Series WX1YZ/2

SET~1

प्रश्न–पत्र कोड
Q.P. Code **430/2/1**

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. नीचे दी गई A.P. में कितने पद हैं ?

14, 19, 24, 29, ..., 119

(a) 18 (b) 14

(c) 22 (d) 21

2. बिन्दुओं A(2, – 3) और B(5, 6) को जोड़ने वाला रेखाखण्ड, x-अक्ष से किस अनुपात में विभाजित होता है ?

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

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

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. How many terms are there in the A.P. given below ?

14, 19, 24, 29, ..., 119

(a) 18 (b) 14

(c) 22 (d) 21

2. In what ratio does x-axis divide the line segment joining the points A(2, – 3) and B(5, 6) ?

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

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

3. $9 \sec^2 A - 9 \tan^2 A$ बराबर है :

(a) 9 (b) 0

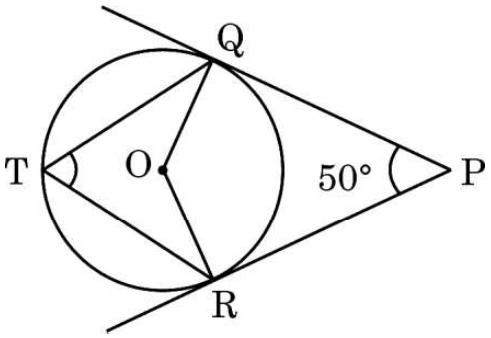
(c) 8 (d) $\frac{1}{9}$

4. वायु में उड़ती एक पतंग की डोरी 50 m लंबी है और यह क्षैतिज से $60°$ का कोण बनाती है । डोरी को सीधा मानकर, पतंग की जमीन से ऊँचाई है :

(a) $50\sqrt{3}$ m (b) $\frac{100}{\sqrt{3}}$ m

(c) $\frac{50}{\sqrt{3}}$ m (d) $25\sqrt{3}$ m

5. केंद्र O वाले एक वृत्त पर बिंदु P से दो स्पर्श-रेखाएँ PQ और PR खींची गई हैं । वृत्त के दीर्घ चाप QR पर एक बिंदु T है । यदि $\angle QPR = 50°$ है, तो $\angle QTR$ बराबर है :



(a) $50°$ (b) $130°$

(c) $65°$ (d) $90°$

6. त्रिज्या R वाले वृत्त के उस त्रिज्यखण्ड का क्षेत्रफल जिसका कोण α (डिग्री में) है, है :

(a) $\frac{\alpha}{180} \times 2\pi R$ (b) $\frac{\alpha}{360} \times 2\pi R$

(c) $\frac{\alpha}{180} \times \pi R^2$ (d) $\frac{\alpha}{360} \times \pi R^2$

3. $9\sec^2 A - 9\tan^2 A$ is equal to :

(a) 9 (b) 0

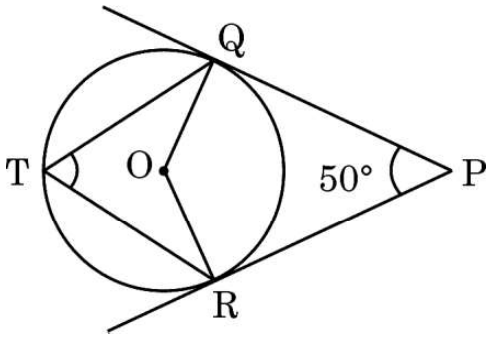
(c) 8 (d) $\frac{1}{9}$

4. The string of a kite in air is 50 m long and it makes an angle of 60° with the horizontal. Assuming the string to be straight, the height of the kite from the ground is :

(a) $50\sqrt{3}$ m (b) $\frac{100}{\sqrt{3}}$ m

(c) $\frac{50}{\sqrt{3}}$ m (d) $25\sqrt{3}$ m

5. From a point P, two tangents PQ and PR are drawn to a circle with centre at O. T is a point on the major arc QR of the circle. If $\angle$ QPR = 50°, then $\angle$ QTR equals :



(a) 50° (b) 130°

(c) 65° (d) 90°

6. The area of a sector of angle α (in degrees) of a circle with radius R is :

(a) $\frac{\alpha}{180} \times 2\pi R$ (b) $\frac{\alpha}{360} \times 2\pi R$

(c) $\frac{\alpha}{180} \times \pi R^2$ (d) $\frac{\alpha}{360} \times \pi R^2$

7. यदि 360 और 64 का HCF 8 है, तो इन संख्याओं का LCM होगा :

(a) 2480 (b) 2780

(c) 512 (d) 2880

8. 14 cm ऊँचाई के एक लंब-वृत्तीय बेलन का वक्र पृष्ठीय क्षेत्रफल 88 cm^2 है । इस बेलन के वृत्तीय आधार का व्यास है :

(a) 2 cm (b) 1 cm

(c) 4 cm (d) 7 cm

9. एक पासा फेंका गया । एक भाज्य संख्या के प्राप्त होने की प्रायिकता है :

(a) $\frac{1}{2}$ (b) $\frac{2}{3}$

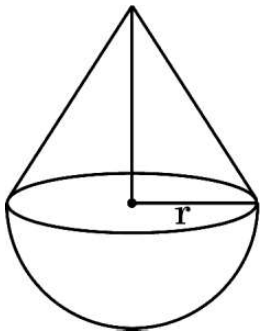
(c) $\frac{1}{3}$ (d) 0

10. यदि द्विघात समीकरण $9x^2 + bx + \frac{1}{4} = 0$ के मूल बराबर हैं, तो b का मान होगा :

(a) 0 (b) केवल -3

(c) केवल 3 (d) ± 3

11. एक ठोस में 'r' त्रिज्या वाला एक शंकु उसी त्रिज्या वाले एक अर्धगोले पर अध्यारोपित है । यदि शंकु की ऊँचाई उसके आधार के व्यास के समान हो, तो ठोस का आयतन होगा :



(a) πr^3 (b) $\frac{4}{3}\pi r^3$

(c) $3\pi r^3$ (d) $\frac{2}{3}\pi r^3$

7. If the HCF of 360 and 64 is 8, then their LCM is :

(a) 2480 (b) 2780

(c) 512 (d) 2880

8. The curved surface area of a right circular cylinder of height 14 cm is 88 cm^2. The diameter of its circular base is :

(a) 2 cm (b) 1 cm

(c) 4 cm (d) 7 cm

9. A die is rolled once. The probability that a composite number comes up, is :

(a) $\frac{1}{2}$ (b) $\frac{2}{3}$

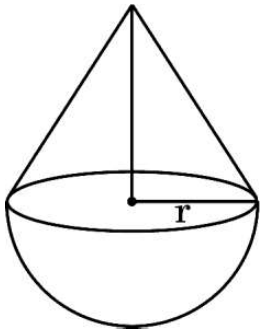
(c) $\frac{1}{3}$ (d) 0

10. If the quadratic equation $9x^2 + bx + \frac{1}{4} = 0$ has equal roots, then the value of b is :

(a) 0 (b) – 3 only

(c) 3 only (d) ± 3

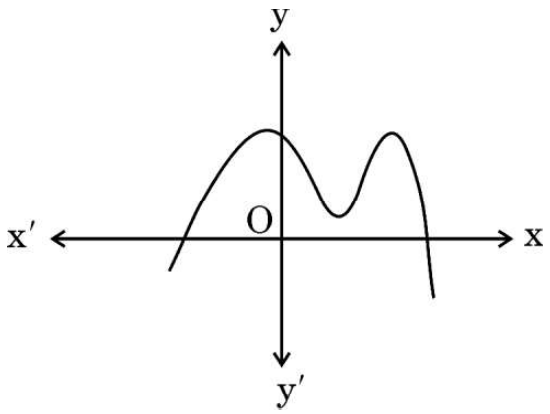
11. A solid is of the form of a cone of radius 'r' surmounted on a hemisphere of the same radius. If the height of the cone is the same as the diameter of its base, then the volume of the solid is :



