Series : EF8GD

SET-1

प्रश्न-पत्र कोड
Q.P. Code **430/8/1**

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.

**नोट / NOTE :** **11**

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

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

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

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।

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

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

**Please write down the Serial Number of the question in the answer-book at the given place before attempting it.**

(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।

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

# गणित (बुनियादी)
# MATHEMATICS (BASIC)

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

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

**सामान्य निर्देश :**

**निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका 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* ***1*** *अंक के प्रश्न हैं ।*

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

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

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

*(vii)* ***खण्ड – ङ*** *में प्रश्न संख्या* ***36*** *से* ***38*** *तक प्रकरण अध्ययन आधारित* ***4*** *अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प* ***2*** *अंकों के प्रश्न में दिया गया है ।*

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

**General Instructions :**

**Read the following instructions carefully and follow them :**

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

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

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

(iv) *In* ***Section–B,*** *question numbers* ***21*** *to* ***25*** *are Very Short Answer (VSA) type questions, carrying* ***2*** *marks each.*

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

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

(vii) *In* ***Section–E,*** *question numbers* ***36*** *to* ***38*** *are case study based questions carrying* ***4*** *marks each. Internal choice is provided in* ***2*** *marks question in each case-study.*

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

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

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

## खण्ड – क

**(बहुविकल्पीय प्रश्न)** **$20 \times 1 = 20$**

प्रश्न संख्या **1** से **20** तक बहुविकल्पी प्रश्न हैं । प्रत्येक प्रश्न **1** अंक का है ।

1. यदि $a = 2^5 \times 3^3$, $b = 2^3 \times 3^2 \times 5$ और $c = 3^3 \times 5^n$ है, तथा L.C.M. $(a, b, c) = 2^5 \times 3^3 \times 5^7$ है, तो n का मान है :

   (A) 7 (B) 5

   (C) 3 (D) 1

2. समीकरणों $x = 2$ और $y = 3$ का युग्म उन रेखाओं को दर्शाता है जो

   (A) (–2, –3) पर प्रतिच्छेदी हैं । (B) (2, 3) पर प्रतिच्छेदी हैं ।

   (C) समान्तर हैं । (D) संगामी हैं ।

3. यदि $x = 3$ बहुपद $p(x) = x^2 - 9k$ का एक शून्यक है, तो k का मान है :

   (A) 1 (B) 10

   (C) 0.1 (D) 100

4. निम्न A.P. का सार्व अंतर है :

   2, –2, –6, –10, .....

   (A) 4 (B) 10

   (C) –4 (D) –16

5. यदि $x = a \sin \theta$ और $y = a \cos \theta$ है, तो $x^2 + y^2$ का मान है :

   (A) 1 (B) $a^2$

   (C) a (D) 0

6. एक ठोस अर्धगोले, जिसकी त्रिज्या 7 cm है, का कुल पृष्ठीय क्षेत्रफल है :

   (A) $447 \pi$ sq. cm (B) $239 \pi$ sq. cm

   (C) $174 \pi$ sq. cm (D) $147 \pi$ sq. cm

## Section – A

**(Multiple Choice Questions)** **20 × 1 = 20**

Q. Nos. **1** to **20** are multiple type questions of **1** mark each.

1. If $a = 2^5 \times 3^3$, $b = 2^3 \times 3^2 \times 5$ and $c = 3^3 \times 5^n$ and L.C.M. (a, b, c) $= 2^5 \times 3^3 \times 5^7$, then n is equal to

   (A) 7 (B) 5

   (C) 3 (D) 1

2. The pair of equations $x = 2$ and $y = 3$ represent the lines which are

   (A) intersecting at (–2, –3) (B) intersecting at (2, 3)

   (C) parallel (D) coincident

3. If $x = 3$ is a zero of the polynomial $p(x) = x^2 - 9k$, then k is equal to

   (A) 1 (B) 10

   (C) 0.1 (D) 100

4. The common difference of the A.P. 2, –2, –6, –10, ..... is

   (A) 4 (B) 10

   (C) –4 (D) –16

5. If $x = a \sin \theta$ and $y = a \cos \theta$, then the value of $x^2 + y^2$ is

   (A) 1 (B) $a^2$

   (C) a (D) 0

6. The total surface area of a solid hemisphere of radius 7 cm is

   (A) 447 π sq. cm (B) 239 π sq. cm

   (C) 174 π sq. cm (D) 147 π sq. cm

7. यदि a और b दो क्रमागत प्राकृतिक संख्याएँ हैं, तो महत्तम समापवर्तक (a, b) है :

(A) a (B) b

(C) 1 (D) ab

8. द्विघात समीकरण $2x^2 - \sqrt{5}x + 1 = 0$ के

(A) दो अलग-अलग वास्तविक मूल हैं । (B) दो समान वास्तविक मूल हैं ।

(C) कोई वास्तविक मूल नहीं है । (D) दो से अधिक वास्तविक मूल हैं ।

9. समांतर श्रेढ़ी (A.P.) $\sqrt{5}, \sqrt{20}, \sqrt{45}$ ..... का चौथा पद है :

(A) 25 (B) $\sqrt{80}$

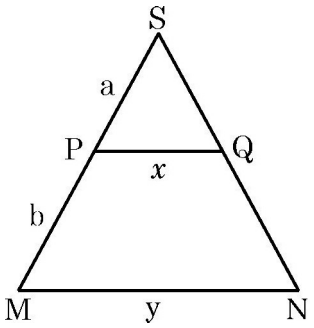
(C) $\sqrt{125}$ (D) $\sqrt{85}$

10. 52 पत्तों की एक ताश की अच्छी प्रकार से फेंटी गई गड्डी से यादृच्छया एक पत्ता निकाला गया । इसके, हुकुम का पत्ता या इक्का होने की प्रायिकता है :

(A) $\frac{7}{13}$ (B) $\frac{5}{13}$

(C) $\frac{4}{13}$ (D) $\frac{3}{13}$

11. दी गई आकृति में, यदि PQ || MN है, तो निम्न में से कौन सा सही विकल्प है ?




(A) $x = \frac{a + b}{ay}$ (B) $\frac{x}{y} = \frac{a}{b}$

(C) $x = \frac{ay}{a + b}$ (D) $\frac{x}{y} = \frac{b}{a}$

7. If a and b are two consecutive natural numbers, then HCF (a, b) is

(A) a (B) b

(C) 1 (D) ab

8. The quadratic equation $2x^2 - \sqrt{5}x + 1 = 0$ has

(A) two distinct real roots. (B) two equal real roots.

(C) no real roots. (D) more than two real roots.

