** **Production yield (in kg/ha) — Number of farms** **50 – 55 — 2** **55 – 60 — 8** **60 – 65 — 12** **65 – 70 — 24** **70 – 75 — 38** **75 – 80 — 16** **Find the mean and median of the data.**	
Soln	Class | x_i | f_i | $u_i = \frac{x_i - 67\cdot5}{5}$ | f_iu_i | cf 50 – 55 | 52·5 | 2 | – 3 | – 6 | 2 55 – 60 | 57·5 | 8 | – 2 | – 16 | 10 60 – 65 | 62·5 | 12 | -1 | -12 | 22 65 – 70 | 67·5 = a | 24 | 0 | 0 | 46 70 – 75 | 72·5 | 38 | 1 | 38 | 84 75 – 80 | 77·5 | 16 | 2 | 32 | 100 | | 100 | | 36 | Mean = $a + \frac{\sum f_i u_i}{\sum f_i} \times h$ $= 67\cdot5 + (\frac{36}{100} \times 5) = 69\cdot3$	2 for correct table $1+\frac{1}{2}$

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

$$= \mathbf{70} + \frac{50-46}{38} \times 5 = 70.5$$

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

35(b)

OR

Find the mean and the mode of the data given below :

Weight (in kg)	Number of students
40 – 45	5
45 – 50	11
50 – 55	20
55 – 60	24
60 – 65	28
65 – 70	12

Soln

Class	x_i	f_i	$u_i = \frac{x_i - 57.5}{5}$	f_iu_i
40 – 45	42·5	5	– 3	– 15
45 – 50	47·5	11	– 2	– 22
50 – 55	52·5	20	-1	-20
55 – 60	57·5= a	24	0	0
60 – 65	62·5	28	1	28
65 – 70	67·5	12	2	24
		100		-5

$1\frac{1}{2}$

For correct table

$$\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 57.5 + \frac{-5}{100} \times 5 = 57.25$$

1+ ½

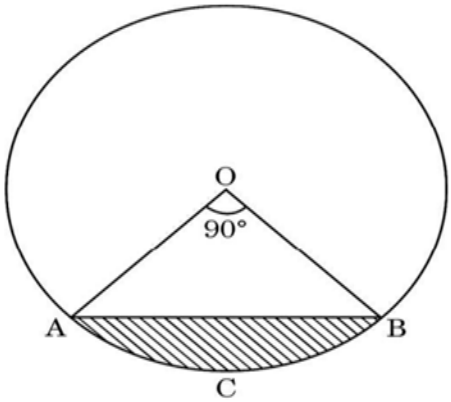
$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

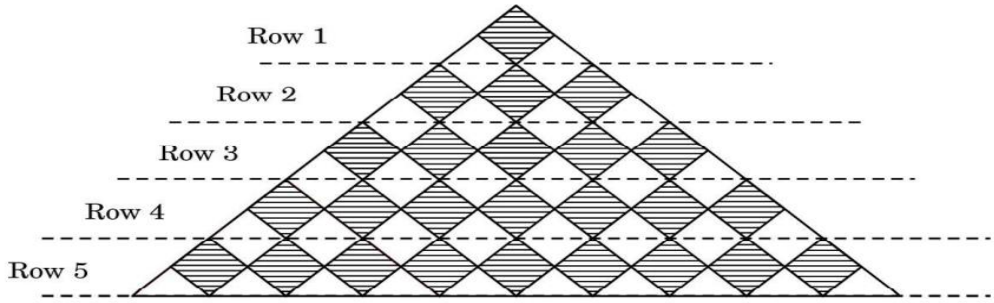
$$= 60 + \frac{\mathbf{28-24}}{\mathbf{2(28)-24-12}} \times 5 = 61$$

1½ +½

SECTION E

This section comprises 3 case study based questions of 4 marks each.