(a) πr^3 (b) $\frac{4}{3}\pi r^3$

(c) $3\pi r^3$ (d) $\frac{2}{3}\pi r^3$

12. आकृति में, बहुपद $p(x)$ का ग्राफ दिया गया है । $p(x)$ के शून्यकों की संख्या है :



(a) 2 (b) 3

(c) 4 (d) 5

13. रैखिक समीकरणों $x + 2y - 5 = 0$ और $2x - 4y + 6 = 0$ का युग्म :

(a) असंगत है

(b) अनेक हलों सहित संगत है

(c) अद्वितीय हल सहित संगत है

(d) दो हल सहित संगत है

14. निम्नलिखित में से कौन-सी संख्या किसी घटना की प्रायिकता ***नहीं*** हो सकती ?

(a) 0·5 (b) 5%

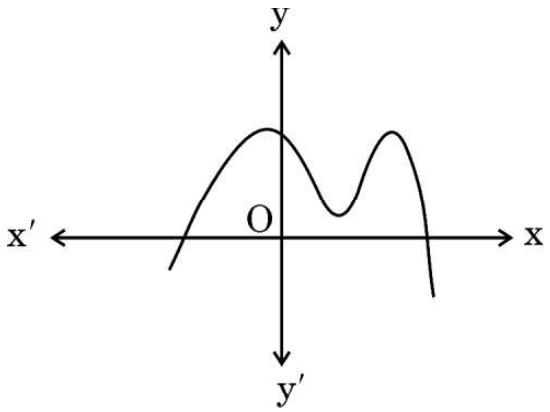
(c) $\frac{1}{0{\cdot}5}$ (d) $\frac{0{\cdot}5}{14}$

15. $2 \sin^2 30° + 3 \tan^2 60° - \cos^2 45°$ का मान है :

(a) $3\sqrt{3}$ (b) $\frac{19}{2}$

(c) $\frac{9}{4}$ (d) 9

12. Graph of a polynomial p(x) is given in the figure. The number of zeroes of p(x) is :



(a) 2 (b) 3

(c) 4 (d) 5

13. The pair of linear equations $x + 2y - 5 = 0$ and $2x - 4y + 6 = 0$:

(a) is inconsistent

(b) is consistent with many solutions

(c) is consistent with a unique solution

(d) is consistent with two solutions

14. Which of the following numbers ***cannot*** be the probability of an event ?

(a) 0·5 (b) 5%

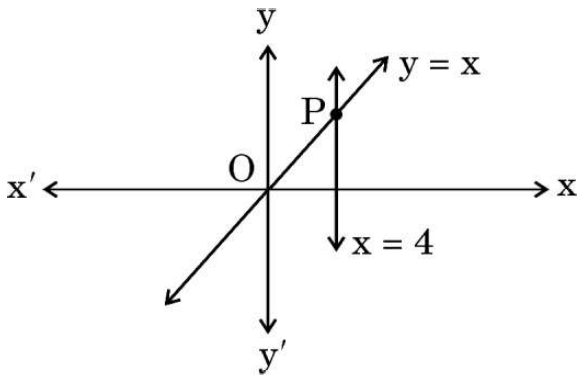
(c) $\frac{1}{0{\cdot}5}$ (d) $\frac{0{\cdot}5}{14}$

15. The value of $2 \sin^2 30° + 3 \tan^2 60° - \cos^2 45°$ is :

(a) $3\sqrt{3}$ (b) $\frac{19}{2}$

(c) $\frac{9}{4}$ (d) 9

16. रैखिक समीकरणों $y = x$ और $x = 4$ द्वारा निरूपित रेखाएँ P पर प्रतिच्छेदी हैं । बिंदु P के निर्देशांक हैं :



(a) $(4, 0)$ (b) $(4, 4)$

(c) $(0, 4)$ (d) $(-4, 4)$

17. एक बंटन के माध्यक और बहुलक क्रमश: 25 और 21 हैं । आनुभविक संबंध से इन आँकड़ों का माध्य है :

(a) 27 (b) 29

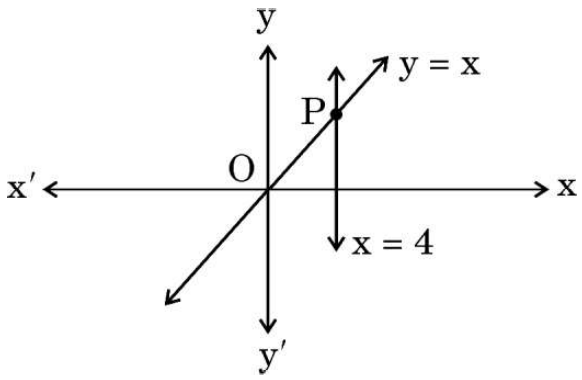
(c) 18 (d) $\frac{29}{3}$

18. यदि $\tan A = \frac{2}{5}$ है, तो $\frac{1-\cos^2 A}{1-\sin^2 A}$ का मान है :

(a) $\frac{25}{4}$ (b) $\frac{4}{25}$

(c) $\frac{4}{5}$ (d) $\frac{5}{4}$

16. The lines represented by the linear equations $y = x$ and $x = 4$ intersect at P. The coordinates of the point P are :



(a) (4, 0) (b) (4, 4)

(c) (0, 4) (d) (– 4, 4)

17. Median and Mode of a distribution are 25 and 21 respectively. Mean of the data using empirical relationship is :

(a) 27 (b) 29

(c) 18 (d) $\frac{29}{3}$

18. If $\tan A = \frac{2}{5}$, then the value of $\frac{1-\cos^2 A}{1-\sin^2 A}$ is :

(a) $\frac{25}{4}$ (b) $\frac{4}{25}$

(c) $\frac{4}{5}$ (d) $\frac{5}{4}$

*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) :* बहुपद $x^2 + 4x$ के दो वास्तविक शून्यक हैं ।

तर्क (R) : बहुपद $x^2 + ax$ $(a \neq 0)$ के शून्यक 0 और a हैं ।

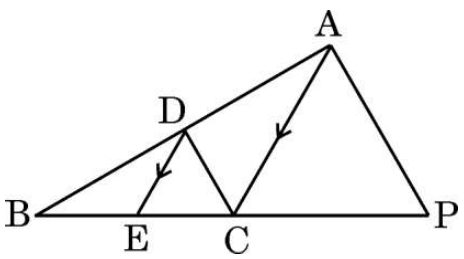
20. *अभिकथन (A) :* एक पासे को एक बार फेंकने पर, अभाज्य संख्या प्राप्त होने की प्रायिकता $\frac{2}{3}$ होती है ।

तर्क (R) : एक पासे के फलकों पर अभाज्य संख्याएँ 2, 3, 5 होती हैं ।

खण्ड ख

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

21. दी गई आकृति में, DE ∥ AC और $\frac{BE}{EC} = \frac{BC}{CP}$ । सिद्ध कीजिए कि DC ∥ AP.



*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) :* Polynomial $x^2 + 4x$ has two real zeroes.

Reason (R) : Zeroes of the polynomial $x^2 + ax\ (a \neq 0)$ are 0 and a.