9. The fourth term of the A.P. $\sqrt{5}, \sqrt{20}, \sqrt{45}$ ..... is

(A) 25 (B) $\sqrt{80}$

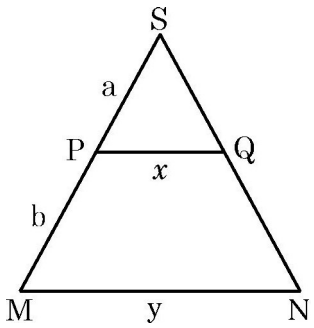
(C) $\sqrt{125}$ (D) $\sqrt{85}$

10. A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of it being a card of spade or an ace is

(A) $\frac{7}{13}$ (B) $\frac{5}{13}$

(C) $\frac{4}{13}$ (D) $\frac{3}{13}$

11. If in the given figure, PQ || MN, then which of the following is true ?




(A) $x = \frac{a + b}{ay}$ (B) $\frac{x}{y} = \frac{a}{b}$

(C) $x = \frac{ay}{a + b}$ (D) $\frac{x}{y} = \frac{b}{a}$

12. यदि $3 \cos \theta = 1$ है, तो $\cot \theta$ का मान है :

(A) $\frac{1}{3}$ (B) $\frac{1}{2\sqrt{2}}$

(C) $2\sqrt{2}$ (D) $\frac{2\sqrt{2}}{3}$

13. $x$ में द्विघात समीकरण $kx^2 + 3x + 2k^2 = 0$ के मूलों का गुणनफल 1 है, तो k का मान है :

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$

(C) $\frac{3}{2}$ (D) 0

14. नीचे दिए गए अपरिमेय संख्याओं के युग्मों में, किसका गुणनफल एक परिमेय संख्या है ?

(A) $\sqrt{8}, \sqrt{32}$ (B) $\sqrt{3}, \sqrt{5}$

(C) $\sqrt{8}, \sqrt{20}$ (D) $\sqrt{2}, \sqrt{15}$

15. 10 सेमी त्रिज्या वाले एक वृत्त की एक जीवा उसके केंद्र पर समकोण अंतरित करती है । जीवा की लम्बाई (सेमी में) है :

(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

(C) $\frac{5}{\sqrt{2}}$ (D) $10\sqrt{3}$

16. निम्नलिखित बारंबारता बंटन में माध्यक वर्ग (मीडियन क्लास) की ऊपरी सीमा है :

| **वर्ग** | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| **बारंबारता** | 5 | 12 | 20 | 8 | 5 |

(A) 10 (B) 20

(C) 30 (D) 40

12. If $3 \cos \theta = 1$, then the value of $\cot \theta$ is

(A) $\frac{1}{3}$ (B) $\frac{1}{2\sqrt{2}}$

(C) $2\sqrt{2}$ (D) $\frac{2\sqrt{2}}{3}$

13. The product of the roots of the quadratic equation $kx^2 + 3x + 2k^2 = 0$ in $x$ is 1, then the value of k is

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$

(C) $\frac{3}{2}$ (D) 0

14. Among the following pair of irrational numbers, whose product is a rational number ?

(A) $\sqrt{8}, \sqrt{32}$ (B) $\sqrt{3}, \sqrt{5}$

(C) $\sqrt{8}, \sqrt{20}$ (D) $\sqrt{2}, \sqrt{15}$

15. A chord of a circle of radius 10 cm, subtends a right angle at its centre. The length of the chord (in cm) is :

(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

(C) $\frac{5}{\sqrt{2}}$ (D) $10\sqrt{3}$

16. The upper limit of median class in the following frequency distribution is :

| **Class** | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| **Frequency** | 5 | 12 | 20 | 8 | 5 |

(A) 10 (B) 20

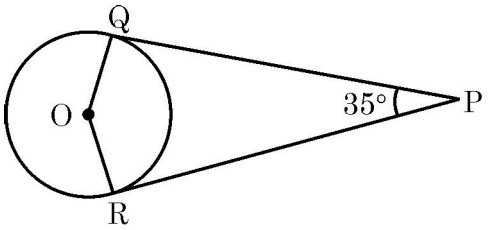
(C) 30 (D) 40

17. यदि $\Delta ABC$ और $\Delta PRQ$ इस प्रकार हैं कि $\frac{AB}{PR} = \frac{AC}{PQ}$, तो वे समरूप होंगे यदि :

(A) $\angle A = \angle P$ (B) $\angle A = \angle R$

(C) $\angle B = \angle Q$ (D) $\angle B = \angle R$

18. दी गई आकृति में, PQ और PR, केंद्र O वाले एक वृत्त पर खींची गई स्पर्श–रेखाएँ हैं । यदि $\angle QPR = 35°$ है, तो $\angle QOR$ बराबर है :




(A) 70° (B) 90°

(C) 135° (D) 145°

**(अभिकथन एवं तर्क आधारित प्रश्न)**

**निर्देश :** प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । 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 विकल्पों (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) गलत है ।

(D) अभिकथन (A) गलत है, परन्तु तर्क (R) सही है ।

19. **अभिकथन (A) :** बिन्दु A(–4, 3) और B(4, 3) को मिलाने वाले रेखाखण्ड का मध्य-बिन्दु (0, 3) है ।

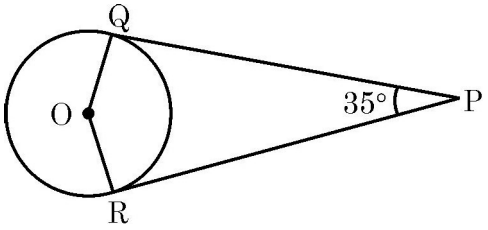
**तर्क (R) :** दो बिंदुओं $A(x_1, y_1)$ और $B(x_2, y_2)$ को मिलाने वाले रेखा खण्ड का मध्य-बिन्दु, खंड सूत्र (section formula) का प्रयोग करके 1 : 1 के अनुपात में निर्धारित किया जा सकता है ।

17. If $\Delta ABC$ and $\Delta PRQ$ are such that $\frac{AB}{PR} = \frac{AC}{PQ}$, then they will be similar if

(A) $\angle A = \angle P$ (B) $\angle A = \angle R$

(C) $\angle B = \angle Q$ (D) $\angle B = \angle R$

18. In the given figure, PQ and PR are tangents to a circle with centre O. If $\angle QPR = 35°$, then $\angle QOR$ is equal to




(A) 70° (B) 90°

(C) 135° (D) 145°

**(Assertion – Reason based questions)**

**Directions :** Question numbers **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the option (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) :** The mid-point of the line segment joining A(–4, 3) and B(4, 3) is (0, 3).

**Reason (R) :** The mid-point of the line segment joining two points A($x_1$, $y_1$) and B($x_2$, $y_2$) can be determined by using section formula with ratio 1 : 1.

20. **अभिकथन (A)** : दो सर्वांगसम त्रिभुज सदैव समरूप होते हैं ।

**तर्क (R)** : यदि दो त्रिभुजों के क्षेत्रफल समान हों, तो वे सर्वांगसम होते हैं ।

## खण्ड – ख

**(अति लघु-उत्तरीय प्रश्न)** **5 × 2 = 10**

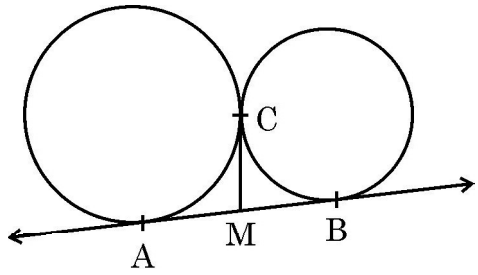
प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय प्रश्न हैं । प्रत्येक प्रश्न **2** अंकों का है ।

21. (a) यदि बिंदु A(a, b), दो बिन्दुओं B(2, 4) और C(–2, –3) से समान दूरी पर है, तो a और b के बीच का सम्बन्ध ज्ञात कीजिए ।

**अथवा**

(b) वह अनुपात ज्ञात कीजिए जिसमें रेखा $x + 3y = 12$, बिन्दुओं (1, 3) और (2, 5) को मिलाने वाले रेखा खण्ड को विभाजित करती है ।

22. दिए गए चित्र में दर्शाए अनुसार दो स्पर्श करने वाले वृत्तों में दो उभयनिष्ठ स्पर्श–रेखाएँ AB और CM हैं । सिद्ध कीजिए कि M, रेखा खंड AB का मध्य-बिन्दु है ।




23. (a) समांतर श्रेढ़ी (A.P.) 6, 12, 18, ..... का कौन सा पद उसके 25वें पद से 150 अधिक होगा ?