36	**Case Study – 1** **Age of a tree** : The most accurate way to determine the age of a tree is to count the annual rings of wood growth. One such trunk has been shown here. To make an identification mark, the forest department has painted segment ACBA. (See diagram) If chord AB makes an angle 90° at the centre and radius of the trunk is 21 cm, then find the :  (i) length of chord AB. *1* (ii) area of Δ OAB. *1* (iii) (a) area of segment ACBA. *2* **OR** (iii) (b) perimeter of sector OACBO. *2*	
Soln	(i) AB = $\sqrt{21^2 + 21^2} = 21\sqrt{2}$ cm (ii) Area of Δ OAB = $\frac{1}{2} \times 21 \times 21 = 220.5$ cm^2 (iii) (a) Area of segment ACBA = $\frac{1}{4} \times \frac{22}{7} \times 21 \times 21 - 220.5$ = 126 cm^2. **OR** (b) Length of arc AB = $\frac{1}{4} \times 2 \times \frac{22}{7} \times 21 = 33$ cm. Perimeter of sector OACBO = 21+33+21 = 75 cm.	1 1 1 ½ ½ 1 1

37	**Case Study – 2** A fashion designer is designing a fabric pattern. In each row, there are some shaded squares and unshaded triangles.  Based on the above, answer the following questions : (i) Identify A.P. for the number of squares in each row. *1* (ii) Identify A.P. for the number of triangles in each row. *1* (iii) (a) If each shaded square is of side 2 cm, then find the shaded area when 15 rows have been designed. *2* **OR** (iii) (b) Write a formula for finding total number of triangles in 'n' number of rows. Hence, find S_{10}. *2*	
Soln	(i) A.P. for the number of squares in each row is 1, 3, 5, 7, 9…. (ii) A.P. for the number of triangles in each row is 2, 6, 10, 14…. (iii) (a) Area of each square = $2 \times 2 = 4$ cm^2 Number of squares in 15 rows = $\frac{15}{2}(2+14\times 2) = 225$ Shaded area = $225 \times 4 = 900$ cm^2 **OR** (b) $S_n = \frac{n}{2}[4+(n-1)4] = 2n^2$ $\therefore S_{10} = 2\times 10^2 = 200$	1 1 $^1/_2$ 1 $^1/_2$ 1 1

38

Case Study – 3

Totem poles are made from large trees. These poles are carved with symbols or figures and mostly found in western Canada and northwestern United States.

In the given picture, two such poles of equal heights are standing 28 m apart. From a point somewhere between them in the same line, the angles of elevation of the top of the two poles are 60° and 30° respectively.

Based on the above, answer the following questions :

(i) Draw a neat labelled diagram. *1*

(ii) (a) Find the height of the poles. *2*

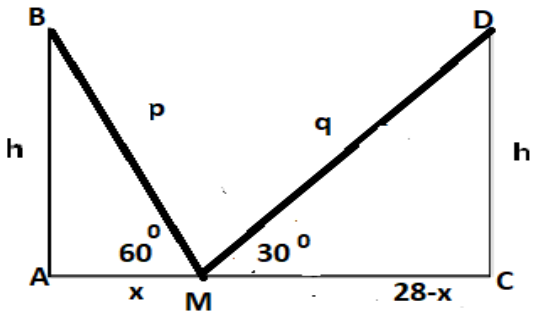
OR

(ii) (b) If the distances of the top of the poles from the point of observation are taken as p and q, then find a relation between p and q. *2*

(iii) Find the location of the point of observation. *1*

Soln

(i) Let AB and CD be the 2 poles and M be a point somewhere between their bases in the same line.



1 for correct figure

(ii) (a)

		$\tan 60^0 = \frac{h}{x} \Rightarrow h = x\sqrt{3}$	½
		$\tan 30^0 = \frac{h}{28-x} \Rightarrow h = \frac{(28-x)}{\sqrt{3}}$	½
		$\therefore h = 7\sqrt{3}\ m$	1
		OR	
	(ii) (b)	BM = p and DM = q	
		$\sin 60^0 = \frac{h}{p} \Rightarrow h = \frac{p\sqrt{3}}{2}$	$^1/_2$
		$\sin 30^0 = \frac{h}{q} \Rightarrow h = \frac{q}{2}$	$^1/_2$
		$\therefore \frac{p\sqrt{3}}{2} = \frac{q}{2} \Rightarrow q = \sqrt{3}p$	1
	(iii)	$\tan 60^0 = \frac{7\sqrt{3}}{x} \Rightarrow x = 7m = AM$	½
		$MC = 28 - x = 21\ m$	½