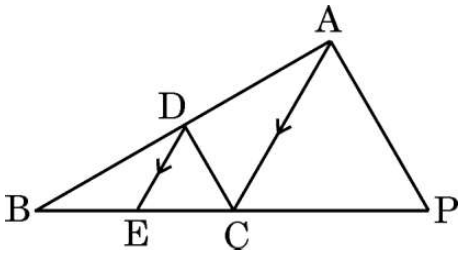
20. *Assertion (A) :* The probability of getting a prime number, when a die is thrown once, is $\frac{2}{3}$.

Reason (R): On the faces of a die, prime numbers are 2, 3, 5.

SECTION B

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

21. In the given figure, DE ∥ AC and $\frac{BE}{EC} = \frac{BC}{CP}$. Prove that DC ∥ AP.



22. (क) अभाज्य गुणनखण्डन विधि का प्रयोग करके, संख्याओं 540 और 630 का HCF ज्ञात कीजिए ।

अथवा

(ख) दर्शाइए कि किसी भी प्राकृत संख्या 'n' के लिए, $(15)^n$ अंक 0 पर समाप्त नहीं हो सकता है ।

23. (क) 'x' का/के मान ज्ञात कीजिए जबकि PQ = QR है, जहाँ बिंदुओं P, Q और R के निर्देशांक क्रमश: $(6, -1)$, $(1, 3)$ और $(x, 8)$ हैं ।

अथवा

(ख) एक त्रिभुज के शीर्ष $(-2, 0)$, $(2, 3)$ और $(1, -3)$ हैं । क्या यह त्रिभुज समबाहु, समद्विबाहु या विषमबाहु है ?

24. 'k' का मान ज्ञात कीजिए जिसके लिए बहुपद $p(x) = 3x^2 + 2kx + x - k - 5$ के शून्यकों का योगफल, उनके गुणनफल का आधा है ।

25. अच्छी प्रकार से फेंटी गई 52 ताश के पत्तों की एक गड्डी से, सभी ईंट के पत्तों को हटा दिया जाता है । बाद में शेष से एक पत्ता यादृच्छया निकाला जाता है । निकाला गया पत्ता एक बादशाह होने की प्रायिकता ज्ञात कीजिए ।

22. (a) Find the HCF of the numbers 540 and 630, using prime factorization method.

OR

(b) Show that $(15)^n$ cannot end with the digit 0 for any natural number 'n'.

23. (a) Find the value(s) of 'x' so that PQ = QR, where the coordinates of P, Q and R are (6, –1), (1, 3) and (x, 8) respectively.

OR

(b) The vertices of a triangle are (–2, 0), (2, 3) and (1, –3). Is the triangle equilateral, isosceles or scalene ?

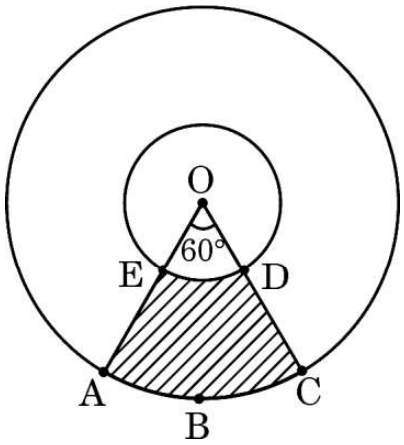
24. Find the value of 'k' such that the polynomial $p(x) = 3x^2 + 2kx + x - k - 5$ has the sum of zeroes equal to half of their product.

25. From a well-shuffled deck of 52 playing cards, all diamond cards are removed. Now, a card is drawn from the remaining pack at random. Find the probability that the selected card is a king.

खण्ड ग

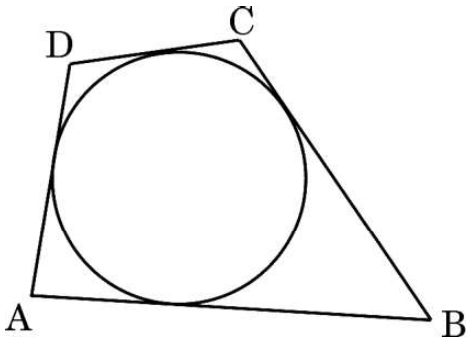
इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं ।

26. दी गई आकृति में, छायांकित भाग का क्षेत्रफल ज्ञात कीजिए, जहाँ केंद्र O वाले दो संकेंद्रीय वृत्तों की त्रिज्याएँ क्रमश: 2 cm और 5 cm हैं ।



27. सिद्ध कीजिए कि $4 + 2\sqrt{3}$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

28. (क) एक वृत्त के परिगत एक चतुर्भुज ABCD आकृति में दिखाए अनुसार खींचा गया है । सिद्ध कीजिए कि AB + CD = AD + BC.



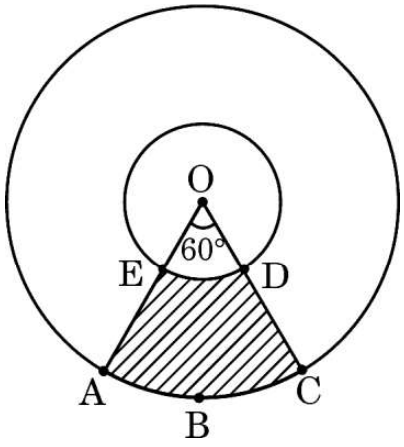
अथवा

(ख) सिद्ध कीजिए कि किसी वृत्त के परिगत समांतर चतुर्भुज, एक समचतुर्भुज होता है ।

SECTION C

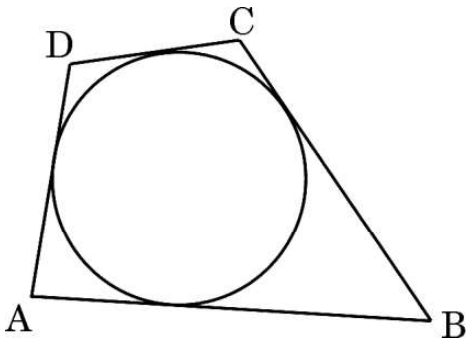
This section comprises short answer (SA) type questions of 3 marks each.

26. In the given figure, two concentric circles with centre O are shown. Radii of the circles are 2 cm and 5 cm respectively. Find the area of the shaded region.



27. Prove that $4 + 2\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

28. (a) A quadrilateral ABCD is drawn to circumscribe a circle, as shown in the figure. Prove that AB + CD = AD + BC.



OR

(b) Prove that the parallelogram circumscribing a circle is a rhombus.

29. (क) सिद्ध कीजिए :

$$\frac{1-\cos\theta}{1+\cos\theta} = (\text{cosec}\,\theta - \cot\theta)^2$$

अथवा

(ख) सिद्ध कीजिए :

$$\left(1+\frac{1}{\tan^2 A}\right)\left(1+\frac{1}{\cot^2 A}\right) = \frac{1}{\sin^2 A - \sin^4 A}$$

30. बहुपद $p(x) = 2x^2 - 7x - 15$ के शून्यक ज्ञात कीजिए और इसके गुणांकों तथा शून्यकों के बीच के संबंध की सत्यता की जाँच कीजिए ।

31. सिद्ध कीजिए कि बिन्दु A(–1, 0), B(3, 1), C(2, 2) और D(– 2, 1) एक समांतर चतुर्भुज ABCD के शीर्ष हैं । क्या यह चतुर्भुज एक आयत भी है ?