**अथवा**

(b) एक समांतर श्रेढ़ी (A.P.) का nवाँ पद ज्ञात कीजिए, जिसका 5वाँ पद 3 और 12वाँ पद 17 है ।

20. **Assertion (A) :** Two congruent triangles are always similar.

**Reason (R) :** If the area of two triangles are equal, then they are congruent.

## Section – B

**(Very Short Answer Type Questions)** **5 × 2 = 10**

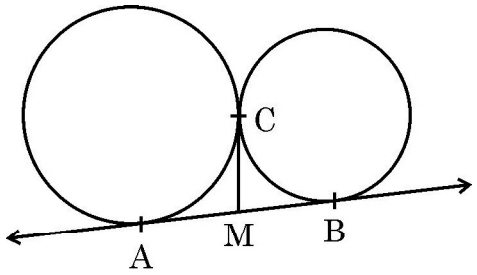
Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

21. (a) If A(a, b) is a point which is equidistant from points B(2, 4) and C(–2, –3), then find the relation between a and b.

**OR**

(b) Find the ratio in which the line $x + 3y = 12$ divides the line segment joining (1, 3) and (2, 5).

22. The two touching circles have common tangents AB and CM as shown in the given figure. Show that M is the midpoint of line segment AB.




23. (a) Which term of the A.P. 6, 12, 18, …… will be 150 more than its $25^{th}$ term ?

**OR**

(b) Determine the $n^{th}$ term of an A.P. whose $5^{th}$ term is 3 and $12^{th}$ term is 17.

24. निम्नलिखित आँकड़ों का माध्य 15.6 है । k का मान ज्ञात कीजिए ।

| वर्ग | 6 – 10 | 10 – 14 | 14 – 18 | 18 – 22 | 22 – 26 |
|---|---|---|---|---|---|
| बारंबारता | 4 | 6 | k | 5 | 3 |

25. यदि $\cos \theta = \frac{4}{5}$ है, तो $\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta}$ का मान ज्ञात कीजिए ।

## खण्ड – ग

**(लघु-उत्तरीय प्रश्न)** **6 × 3 = 18**

प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय प्रश्न हैं । प्रत्येक प्रश्न **3** अंकों का है ।

26. (a) वह सबसे छोटी संख्या ज्ञात कीजिए जिसमें 17 जोड़ने पर प्राप्त संख्या 520 और 468 दोनों से पूर्णतः विभाजित हो जाए ।

**अथवा**

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

27. (a) एक निश्चित भिन्न में, यदि अंश को 4 से गुणा किया जाए और हर को 5 से कम किया जाए, तो परिणामी भिन्न $\frac{8}{5}$ हो जाती है । लेकिन यदि अंश में 1 जोड़ा जाए और हर को 2 से बढ़ाया जाए, तो परिणामी भिन्न $\frac{1}{3}$ हो जाती है । मूल भिन्न ज्ञात कीजिए ।

**अथवा**

(b) 2-अंकों की एक संख्या ऐसी है कि उसके इकाई का अंक उसके दहाई के अंक से दो कम है, साथ ही, उस संख्या और अंकों को पलटकर बनी संख्या का योगफल 154 है । वह संख्या ज्ञात कीजिए ।

24. The mean of the following data is 15.6. Find the value of k.

| **Class** | 6 – 10 | 10 – 14 | 14 – 18 | 18 – 22 | 22 – 26 |
|---|---|---|---|---|---|
| **Frequency** | 4 | 6 | k | 5 | 3 |

25. If $\cos\theta = \frac{4}{5}$, find the value of $\frac{\sec\theta - \tan\theta}{\sec\theta + \tan\theta}$.

## Section – C

**(Short Answer Type Questions)** **6 × 3 = 18**

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. (a) Find the smallest number which when increased by 17 is exactly divisible by both 520 and 468.

**OR**

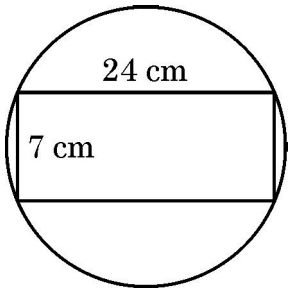
(b) Prove that $\sqrt{5}$ is an irrational number.

27. (a) In a certain fraction, if the numerator is multiplied by 4 and the denominator is decreased by 5, the result becomes $\frac{8}{5}$. But if the numerator is increased by 1 and denominator is increased by 2, the result becomes $\frac{1}{3}$. Find the original fraction.

**OR**

(b) A 2-digit number is such that its units digit is two less than the tens digit, also the sum of the number and the number formed by reversing the digits is 154. Find the number.

28. एक आयत जिसकी भुजाएँ 24 cm और 7 cm हैं, एक वृत्त के अन्तर्गत बना हुआ है । वृत्त की त्रिज्या ज्ञात कीजिए ।




29. यदि A(–7, 5) और B(8, –3) दो दिए गए बिन्दु हैं, तो निम्न ज्ञात करें :

(i) रेखा खण्ड AB की लम्बाई ;

(ii) रेखा खण्ड AB पर बिंदु P के निर्देशांक जो इसे 3 : 2 के अनुपात में बाँटता है ।

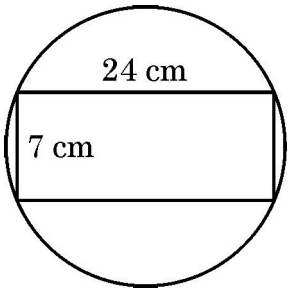
30. यदि $\sin (A - B) = \frac{1}{2}$ और $\cos (A + B) = \frac{1}{2}$, $0 < A + B \leq 90°$, $A > B$ है, तो $\sin A$ का मान ज्ञात कीजिए ।

31. किसी विद्यालय में 140 दिनों तक प्रतिदिन अनुपस्थित छात्रों की संख्या दर्ज की गई और इन आँकड़ों को निम्नलिखित बारंबारता सारणी के रूप में प्रस्तुत किया गया है :

| **अनुपस्थित छात्रों की संख्या** | 2-4 | 4-6 | 6-8 | 8-10 | 10-12 | 12-14 | 14-16 | 16-18 | 18-20 | **कुल** |
|---|---|---|---|---|---|---|---|---|---|---|
| **दिनों की संख्या** | 1 | 5 | 11 | 14 | 16 | 13 | 14 | 60 | 6 | **140** |

आँकड़ों का माध्यक और बहुलक ज्ञात कीजिए ।

28. A rectangle with side lengths 24 cm and 7 cm is inscribed in a circle. Find the radius of the circle.




29. If A(–7, 5) and B(8, –3) are two given points, then find

(i) the length of line segment AB ;

(ii) the coordinates of point P which divides the line segment AB in the ratio 3 : 2.

30. If $\sin (A - B) = \frac{1}{2}$ and $\cos (A + B) = \frac{1}{2}$, $0 < A + B \leq 90°$, $A > B$, then find the value of sin A.

31. The number of students absent in a school was recorded everyday for 140 days and the data was presented in the form of the following frequency table.

| **Number of absentees** | 2-4 | 4-6 | 6-8 | 8-10 | 10-12 | 12-14 | 14-16 | 16-18 | 18-20 | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Number of days** | 1 | 5 | 11 | 14 | 16 | 13 | 14 | 60 | 6 | **140** |

Obtain the median and the mode of the data.

## खण्ड – घ

**(दीर्घ-उत्तरीय प्रश्न)** **$4 \times 5 = 20$**

प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय प्रश्न हैं । प्रत्येक प्रश्न **5** अंकों का है ।

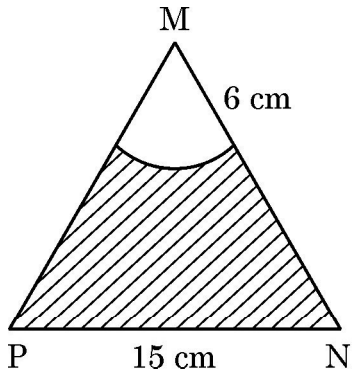
32. (a) एक पिता और उसके पुत्र की आयु का योग 45 वर्ष है । पाँच साल पूर्व, उनकी आयु (वर्ष में) का गुणनफल 124 था । पाँच साल बाद उनकी क्रमशः आयु ज्ञात कीजिए ।

**अथवा**

(b) समीकरण $\frac{1}{x-3} - \frac{1}{x+5} = \frac{1}{6}$ ; $(x \neq 3, -5)$ को एक द्विघात समीकरण के मानक रूप में व्यक्त कीजिए तथा प्राप्त समीकरण को हल कीजिए ।

33. एक भवन की ऊँचाई 120 m है । भवन की छत से दो व्यक्तियों के अवनमन कोण क्रमशः $30°$ और $60°$ मापे गए हैं, जो भवन की विपरीत दिशाओं में खड़े हैं । दोनों व्यक्तियों के बीच की दूरी ज्ञात कीजिए ।

34. दी गई आकृति में छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए, जब एक वृत्तीय चाप जिसकी त्रिज्या 6 सेमी है, समबाहु त्रिभुज PMN के शिखर M को केंद्र मानकर खींची गई हो, तथा त्रिभुज की प्रत्येक भुजा 15 सेमी हो । [$\sqrt{3} = 1.732$ लीजिए]




35. (a) ABCD एक चतुर्भुज है । बिंदु P, Q, R तथा S क्रमशः भुजाओं AB, BC, CD और DA को इस प्रकार त्रिविभाजन करते हैं कि ये सभी बिंदु बिंदुओं A तथा C के समीप हों । सिद्ध कीजिए कि PQRS एक समांतर–चतुर्भुज है ।

**अथवा**

## Section – D

**(Long Answer Type Questions)** **4 × 5 = 20**

Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each.

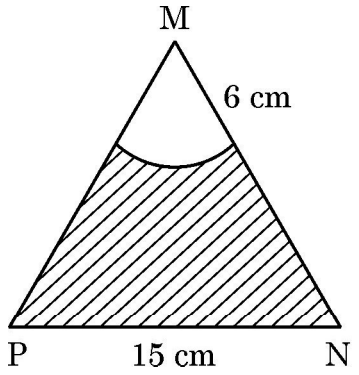
32. (a) The sum of ages of a father and his son is 45 years. Five years ago, the product of their ages (in years) was 124. Determine their ages respectively after five years.

**OR**

(b) Express the equation $\frac{1}{x-3} - \frac{1}{x+5} = \frac{1}{6}$ ; $(x \neq 3, -5)$ as a quadratic equation in standard form. Hence, solve the equation so formed.

33. A building is 120 m tall. From the top of the building, the angles of depression of two persons standing on opposite sides of the building are 30° and 60°. Calculate the distance between the two persons.

34. Find the area of the shaded region in the given figure, where a circular arc of radius 6 cm has been drawn with vertex M of an equilateral triangle PMN of side 15 cm as centre. [Use $\sqrt{3} = 1.732$]




35. (a) ABCD is a quadrilateral and P, Q, R and S are the points of trisection of sides AB, BC, CD and DA respectively such that these are adjacent to A and C. Prove that PQRS is a parallelogram.

**OR**

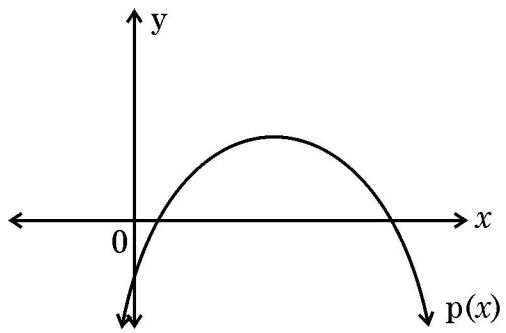
(b) समद्विबाहु त्रिभुज ABC में AB = AC है । बिंदु P और Q क्रमशः भुजाओं AB और AC पर इस प्रकार स्थित हैं कि AP = AQ है । सिद्ध कीजिए कि बिंदु B, C, Q, P एकवृत्तीय हैं ।

## खण्ड – ङ

**(प्रकरण अध्ययन आधारित प्रश्न)** **3 × 4 = 12**

इस खण्ड में **3** प्रकरण अध्ययन आधारित प्रश्न हैं । प्रत्येक प्रश्न 4 अंकों का है ।

36. पार्क में एक परवलय के आकार का फव्वारा इस प्रकार डिज़ाइन किया गया है कि इसका आकार एक बहुपद (polynomial) $p(x) = -x^2 + 6x - 5$ का अनुसरण करता है, जहाँ $p(x)$ ज़मीन से ऊपर ऊँचाई (मीटर में) को दर्शाता है, जब मूल बिन्दु से क्षैतिज दूरी $x$ m हो ।




उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) $p(x)$ के शून्यक ज्ञात कीजिए । **(1)**

(ii) मूल बिंदु से 2 मीटर की क्षैतिज दूरी पर फव्वारे की ऊँचाई क्या होगी ? **(1)**

(iii) (a) यदि $q(x)$, $p(x)$ का प्रतिबिम्ब है, (अर्थात् $q(x) = -p(x)$), तो इसे एक बहुपद के रूप में लिखें तथा इसकी आकृति दर्शाएँ । **(2)**

**अथवा**

(b) मूल बिंदु से कितनी क्षैतिज दूरी पर पानी ज़मीन को छूता है ? **(2)**

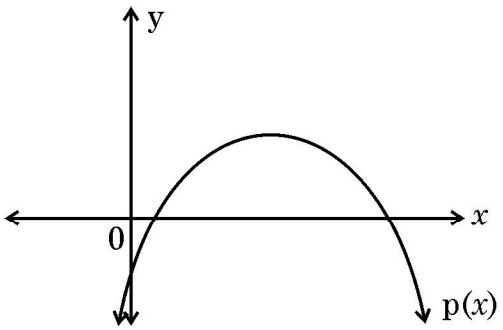
(b) In an isosceles $\Delta ABC$ with AB = AC, points P and Q are on the sides AB and AC respectively such that AP = AQ. Show that the points B, C, Q, P are concyclic.