खण्ड घ

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

32. (क) 60 m ऊँचे भवन के शिखर से देखने पर एक टावर के शिखर और तल के अवनमन कोण क्रमश: 30° तथा 60° हैं । टावर की ऊँचाई ज्ञात कीजिए । टावर और भवन के बीच की दूरी भी ज्ञात कीजिए । ($\sqrt{3}$ = 1·732 का प्रयोग कीजिए)

अथवा

(ख) भूमि के एक बिंदु A से, एक भवन के शिखर का उन्नयन कोण 30° है । भवन के आधार की ओर 30 m चलकर बिन्दु B तक पहुँचने पर उन्नयन कोण 45° हो जाता है । भवन की ऊँचाई ज्ञात कीजिए और बिंदु A से भवन के आधार की दूरी भी ज्ञात कीजिए । ($\sqrt{3}$ = 1·732 का प्रयोग कीजिए)

29. (a) Prove that :

$$\frac{1-\cos\theta}{1+\cos\theta} = (\text{cosec}\,\theta - \cot\theta)^2$$

OR

(b) Prove that :

$$\left(1+\frac{1}{\tan^2 A}\right)\left(1+\frac{1}{\cot^2 A}\right) = \frac{1}{\sin^2 A - \sin^4 A}$$

30. Find the zeroes of the polynomial $p(x) = 2x^2 - 7x - 15$ and verify the relationship between its coefficients and zeroes.

31. Prove that the points A(–1, 0), B(3, 1), C(2, 2) and D(–2, 1) are the vertices of a parallelogram ABCD. Is it also a rectangle ?

SECTION D

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

32. (a) From the top of a building 60 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° respectively. Find the height of the tower. Also, find the distance between the building and the tower. (Use $\sqrt{3}$ = 1·732)

OR

(b) The angle of elevation of the top of a building from a point A on the ground is 30°. On moving a distance of 30 m towards its base to the point B, the angle of elevation changes to 45°. Find the height of the building and the distance of its base from point A. (Use $\sqrt{3}$ = 1·732)

33. निम्नलिखित आँकड़ों का माध्य और माध्यक ज्ञात कीजिए :

प्राप्तांक	विद्यार्थियों की संख्या
0 – 10	3
10 – 20	5
20 – 30	16
30 – 40	12
40 – 50	13
50 – 60	20
60 – 70	6
70 – 80	5

34. यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिन्दुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती हैं ।

35. (क) यदि किसी A.P. के पहले 7 पदों का योगफल -14 और पहले 11 पदों का योगफल -55 हो, तो इस A.P. के पहले 'n' पदों का योगफल ज्ञात कीजिए ।

अथवा

(ख) किसी A.P. में, प्रथम 'n' पदों का योगफल $3n^2 + n$ है । इस A.P. का प्रथम पद तथा सार्व अंतर ज्ञात कीजिए । अत:, इसका 15वाँ पद ज्ञात कीजिए ।

33. Find the mean and the median of the following data :

Marks	Number of Students
0 – 10	3
10 – 20	5
20 – 30	16
30 – 40	12
40 – 50	13
50 – 60	20
60 – 70	6
70 – 80	5

34. 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.

35. (a) If the sum of the first 7 terms of an A.P. is –14 and that of 11 terms is – 55, then find the sum of its first 'n' terms.

OR

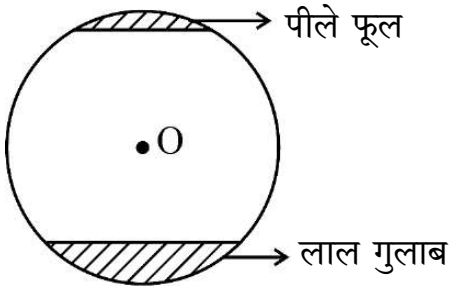
(b) In an A.P., the sum of the first 'n' terms is $3n^2 + n$. Find the first term and the common difference of the A.P. Hence, find its 15^{th} term.

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. बगीचे में लगे हुए फूलों की क्यारियाँ बहुत सुंदर लगती हैं । ऐसे ही एक वृत्ताकार पार्क में जिसकी त्रिज्या 'r' m है, दो वृत्त-खण्डों में फूल लगे हुए हैं । एक वृत्त-खण्ड जो केंद्र पर $90°$ का कोण अंतरित करता है, में लाल गुलाब के फूल लगे हुए हैं, जबकि दूसरे वृत्त-खण्ड, जो केंद्र पर $60°$ का कोण अंतरित करता है, में पीले रंग के फूल लगे हैं । [चित्र देखिए]



यह दिया गया है कि फूलों वाले भाग (दोनों वृत्त-खण्डों) का कुल क्षेत्रफल $256\frac{2}{3}$ वर्ग मी. है ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) दोनों वृत्त-खण्डों के क्षेत्रफलों के योगफल को दर्शाता हुआ 'r' के पदों में समीकरण लिखिए । *1*

(ii) 'r' का मान ज्ञात कीजिए । *1*

(iii) (क) लाल गुलाबों वाले वृत्त-खण्ड का क्षेत्रफल ज्ञात कीजिए । *2*

अथवा

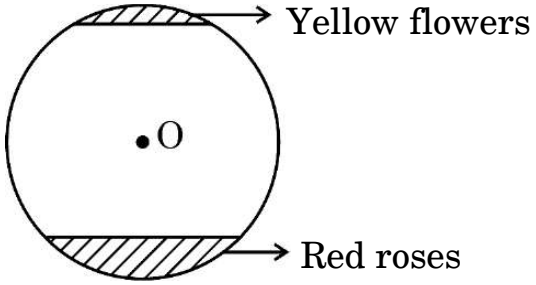
(iii) (ख) पीले फूलों वाले वृत्त-खण्ड का क्षेत्रफल ज्ञात कीजिए । *2*

SECTION E

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

Case Study – 1

36. Flower beds look beautiful growing in gardens. One such circular park of radius 'r' m, has two segments with flowers. One segment which subtends an angle of 90° at the centre is full of red roses, while the other segment with central angle 60° is full of yellow coloured flowers. [See figure]



It is given that the combined area of the two segments (of flowers) is $256\frac{2}{3}$ sq m.

Based on the above, answer the following questions :

(i) Write an equation representing the total area of the two segments in terms of 'r'. *1*

(ii) Find the value of 'r'. *1*

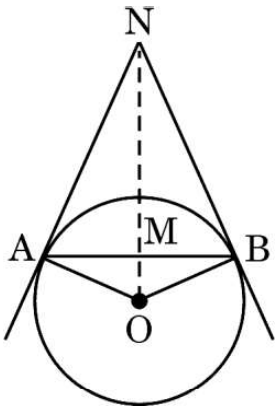
(iii) (a) Find the area of the segment with red roses. *2*

OR

(iii) (b) Find the area of the segment with yellow flowers. *2*

प्रकरण अध्ययन – 2

37. वृत्त हमारे जीवन में एक महत्त्वपूर्ण भूमिका निभाते हैं । जब एक वृत्ताकार वस्तु को कील N पर एक डोरी के साथ दीवार पर लटकाया जाता है, तो डोरियाँ NA और NB स्पर्श-रेखाओं की तरह काम करती हैं । आकृति का अवलोकन कीजिए, जबकि दिया हुआ है कि $\angle ANO = 30°$ और $OA = 5$ cm है ।



उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) AN की लम्बाई ज्ञात कीजिए । *1*

(ii) $\angle AOB$ का माप ज्ञात कीजिए । *1*

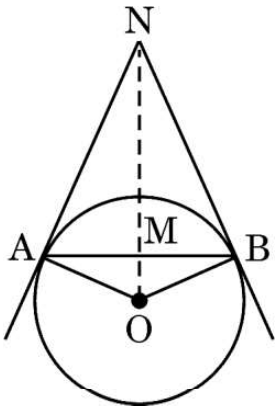
(iii) (क) डोरियों NA, NB और जीवा AB की कुल लम्बाई ज्ञात कीजिए । *2*

अथवा

(iii) (ख) यदि $\angle ANO = 45°$ है, तो चतुर्भुज OANB के प्रकार का नाम लिखिए । अपने उत्तर का औचित्य साबित कीजिए । *2*

Case Study – 2

37. Circles play an important part in our life. When a circular object is hung on the wall with a cord at nail N, the cords NA and NB work like tangents. Observe the figure, given that $\angle ANO = 30°$ and OA = 5 cm.