## Section – E

### (Case-study based Questions) $3 \times 4 = 12$

This section has **3** case study based questions carrying **4** marks each.

36. A parabolic fountain in a park is designed such that its shape follows the polynomial $p(x) = -x^2 + 6x - 5$, where $p(x)$ is the height (in metres) above ground level at a horizontal distance $x$ metre from the origin.




Based on the above, answer the following questions :

(i) What are the zeroes of $p(x)$ ? **(1)**

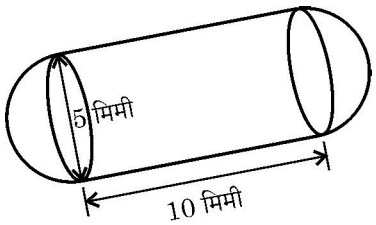
(ii) What is the height of the fountain at a horizontal distance of 2 metres from origin ? **(1)**

(iii) (a) If $q(x)$ is a reflection of $p(x)$, that is $q(x) = -p(x)$, write its value as polynomial and draw its figure. **(2)**

**OR**

(b) At what horizontal distance from the origin does water hit the ground ? **(2)**

37. एक अस्पताल दवाइयों के कैप्सूल स्टोर करता है, जिनका आकार बेलन के साथ दोनों सिरों पर अर्द्ध-गोलाकार है । प्रत्येक कैप्सूल के बेलनाकार भाग की लंबाई 10 मिमी है और इसका व्यास 5 मिमी है ।




उपरोक्त के आधार पर निम्न के उत्तर दीजिए :

(i) एक कैप्सूल का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए । **(1)**

(ii) एक कैप्सूल का आयतन ज्ञात कीजिए । **(1)**

(iii) (a) यदि यह कैप्सूल पूरी तरह दवा से भरा हो और दवा की कीमत ₹ 0.05 प्रति घन मिमी ($mm^3$) हो, तो एक कैप्सूल में भरी दवा की लागत ज्ञात कीजिए । **(2)**

**अथवा**

(b) यदि कैप्सूल की लंबाई को दुगुना कर दिया जाए, तो ज्ञात कीजिए कि उसमें पहले से कितनी अधिक दवा भरी जा सकती है । **(2)**

38. एक विद्यालय ने अपने वार्षिक उत्सव के दौरान एक लकी ड्रा का आयोजन किया । ड्रा बॉक्स में कुल 100 पर्चियाँ थीं, जिनमें प्रत्येक पर 1 से 100 तक का एक विशिष्ट अंक लिखा हुआ है । पर्चियों का वितरण इस प्रकार था :

- 30 पर्चियों पर एक लाल निशान था ।
- 20 पर्चियाँ ऐसी थीं, जिन पर अंक 5 के गुणज थे ।
- 15 पर्चियाँ ऐसी थीं, जिन पर लाल निशान भी था और जिन पर 5 के गुणज वाली संख्या भी थी ।
- बाकी पर्चियाँ सादी थीं (ना तो उन पर लाल निशान था, ना ही संख्या थीं)

अब बॉक्स से एक पर्ची यादृच्छिक (random) रूप से निकाली जाती है ।

दी गई स्थिति को पढ़कर निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) कुल संभावित परिणामों की संख्या क्या है ? **(1)**

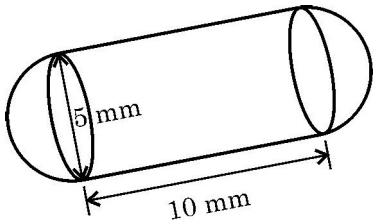
(ii) उस पर्ची के निकालने की प्रायिकता क्या है, जिस पर केवल लाल निशान हो ? **(1)**

(iii) (a) उस पर्ची के निकालने की प्रायिकता क्या है जो 5 की गुणज तो हो पर उस पर लाल निशान न हो ? **(2)**

**अथवा**

(b) उस पर्ची के निकालने की प्रायिकता ज्ञात कीजिए, जो न तो लाल निशान वाली हो और न ही 5 के गुणज वाली हो । **(2)**

37. A hospital stores medicine capsules shaped like cylinders with hemispherical ends. Each capsule has length of the cylindrical part of 10 mm and a diameter of 5 mm.




Based on the above, answer the following questions :

(i) Find the total surface area of one capsule. **(1)**

(ii) What is the capacity of the capsule ? **(1)**

(iii) (a) If the capsule is filled with medicine, which costs ₹ 0.05/$mm^3$, calculate the cost of medicine per capsule. **(2)**

**OR**

(b) How much extra medicine (in volume) can be stored in the capsule, if the capsule length is doubled ? **(2)**

38. A school conducted a lucky draw during its annual function. The draw box contained 100 chits, each with a unique number from 1 to 100. The distribution of the chits is as follows :

– 30 chits had red markings.

– 20 chits were having numbers which are multiples of 5.

– 15 chits had both red markings and numbers which are multiples of 5.

– The rest were plain having no marking and no number.

One chit is drawn at random from the box.

Based on the above, answer the following questions :

(i) What are the total number of outcomes ? **(1)**

(ii) What is the probability that the chit drawn has a red marking only ? **(1)**

(iii) (a) What is the probability that the chit has a multiple of 5 but no red marking ? **(2)**

**OR**

(b) What is the probability that the chit drawn is neither of red marking nor a multiple of 5 ? **(2)**

**Marking Scheme Strictly Confidential**
**(For Internal and Restricted use only)**
**Secondary School Examination, 2026(2nd Board Examination)**
**SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/8/1)**

**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. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."** |
| **3** | Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.** |
| **4** | The Marking scheme carries only suggested value points for the answers.<br>These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly. |
| **5** | The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators. |
| **6** | Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.** |
| **7** | If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly. |
| **8** | If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly. |
| **9** | If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**. |
| **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).This is in view of the reduced syllabus and number of questions in question paper. |

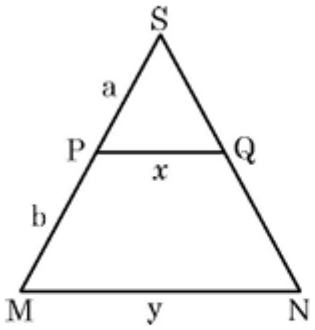
| | |
|---|---|
| **13** | Ensure that you do not make the following common types of errors committed by the Examiner in the past:-<br>Leaving answer or part thereof unassessed in an answer book.<br>Giving more marks for an answer than assigned to it.<br>Wrong totaling of marks awarded on an answer.<br>Wrong transfer of marks from the inside pages of the answer book to the title page.<br>Wrong question wise totaling on the title page.<br>Wrong totaling of marks of the two columns on the title page.<br>Wrong grand total.<br>Marks in words and figures not tallying/not same.<br>Wrong transfer of marks from the answer book to online award list.<br>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.)<br>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 unassessed 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 (Subject Code 241)