Based on the above, answer the following questions :

(i) Find the distance AN. *1*

(ii) Find the measure of $\angle AOB$. *1*

(iii) (a) Find the total length of cords NA, NB and the chord AB. *2*

OR

(iii) (b) If $\angle ANO$ is 45°, then name the type of quadrilateral OANB. Justify your answer. *2*

प्रकरण अध्ययन – 3

38. चित्र में एक लकड़ी का खिलौना दिखाया गया है । $14\ cm \times 17\ cm \times 4\ cm$ विमाओं का एक घनाभाकार लकड़ी का गुटका है । इसके ऊपरी तल पर मधुमक्खियों के फिट होने के लिए सात बेलनाकार खोखले हैं । प्रत्येक बेलनाकार खोखले की ऊँचाई 3 cm और त्रिज्या 2 cm है ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) एक बेलनाकार खोखला बनाने के लिए खोदी गई लकड़ी का आयतन ज्ञात कीजिए । *1*

(ii) घनाभाकार गुटके को हरे रंग में रंगने के लिए पार्श्व पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *1*

(iii) (क) सात बेलनाकार खोखले खोदने के पश्चात्, घनाभाकार गुटके में बची हुई लकड़ी का आयतन ज्ञात कीजिए । *2*

अथवा

(iii) (ख) घनाभाकार गुटके के ऊपरी सतह पर पीला रंग करवाने के लिए इसका पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *2*

Case Study – 3

38. A wooden toy is shown in the picture. This is a cuboidal wooden block of dimensions 14 cm × 17 cm × 4 cm. On its top there are seven cylindrical hollows for bees to fit in. Each cylindrical hollow is of height 3 cm and radius 2 cm.

Based on the above, answer the following questions :

(i) Find the volume of wood carved out to make one cylindrical hollow. *1*

(ii) Find the lateral surface area of the cuboid to paint it with green colour. *1*

(iii) (a) Find the volume of wood in the remaining cuboid after carving out seven cylindrical hollows. *2*

OR

(iii) (b) Find the surface area of the top surface of the cuboid to be painted yellow. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
SUBJECT NAME MATHEMATICS (BASIC) (SUBJECT CODE 241) (PAPER CODE 430/2/1)

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 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 the most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.

	However ,for MCQs(Q1 to Q20),only first attempt to be evaluated.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _____(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● 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) 430/2/1

SECTION A

1. How many terms are there in the A.P. given below ?

14, 19, 24, 29, ..., 119

(a) 18 (b) 14

(c) 22 (d) 21

Answer (c) 22 1

---

2. In what ratio does x-axis divide the line segment joining the points A(2, – 3) and B(5, 6) ?

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

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

Answer (d) 1 : 2 1

---

3. $9 \sec^2 A - 9 \tan^2 A$ is equal to :

(a) 9 (b) 0

(c) 8 (d) $\frac{1}{9}$

Answer (a) 9 1

---

4. The string of a kite in air is 50 m long and it makes an angle of 60° with the horizontal. Assuming the string to be straight, the height of the kite from the ground is :

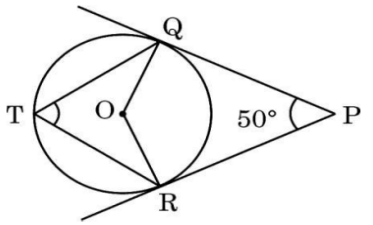
(a) $50\sqrt{3}$ m (b) $\frac{100}{\sqrt{3}}$ m

(c) $\frac{50}{\sqrt{3}}$ m (d) $25\sqrt{3}$ m

Answer (d) $25\sqrt{3}$ m 1

---

5. From a point P, two tangents PQ and PR are drawn to a circle with centre at O. T is a point on the major arc QR of the circle. If $\angle$ QPR = 50°, then $\angle$ QTR equals :



(a) 50° (b) 130°

(c) 65° (d) 90°

Answer (c) 65° 1

---

6. The area of a sector of angle α (in degrees) of a circle with radius R is :

(a) $\frac{\alpha}{180} \times 2\pi R$ (b) $\frac{\alpha}{360} \times 2\pi R$

(c) $\frac{\alpha}{180} \times \pi R^2$ (d) $\frac{\alpha}{360} \times \pi R^2$

Answer (d) $\frac{\alpha}{360} \times \pi R^2$ 1

---

7. If the HCF of 360 and 64 is 8, then their LCM is :

(a) 2480 (b) 2780

(c) 512 (d) 2880

Answer (d) 2880 1

---

8. The curved surface area of a right circular cylinder of height 14 cm is 88 cm^2. The diameter of its circular base is :

(a) 2 cm (b) 1 cm

(c) 4 cm (d) 7 cm

Answer (a) 2 cm 1

---

9. A die is rolled once. The probability that a composite number comes up, is :

(a) $\frac{1}{2}$ (b) $\frac{2}{3}$

(c) $\frac{1}{3}$ (d) 0

Answer (c) $\frac{1}{3}$ 1

---

10. If the quadratic equation $9x^2 + bx + \frac{1}{4} = 0$ has equal roots, then the value of b is :

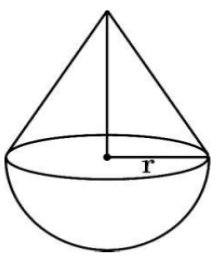
(a) 0 (b) – 3 only

(c) 3 only (d) ± 3

Answer (d) ± 3 1

---

11. A solid is of the form of a cone of radius 'r' surmounted on a hemisphere of the same radius. If the height of the cone is the same as the diameter of its base, then the volume of the solid is :



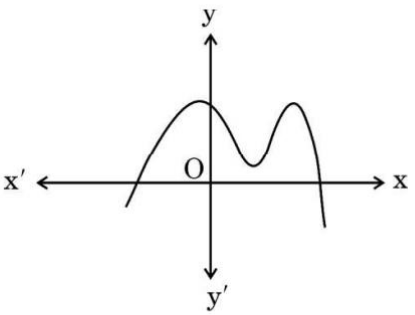
(a) πr^3 (b) $\frac{4}{3}\pi r^3$

(c) $3\pi r^3$ (d) $\frac{2}{3}\pi r^3$

Answer (b) $\frac{4}{3}\pi r3$
1

---

12. Graph of a polynomial p(x) is given in the figure. The number of zeroes of p(x) is :



(a) 2 (b) 3

(c) 4 (d) 5

Answer (a) 2 1

---

13. The pair of linear equations $x + 2y - 5 = 0$ and $2x - 4y + 6 = 0$:

(a) is inconsistent

(b) is consistent with many solutions

(c) is consistent with a unique solution

(d) is consistent with two solutions

Answer (c) is consistent with a unique solution 1

---

14. Which of the following numbers ***cannot*** be the probability of an event ?

(a) 0·5 (b) 5%

(c) $\frac{1}{0{\cdot}5}$ (d) $\frac{0{\cdot}5}{14}$

Answer (c) $\frac{1}{0{\cdot}5}$ 1

---

15. The value of $2 \sin^2 30° + 3 \tan^2 60° - \cos^2 45°$ is :

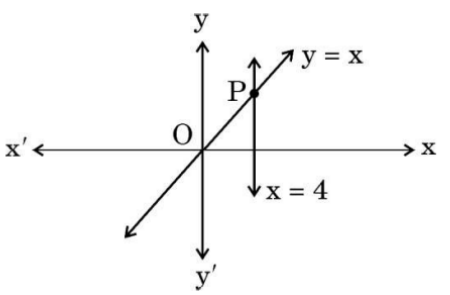
(a) $3\sqrt{3}$ (b) $\frac{19}{2}$

(c) $\frac{9}{4}$ (d) 9

Answer (d) 9 1

---

16. The lines represented by the linear equations $y = x$ and $x = 4$ intersect at P. The coordinates of the point P are :