| | |
|---|---|
| **Section – A**<br>**(Multiple Choice Questions)** **20 × 1 = 20**<br>Q. Nos. **1** to **20** are multiple type questions of **1** mark each. | |
| 1. If $a = 2^5 \times 3^3$, $b = 2^3 \times 3^2 \times 5$ and $c = 3^3 \times 5^n$ and L.C.M. (a, b, c) $= 2^5 \times 3^3 \times 5^7$ then n is equal to<br>(A) 7 (B) 5<br>(C) 3 (D) 1 | |
| Answer : (A) 7 | 1 |
| 2. The pair of equations $x = 2$ and $y = 3$ represent the lines which are<br>(A) intersecting at (–2, –3) (B) intersecting at (2, 3)<br>(C) parallel (D) coincident | |
| Answer : (B) intersecting at (2,3) | 1 |
| 3. If $x = 3$ is a zero of the polynomial $p(x) = x^2 - 9k$, then k is equal to<br>(A) 1 (B) 10<br>(C) 0.1 (D) 100 | |
| Answer : (A) 1 | 1 |
| 4. The common difference of the A.P. 2, –2, –6, –10, ..... is<br>(A) 4 (B) 10<br>(C) –4 (D) –16 | |
| Answer : (C) –4 | 1 |
| 5. If $x = a \sin\theta$ and $y = a \cos\theta$, then the value of $x^2 + y^2$ is<br>(A) 1 (B) $a^2$<br>(C) a (D) 0 | |
| Answer : (B) $a^2$ | 1 |

| | |
|---|---|
| 6. The total surface area of a solid hemisphere of radius 7 cm is<br>(A) 447 π sq. cm (B) 239 π sq. cm<br>(C) 174 π sq. cm (D) 147 π sq. cm | |
| Answer : (D) 147 $\pi$ sq. cm | 1 |
| 7. If a and b are two consecutive natural numbers, then HCF (a, b) is<br>(A) a (B) b<br>(C) 1 (D) ab | |
| Answer: (C) 1 | 1 |
| 8. The quadratic equation $2x^2 - \sqrt{5}x + 1 = 0$ has<br>(A) two distinct real roots. (B) two equal real roots.<br>(C) no real roots. (D) more than two real roots. | |
| Answer : (C) no real roots | 1 |
| 9. The fourth term of the A.P. $\sqrt{5}, \sqrt{20}, \sqrt{45}$ ..... is<br>(A) 25 (B) $\sqrt{80}$<br>(C) $\sqrt{125}$ (D) $\sqrt{85}$ | |
| Answer : (B) $\sqrt{80}$ | 1 |
| 10. A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of it being a card of spade or an ace is<br>(A) $\frac{7}{13}$ (B) $\frac{5}{13}$<br>(C) $\frac{4}{13}$ (D) $\frac{3}{13}$ | |
| Answer: (C) $\frac{4}{13}$ | 1 |

11. If in the given figure, PQ || MN, then which of the following is true ?




(A) $x = \frac{a + b}{ay}$ (B) $\frac{x}{y} = \frac{a}{b}$

(C) $x = \frac{ay}{a + b}$ (D) $\frac{x}{y} = \frac{b}{a}$

Answer : (C) $x = \frac{ay}{a + b}$ 1

12. If $3 \cos \theta = 1$, then the value of $\cot \theta$ is

(A) $\frac{1}{3}$ (B) $\frac{1}{2\sqrt{2}}$

(C) $2\sqrt{2}$ (D) $\frac{2\sqrt{2}}{3}$

Answer : (B) $\frac{1}{2\sqrt{2}}$ 1

13. The product of the roots of the quadratic equation $kx^2 + 3x + 2k^2 = 0$ in $x$ is 1, then the value of k is

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$

(C) $\frac{3}{2}$ (D) 0

Answer : (B) $\frac{1}{2}$ 1

14. Among the following pair of irrational numbers, whose product is a rational number ?

(A) $\sqrt{8}, \sqrt{32}$ (B) $\sqrt{3}, \sqrt{5}$

(C) $\sqrt{8}, \sqrt{20}$ (D) $\sqrt{2}, \sqrt{15}$

Answer : (A) $\sqrt{8}$ , $\sqrt{32}$ 1

15. A chord of a circle of radius 10 cm, subtends a right angle at its centre.

The length of the chord (in cm) is :

(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

(C) $\frac{5}{\sqrt{2}}$ (D) $10\sqrt{3}$

Answer : (B) $10\sqrt{2}$ 1

16. The upper limit of median class in the following frequency distribution is :

| **Class** | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 |
|---|---|---|---|---|---|
| **Frequency** | 5 | 12 | 20 | 8 | 5 |

(A) 10 (B) 20

(C) 30 (D) 40

Answer : (C) 30 1

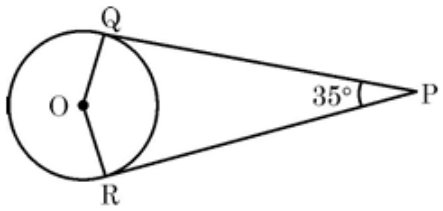
17. If $\Delta ABC$ and $\Delta PRQ$ are such that $\frac{AB}{PR} = \frac{AC}{PQ}$, then they will be similar if

(A) $\angle A = \angle P$ (B) $\angle A = \angle R$

(C) $\angle B = \angle Q$ (D) $\angle B = \angle R$

Answer : (A) $\angle A = \angle P$ 1

18. In the given figure, PQ and PR are tangents to a circle with centre O. If $\angle QPR = 35°$, then $\angle QOR$ is equal to




(A) 70° (B) 90°

(C) 135° (D) 145°

Answer : (D) 145° 1

**(Assertion – Reason based questions)**

**Directions :** Question numbers **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the option (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) :** The mid-point of the line segment joining A(–4, 3) and B(4, 3) is (0, 3).

**Reason (R) :** The mid-point of the line segment joining two points A($x_1$, $y_1$) and B($x_2$, $y_2$) can be determined by using section formula with ratio 1 : 1.

| | |
|---|---|
| Answer : (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). | 1 |

20. **Assertion (A) :** Two congruent triangles are always similar.

**Reason (R) :** If the area of two triangles are equal, then they are congruent.

| | |
|---|---|
| Answer : (C) Assertion (A) is true, but Reason (R) is false. | 1 |

**Section – B**

**(Very Short Answer Type Questions)** **5 × 2 = 10**

Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

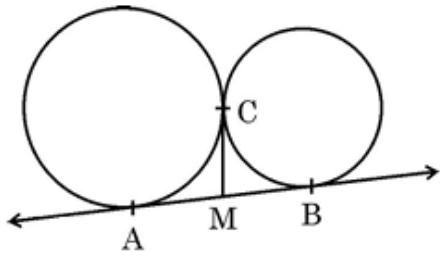
21. (a) If A(a, b) is a point which is equidistant from points B(2, 4) and C(–2, –3), then find the relation between a and b.