(a) (4, 0) (b) (4, 4)

(c) (0, 4) (d) (– 4, 4)

Answer (b) (4, 4) 1

---

17. Median and Mode of a distribution are 25 and 21 respectively. Mean of the data using empirical relationship is :

(a) 27 (b) 29

(c) 18 (d) $\frac{29}{3}$

Answer (a) 27 1

---

18. If $\tan A = \frac{2}{5}$, then the value of $\frac{1-\cos^2 A}{1-\sin^2 A}$ is :

(a) $\frac{25}{4}$ (b) $\frac{4}{25}$

(c) $\frac{4}{5}$ (d) $\frac{5}{4}$

Answer (b) $\frac{4}{25}$ 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) :* Polynomial $x^2 + 4x$ has two real zeroes.

Reason (R) : Zeroes of the polynomial $x^2 + ax$ $(a \neq 0)$ are 0 and a.

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

---

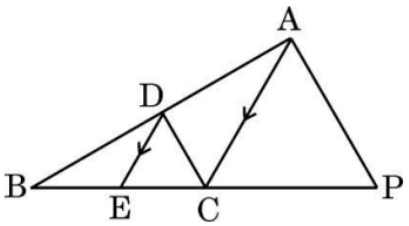
20. *Assertion (A) :* The probability of getting a prime number, when a die is thrown once, is $\frac{2}{3}$.

Reason (R): On the faces of a die, prime numbers are 2, 3, 5.

Answer (d) Assertion (A) is false, **but** Reason (R) is true 1

SECTION B

21. In the given figure, DE ∥ AC and $\frac{BE}{EC} = \frac{BC}{CP}$. Prove that DC ∥ AP.



Solution In Δ ABC, DE || AC $\Rightarrow \frac{BE}{EC} = \frac{BD}{DA}$ 1

Also given, $\frac{BE}{EC} = \frac{BC}{CP} \Rightarrow \frac{BD}{DA} = \frac{BC}{CP}$ 1/2

$\therefore$ DC || AP [Converse of BPT] 1/2

---

22. (a) Find the HCF of the numbers 540 and 630, using prime factorization method.

Solution (a) $540 = 2^2 \times 3^3 \times 5$ 1/2

$630 = 2 \times 3^2 \times 5 \times 7$ 1/2

HCF = $2 \times 3^2 \times 5 = 90$ *1*

OR

(b) Show that $(15)^n$ cannot end with the digit 0 for any natural number 'n'.

Solution (b) $15^n = (3 \times 5)^n = 3^n \times 5^n$ *1*

For a number to end with zero it should have both 2 and 5 in its prime factorization but 15^n has only prime numbers 3 and 5 as its factors so it can not end with zero. *1*

---

23. (a) Find the value(s) of 'x' so that PQ = QR, where the coordinates of P, Q and R are (6, –1), (1, 3) and (x, 8) respectively.

Solution (a) $PQ = QR \Rightarrow \sqrt{(6-1)^2+(-1-3)^2} = \sqrt{(x-1)^2+(8-3)^2}$ 1

$\Rightarrow (x-1)^2 = 16, \quad x-1 = \pm 4$ 1/2

$\Rightarrow x = -3$ or 5 1/2

OR

(b) The vertices of a triangle are (–2, 0), (2, 3) and (1, –3). Is the triangle equilateral, isosceles or scalene ?

Solution (b) Let vertices of Δ be A(– 2, 0), B(2, 3) and C(1, – 3)

$AB = \sqrt{4^2+3^2} = 5$ 1/2

$BC = \sqrt{(-1)^2+(-6)^2} = \sqrt{37}$ 1/2

$CA = \sqrt{(1+2)^2+(-3)^2} = 3\sqrt{2}$ 1/2

$\therefore \Delta ABC$ is a scalene triangle 1/2

---

24. Find the value of 'k' such that the polynomial $p(x) = 3x^2 + 2kx + x - k - 5$ has the sum of zeroes equal to half of their product.

Solution $3x^2 + (2k+1)x - k - 5 = 0$

Sum of zeroes $= \frac{-(2k+1)}{3}$ 1/2

Product of zeroes $= \frac{-k-5}{3}$ 1/2

$\therefore \frac{-(2k+1)}{3} = -\frac{1}{2}\frac{(k+5)}{3}$ 1/2

$\Rightarrow 4k + 2 = k + 5 \Rightarrow k = 1$ 1/2

---

25. From a well-shuffled deck of 52 playing cards, all diamond cards are removed. Now, a card is drawn from the remaining pack at random. Find the probability that the selected card is a king.

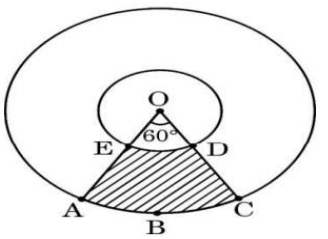
Solution Total number of cards = 52 – 13 = 39 1/2

Number of kings = 3 1/2

P(drawn card is a king) = $\frac{3}{39}$ **or** $\frac{1}{13}$ 1

SECTION C

26. In the given figure, two concentric circles with centre O are shown. Radii of the circles are 2 cm and 5 cm respectively. Find the area of the shaded region.



Solution Area of sector OABC = $\frac{\pi \times 5^2 \times 60°}{360°} = \frac{25\pi}{6}$ cm^2 1

Area of sector OED = $\frac{\pi \times 2^2 \times 60°}{360°} = \frac{4\pi}{6}$ cm^2 1

Area of shaded region = $\frac{25\pi}{6} - \frac{4\pi}{6} = \frac{21}{6} \times \frac{22}{7} = 11$ cm^2 1

---

27. Prove that $4 + 2\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

Solution Let us assume that $4 + 2\sqrt{3}$ is a rational number

$4 + 2\sqrt{3} = \frac{p}{q}$; $q \neq 0$ and p, q are integers 1

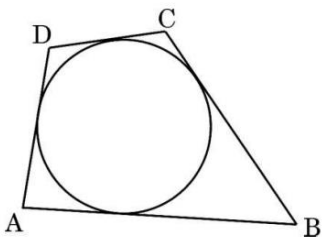
$\Rightarrow \sqrt{3} = \frac{p-4q}{2q}$ 1

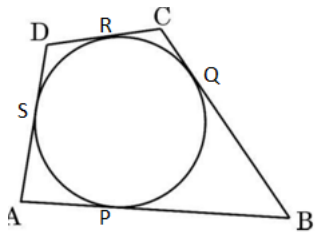
RHS is rational but LHS is irrational

$\therefore$ Our assumption is wrong. Hence $4 + 2\sqrt{3}$ is an irrational number **1**

---

28. (a) A quadrilateral ABCD is drawn to circumscribe a circle, as shown in the figure. Prove that AB + CD = AD + BC.





Solution (a)

Tangents from an external point are equal therefore

AP = AS, BP = BQ, QC = CR and DR = DS 1

AB + CD = (AP + PB) + (CR + RD) 1/2

= (AS + BQ) + (CQ + DS) 1/2

= (AS + DS) + (BQ + CQ) 1/2

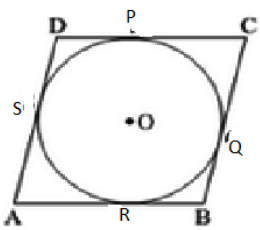
= AD + BC

1/2

OR

(b) Prove that the parallelogram circumscribing a circle is a rhombus.

Solution (b)



For figure *1*

Here AS = AR, DS = DP, CP = CQ And BQ = BR 1/2

Now AB + CD = (AR + RB) + (CP + DP) = (AS + BQ) + (CQ + DS)

= (AS + DS) + (BQ + CQ)

= AD + BC 1

Since ABCD is a parallelogram

Therefore, 2AB = 2AD or AB = AD 1/2

⇒ ABCD is a rhombus.

29. (a) Prove that :

$$\frac{1-\cos\theta}{1+\cos\theta} = (\text{cosec}\,\theta - \cot\theta)^2$$

Solution (a) LHS = $\frac{1-\cos\theta}{1+\cos\theta}$

$= \frac{(1-\cos\theta)^2}{(1-\cos\theta)(1+\cos\theta)}$ 1

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

$= \left(\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta}\right)^2$ 1/2

$= (\text{cosec}\,\theta - \cot\theta)^2 = \text{RHS}$ 1/2

OR

(b) Prove that :

$$\left(1+\frac{1}{\tan^2 A}\right)\left(1+\frac{1}{\cot^2 A}\right) = \frac{1}{\sin^2 A - \sin^4 A}$$

Solution (b)LHS = $(1+\frac{\cos^2 A}{\sin^2 A})\,(1+\frac{\sin^2 A}{\cos^2 A})$ 1

$= (\frac{\sin^2 A+\cos^2 A}{\sin^2 A})\,(\frac{\cos^2 A+\sin^2 A}{\cos^2 A})$

$= \frac{1}{\sin^2 A} \times \frac{1}{\cos^2 A}$ 1

$= \frac{1}{\sin^2 A\,(1-\sin^2 A)}$ 1/2

$= \frac{1}{\sin^2 A - \sin^4 A} = \text{RHS}$ 1/2

---

30. Find the zeroes of the polynomial $p(x) = 2x^2 - 7x - 15$ and verify the relationship between its coefficients and zeroes.

Solution $p(x) = 2x^2 - 7x - 15 = 0$

$\Rightarrow (2x + 3)(x - 5) = 0$ 1

$\Rightarrow \alpha = x = -\frac{3}{2}, \ \beta = x = 5.$ 1

$\therefore \alpha + \beta = -\frac{3}{2} + 5 = \frac{7}{2} = -\frac{(-7)}{2} = \frac{-\ coefficient\ of\ x}{coefficient\ of\ x^2}$ 1/2

$\alpha\beta = -\frac{3}{2} \times 5 = -\frac{15}{2} = \frac{constant\ term}{coefficient\ of\ x^2}$ 1/2

---

31. Prove that the points A(–1, 0), B(3, 1), C(2, 2) and D(–2, 1) are the vertices of a parallelogram ABCD. Is it also a rectangle ?

Solution Mid-point of AC = $(\frac{1}{2}, 1)$ 1/2

Mid-point of BD = $(\frac{1}{2}, 1)$ 1/2

Since Mid-point of AC = BD, therefore ABCD is a parallelogram. 1

Now AC = $\sqrt{9+4} = \sqrt{13}$

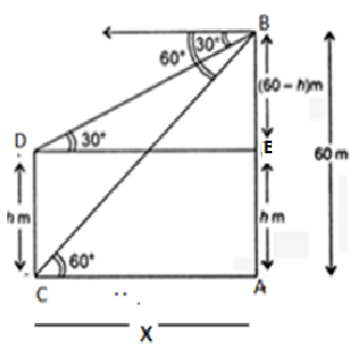
and BD = $\sqrt{25+0} = \sqrt{25} = 5$

$\therefore$ AC $\neq$ BD therefore ABCD is not a rectangle. 1

SECTION D

32. (a) From the top of a building 60 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° respectively. Find the height of the tower. Also, find the distance between the building and the tower. (Use $\sqrt{3} = 1{\cdot}732$)

Solution (a)



For figure 1

Let AB be the building and CD be the tower

In ΔBAC, $\tan 60° = \frac{60}{x} \Rightarrow x = \frac{60}{\sqrt{3}} = 20\sqrt{3}$ _____ (i) *1*+1/2

In ΔBED, $\tan 30° = \frac{60-h}{x} \Rightarrow 60 - h = \frac{20\sqrt{3}}{\sqrt{3}}$ _____ (ii) *1*+1/2

using equations (i) and (ii)

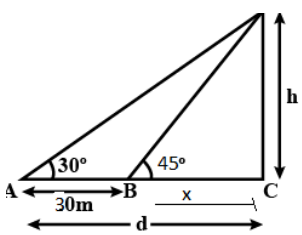
distance between building and the tower = $x = 20\sqrt{3} = 34{\cdot}64$ m 1/2

and the height of tower = h = 40 m 1/2

OR

(b) **The angle of elevation of the top of a building from a point A on the ground is 30°. On moving a distance of 30 m towards its base to the point B, the angle of elevation changes to 45°. Find the height of the building and the distance of its base from point A. (Use $\sqrt{3} = 1{\cdot}732$)**

Solution (b)



For figure 1

Let CD be the building

In ΔDCA, $\tan 30° = \frac{h}{x+30} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+30}$ _____ (i) *1*+1/2

In ΔDCB, $\tan 45° = \frac{h}{x} \Rightarrow h = x$ _____ (ii) *1*

using equations (i) and (ii), $h = x = 15(\sqrt{3}+1)$ 1/2

$= 15 \times 2{\cdot}732 = 40.98$ m

Height of building h = x = 40·98 m 1/2

Distance(d) of base from point A = x + 30 = 70.98 m 1/2

---

33. Find the mean and the median of the following data :

Marks	Number of Students
0 – 10	3
10 – 20	5
20 – 30	16
30 – 40	12
40 – 50	13
50 – 60	20
60 – 70	6
70 – 80	5

Solution Correct table 2

Marks	x	f	$u = \frac{x - 35}{10}$	fu	cf
0 – 10	5	3	– 3	– 9	3
10 – 20	15	5	– 2	– 10	8
20 – 30	25	16	– 1	– 16	24
30 – 40	35	12	0	0	36
40 – 50	45	13	1	13	49
50 – 60	55	20	2	40	69
60 – 70	65	6	3	18	75
70 – 80	75	5	4	20	80
		80		56	

Mean = $35 + (10 \times \frac{56}{80}) = 42$ *1*+1/2

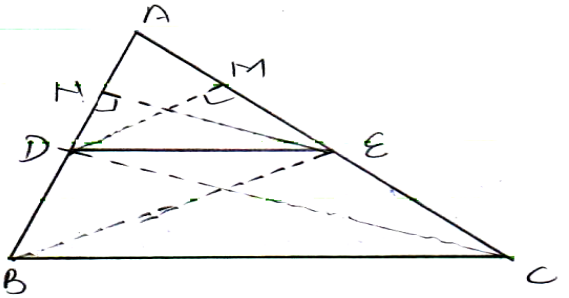
Median class : 40-50 1/2

Median = $40 + \frac{10}{13}(40 - 36) = 43{\cdot}1$ (approx..) 1

---

34. 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.