**OR**

(b) Find the ratio in which the line $x + 3y = 12$ divides the line segment joining (1, 3) and (2, 5).

| | |
|---|---|
| Solution: (a) $(a-2)^2 + (b-4)^2 = (a+2)^2 + (b+3)^2$ | **1** |
| $8a + 14b = 7$ | **1** |
| **OR** | |
| (b) Let P be the point $P\left(\frac{2K+1}{K+1}, \frac{5K+3}{K+1}\right)$ which also lies on the line $x + 3y = 12$ | **1** |
| $2K + 1 + 15K + 9 = 12K + 12$ | ½ |
| $\Rightarrow \quad K = \frac{2}{5}$ | ½ |
| Ratio = 2 : 5 | |

22. **The two touching circles have common tangents AB and CM as shown in the given figure. Show that M is the midpoint of line segment AB.**




| | |
|---|---|
| Solution: Tangents from an external point to a circle are equal in length. | |
| CM = AM | 1 |
| CM = MB | ½ |
| AM = MB | ½ |
| Therefore, M is the mid-point of AB. | |

23. (a) **Which term of the A.P. 6, 12, 18, ..... will be 150 more than its $25^{th}$ term ?**

**OR**

(b) **Determine the $n^{th}$ term of an A.P. whose $5^{th}$ term is 3 and $12^{th}$ term is 17.**

| | |
|---|---|
| Solution: (a) Let $a_n$ be 150 more than $a_{25}$ | |
| $\therefore a_n = 150 + a + 24d$ | 1 |
| $6 + (n-1)6 = 150 + 6 + 24 \times 6$ | ½ |
| $\Rightarrow n = 50$ | ½ |
| **OR** | |
| (b) $a + 4d = 3$.....(1) | ½ |
| $a + 11d = 17$.....(2) | ½ |
| Solving equation (1) and (2) we get, $a = -5$ and $d = 2$ | ½ |

$a_n = -7 + 2n$ ½

24. The mean of the following data is 15.6. Find the value of k.

| Class | 6 – 10 | 10 – 14 | 14 – 18 | 18 – 22 | 22 – 26 |
|---|---|---|---|---|---|
| Frequency | 4 | 6 | k | 5 | 3 |

Solution:

| Class | 6-10 | 10-14 | 14-18 | 18-22 | 22-26 | Total |
|---|---|---|---|---|---|---|
| $x_i$ | 8 | 12 | 16 | 20 | 24 | |
| fi | 4 | 6 | k | 5 | 3 | 18 + k |
| fixi | 32 | 72 | 16k | 100 | 72 | 276 + 16k |

½

$15.6 = \frac{276 + 16k}{18 + k}$ 1

$k = 12$ ½

25. If $\cos\theta = \frac{4}{5}$, find the value of $\frac{\sec\theta - \tan\theta}{\sec\theta + \tan\theta}$.

Solution: $\sec\theta = \frac{5}{4}$ ½

$\tan\theta = \frac{3}{4}$ ½

$\frac{sec\theta - tan\theta}{sec\theta + tan\theta} = \frac{1}{4}$ 1

## Section – C

**(Short Answer Type Questions)** **6 × 3 = 18**

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. (a) Find the smallest number which when increased by 17 is exactly divisible by both 520 and 468.

**OR**

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

Solution: (a) $520 = 2^3 \times 13 \times 5$, $468 = 2^2 \times 3^2 \times 13$ — 1

LCM(520, 468) $= 2^3 \times 3^2 \times 5 \times 13 = 4680$ — 1

Required number $= 4680 - 17 = 4663$ — 1

**OR**

(b) Let $\sqrt{5}$ be a rational number such that $\sqrt{5} = \frac{p}{q}$ where p and q are co-prime integers and $q \neq 0$. — ½

$\sqrt{5}q = p \Rightarrow 5q^2 = p^2$

5 divides $p^2 \Rightarrow$ 5 divides p as well — 1

Let p = 5m (for some integer m)

$5q^2 = 25m^2 \quad \Rightarrow q^2 = 5m^2$

5 divides $q^2 \Rightarrow$ 5 divides q as well — 1

p and q have a common factor 5, which is a contradiction as p and q are co-prime integers. — ½

$\therefore$ our assumption is wrong

Hence, $\sqrt{5}$ is an irrational number.

27. (a) **In a certain fraction, if the numerator is multiplied by 4 and the denominator is decreased by 5, the result becomes $\frac{8}{5}$. But if the numerator is increased by 1 and denominator is increased by 2, the result becomes $\frac{1}{3}$. Find the original fraction.**

**OR**

(b) **A 2-digit number is such that its units digit is two less than the tens digit, also the sum of the number and the number formed by reversing the digits is 154. Find the number.**

Solution: (a) Let the fraction is $\frac{x}{y}$

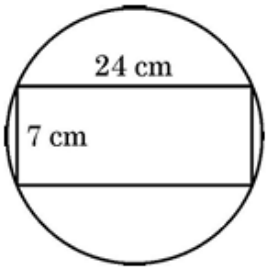
ATQ

$\frac{4x}{y-5} = \frac{8}{5}$

$\Rightarrow 20x - 8y + 40 = 0$ — 1

| | |
|---|---|
| and $\frac{x+1}{y+2}=\frac{1}{3}$ | |
| $\Rightarrow$ 3x – y + 1 = 0 | 1 |
| $x = 8, y = 25$ $\therefore$ fraction is $\frac{8}{25}$ | 1 |
| **OR** | |
| (b) Let units digit is x – 2 and tens digit is $x$ | ½ |
| ATQ<br>$(10x + x–2) + [10(x–2) + x] = 154$ | 1 |
| $22x – 22 = 154$<br>$22x = 176$<br>$x = 8$ | ½ |
| Unit's place = 6 and ten's place = 8<br>$\therefore$ Number = 86 | 1 |

28. A rectangle with side lengths 24 cm and 7 cm is inscribed in a circle. Find the radius of the circle.




| | |
|---|---|
| Solution: Since the diagonal of the rectangle will be diameter. | ½ |
| $\therefore (2r)^2 = 24^2 + 7^2$ | 1 |
| $4r^2 = 576 + 49 = 625$ | |
| $r^2 = \frac{625}{4}$ | 1 |
| $r = \frac{25}{2} = 12.5$ cm | ½ |

29. If A(–7, 5) and B(8, –3) are two given points, then find

(i) the length of line segment AB ;

(ii) the coordinates of point P which divides the line segment AB in the ratio 3 : 2.

| | |
|---|---|
| Solution: (i) Length of the line segment AB = $\sqrt{(8+7)^2+(-3-5)^2}$ | 1 |
| = 17 | |

(ii) Coordinates of point P : $x=\frac{3\times8-2\times7}{3+2}=\frac{10}{5}=2$ — 1

$y=\frac{3\times(-3)+2(5)}{5}=\frac{1}{5}$ — 1

Hence, P(2, $\frac{1}{5}$)

30. If $\sin(A-B)=\frac{1}{2}$ and $\cos(A+B)=\frac{1}{2}$, $0 < A+B \le 90°$, $A > B$, then find the value of sin A.

Solution: $\sin(A-B)=\frac{1}{2} \Rightarrow A-B=30°$ — 1

$\cos(A+B)=\frac{1}{2} \Rightarrow A+B=60°$ — 1

$\Rightarrow$ A = 45°, B = 15° — ½

$\sin A = \sin 45° = \frac{1}{\sqrt{2}}$ — ½

31. The number of students absent in a school was recorded everyday for 140 days and the data was presented in the form of the following frequency table.

| **Number of absentees** | 2-4 | 4-6 | 6-8 | 8-10 | 10-12 | 12-14 | 14-16 | 16-18 | 18-20 | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Number of days** | 1 | 5 | 11 | 14 | 16 | 13 | 14 | 60 | 6 | **140** |

Obtain the median and the mode of the data.

Solution:

| Class Interval | 2-4 | 4-6 | 6-8 | 8-10 | 10-12 | 12-14 | 14-16 | 16-18 | 18-20 |
|---|---|---|---|---|---|---|---|---|---|
| *f* | 1 | 5 | 11 | 14 | 16 | 13 | 14 | 60 | 6 |
| c*f* | 1 | 6 | 17 | 31 | 47 | 60 | 74 | 134 | 140 |

Correct table: 1 mark

Median = $14+\frac{70-60}{14}\times2$

= 15.4 — 1

Mode $= 16+\frac{60-14}{120-14-6}\times 2$

$= 16.92$ 1

## Section – D

**(Long Answer Type Questions)** **4 × 5 = 20**

Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each.