Solution (a)



For figure 1

Given In Δ ABC, DE // BC 1/2

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

Const. : Join BE, CD. Draw DM ⊥ AC and EN ⊥ AB 1/2

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

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

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

ar(Δ BDE) = ar(Δ CDE) _____ (iii) 1/2

From (i), (ii) and (iii)

$\frac{AD}{DB} = \frac{AE}{EC}$ 1/2

---

35. (a) If the sum of the first 7 terms of an A.P. is −14 and that of 11 terms is – 55, then find the sum of its first 'n' terms.

Solution (a) $\frac{7}{2}(2a + 6d) = -14$ _____ (i) *1*

$\frac{11}{2}(2a + 10d) = -55$ _____ (ii) *1*

Solving (i) and (ii) $d = -\frac{3}{2}$, $a = \frac{5}{2}$ *1+1*

$S_n = \frac{n}{2}[5 + (n-1)(-\frac{3}{2})] = \frac{n}{4}[13 - 3n]$ *1*

OR

(b) In an A.P., the sum of the first 'n' terms is $3n^2 + n$. Find the first term and the common difference of the A.P. Hence, find its 15^{th} term.

Solution (b) Here $S_n = 3n^2 + n$

So, $a_1 = S_1 = 3(1)^2 + 1 = 4$ 1

$S_2 = a_1 + a_2 = 3(2)^2 + 2 = 14$ 1

$\Rightarrow a_2 = 10$ 1

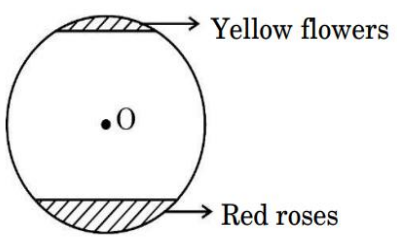
Now $a_2 = a_1 + d = 10 \Rightarrow d = 6$ 1

$\Rightarrow a_{15} = a + 14d$

$= 4 + 14(6) = 88$ 1

SECTION E

36. Flower beds look beautiful growing in gardens. One such circular park of radius 'r' m, has two segments with flowers. One segment which subtends an angle of 90° at the centre is full of red roses, while the other segment with central angle 60° is full of yellow coloured flowers. [See figure]



It is given that the combined area of the two segments (of flowers) is $256\frac{2}{3}$ sq m.

Based on the above, answer the following questions :

(i) Write an equation representing the total area of the two segments in terms of 'r'. *1*

(ii) Find the value of 'r'. *1*

(iii) (a) Find the area of the segment with red roses. *2*

OR

(iii) (b) Find the area of the segment with yellow flowers. *2*

Solution (i) Total area of two segments = $\frac{1}{4}\pi r^2 - \frac{1}{2}r^2 + \frac{1}{6}\pi r^2 - \frac{\sqrt{3}}{4}r^2 = 256\frac{2}{3}$ 1

(ii) $(\frac{1}{4}\pi - \frac{1}{2} + \frac{1}{6}\pi - \frac{\sqrt{3}}{4})r^2 = \frac{770}{3}$

1

$\Rightarrow$ r = 26.1 cm (approx.)

(iii)(a) Area of segment with red roses = $\frac{1}{4}\pi r^2 - \frac{1}{2}r^2$ sq m 2

= 194.63 sq m (approx.)

OR

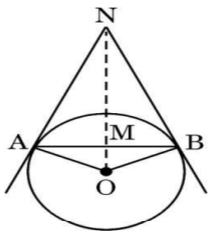
(iii)(b) Area of segment with yellow roses = $\frac{1}{6}\pi r^2 - \frac{\sqrt{3}}{4}r^2$ sq m 2

= 62.03 sq m (approx.)

Note: If the student has correctly written the area of two segments in part (i), then 2 marks to be awarded for part (iii), even if the student has not attempted part (iii).

---

37. Circles play an important part in our life. When a circular object is hung on the wall with a cord at nail N, the cords NA and NB work like tangents. Observe the figure, given that $\angle ANO = 30°$ and $OA = 5$ cm.



Based on the above, answer the following questions :

(i) Find the distance AN.

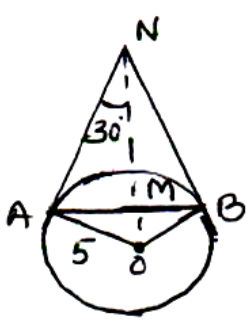
(ii) Find the measure of $\angle AOB$.

(iii) (a) Find the total length of cords NA, NB and the chord AB.

OR

(iii) (b) If $\angle ANO$ is 45°, then name the type of quadrilateral OANB. Justify your answer.

Solution (i) $\tan 30° = \frac{5}{AN}$ 1/2



$\Rightarrow AN = \mathbf{5\sqrt{3}}$ cm 1/2

(ii) $\angle BNO = 30° \Rightarrow \angle BNA = 60°$

$\therefore \angle AOB = 180° - 60° = 120°$ 1

(iii) (a) $AN = 5\sqrt{3}$ and in ΔANB, $\angle ANB = 60°$ and $NA = NB$

$\therefore \angle NAB = \angle NBA = 60°$ or ΔNAB is an equilateral Δ 1/2

Hence, $AB = 5\sqrt{3}$ cm. 1

$AN + NB + AB = 3 \times 5\sqrt{3} = 15\sqrt{3}$ cm. 1/2

OR

(iii) (b) $\angle ANO = 45° \Rightarrow \angle AOB = 90°$ 1/2

$\therefore$ Each angle of quad. AOBN is 90°. 1

Also, OA = OB. $\therefore$ OANB is a square. 1/2

---

38. A wooden toy is shown in the picture. This is a cuboidal wooden block of dimensions 14 cm × 17 cm × 4 cm. On its top there are seven cylindrical hollows for bees to fit in. Each cylindrical hollow is of height 3 cm and radius 2 cm.

Based on the above, answer the following questions :

(i) Find the volume of wood carved out to make one cylindrical hollow.

(ii) Find the lateral surface area of the cuboid to paint it with green colour.

(iii) (a) Find the volume of wood in the remaining cuboid after carving out seven cylindrical hollows.

OR

(iii) (b) Find the surface area of the top surface of the cuboid to be painted yellow.

Solution (i) Volume of wood carved out to make one hollow

$= \frac{22}{7} \times 2 \times 2 \times 3 = \frac{264}{7}$ cm^3 or 37.7 cm^3 *1*

(ii) LSA of cuboid = $2(14 \times 4 + 17 \times 4) = 248$ cm^2. *1*

(iii)(a) Volume of 7 cylindrical hollows = 264 cm^3. 1/2

Volume of original cuboid = $14 \times 17 \times 4 = 952$ cm^3. *1*

$\therefore$ Volume of remaining solid = $952 - 264 = 688$ cm^3. 1/2

OR

(iii) (b) Area of top surface to be painted = $(l \times b) - 7 \times \pi r^2$

$= (14 \times 17) - (\frac{22}{7} \times 4 \times 7)$ 1

$= 150$ cm^2 1