32. (a) The sum of ages of a father and his son is 45 years. Five years ago, the product of their ages (in years) was 124. Determine their ages respectively after five years.

**OR**

(b) Express the equation $\frac{1}{x-3}-\frac{1}{x+5}=\frac{1}{6}$; $(x \neq 3, -5)$ as a quadratic equation in standard form. Hence, solve the equation so formed.

Solution:(a) Let Son's present age be $x$ years and Father's present age be $(45-x)$ years 1

ATQ

$(x-5)(45-x-5) = 124$ 1

$x^2 - 45x + 324 = 0$ 1

$x = 9, 36$ (rejecting x = 36) 1

Son's age after 5 years = 14 and Father's age after 5 years = 41 1

**OR**

(b) $\frac{1}{x-3}-\frac{1}{x+5}=\frac{1}{6}$

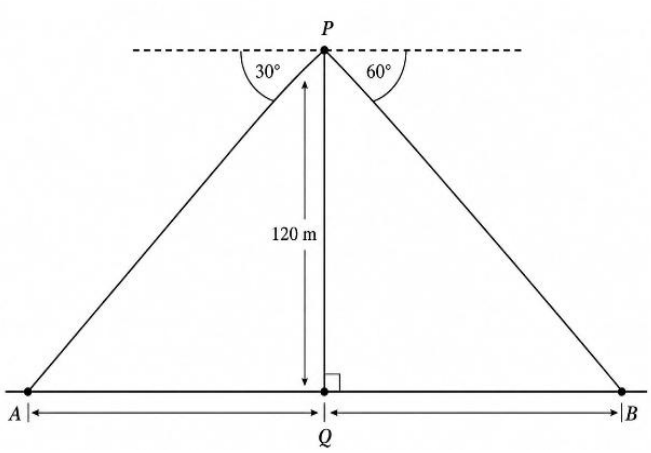
$x^2 + 2x - 63 = 0$ 2

$(x + 9)(x - 7) = 0$ 2

$x = -9, 7$ 1

33. A building is 120 m tall. From the top of the building, the angles of depression of two persons standing on opposite sides of the building are 30° and 60°. Calculate the distance between the two persons.

Solution:




Correct figure: 1 mark

Let PQ is the building and A and B be the positions of two persons such that $\angle PAQ = 30°$ and $\angle PBQ = 60°$

In $\Delta PAQ$ $\frac{AQ}{PQ} = \cot 30°$ — 1

$AQ = 120\sqrt{3}$ — ½

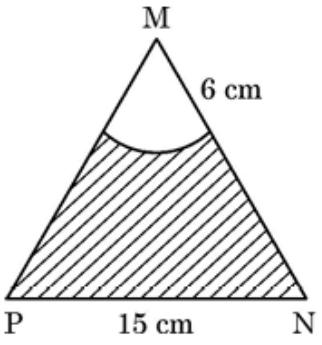
In $\Delta PBQ$ $\frac{QB}{PQ} = \cot 60°$ — 1

$QB = \frac{120}{\sqrt{3}} = 40\sqrt{3}$ — ½

Distance between A and B $= 120\sqrt{3} + 40\sqrt{3}$

$= 160\sqrt{3}$ m — 1

34. **Find the area of the shaded region in the given figure, where a circular arc of radius 6 cm has been drawn with vertex M of an equilateral triangle PMN of side 15 cm as centre. [Use $\sqrt{3} = 1.732$]**



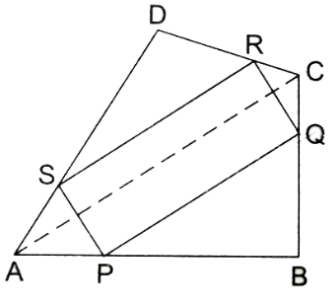
| | |
|---|---|
| Solution: Area of equilateral triangle $= \frac{\sqrt{3}}{4}\times 15\times 15$ | 1 |
| $= \frac{225\sqrt{3}}{4}\text{ cm}^2$ or 97.425 $\text{cm}^2$ | 1 |
| Area of sector $= \frac{1}{6}\times\frac{22}{7}\times 6\times 6$ | 1 |
| $= \frac{132}{7}\text{ cm}^2$ or 18.857 $\text{cm}^2$ | 1 |
| Area of the shaded Region = 97.425 – 18.857 = 78.568 $\text{cm}^2$ | 1 |

35. (a) **ABCD is a quadrilateral and P, Q, R and S are the points of trisection of sides AB, BC, CD and DA respectively such that these are adjacent to A and C. Prove that PQRS is a parallelogram.**

**OR**

(b) **In an isosceles ΔABC with AB = AC, points P and Q are on the sides AB and AC respectively such that AP = AQ. Show that the points B, C, Q, P are concyclic.**

Solution: (a)




Correct figure: 1 mark

Construction: Join AC.

Proof: In ΔABC, we have $\frac{AP}{PB} = \frac{CQ}{QB} = \frac{1}{2}$ — 1

∴ By converse of BPT

PQ || AC ……(1) — ½

Similarly, In ΔADC, we have $\frac{AS}{SD} = \frac{CR}{RD} = \frac{1}{2}$ — 1

∴ SR || AC ……(2)

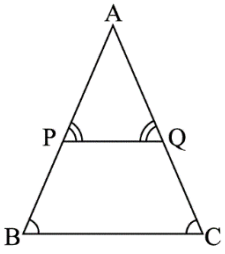
Thus, SR || PQ [ from 1 and 2] — ½

Similarly, SP || RQ — ½

Hence, PQRS is a parallelogram. — ½

**OR**

(b)




Correct Fig: 1

Since, AB = AC and AP = AQ

$\Rightarrow \angle B = \angle C = \alpha$ ½

Similarly, $\angle P = \angle Q = \beta$ ½

Also, $\frac{AP}{AB} = \frac{AQ}{AC}$ $\Rightarrow$ PQ||BC ( by converse of BPT) 1

$\angle APQ = \angle ABC$

$\therefore \alpha = \beta$ 1

$\angle QPB = 180 - \alpha$

$\therefore \angle QPB + \angle C = 180°$ 1

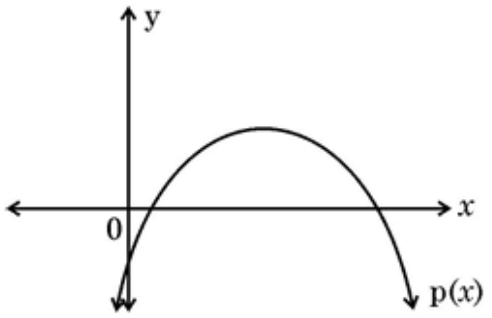
$\therefore$ B, C, Q and P is a concyclic.

## Section – E

**(Case-study based Questions)** **3 × 4 = 12**

This section has **3** case study based questions carrying **4** marks each.

36. A parabolic fountain in a park is designed such that its shape follows the polynomial $p(x) = -x^2 + 6x - 5$, where $p(x)$ is the height (in metres) above ground level at a horizontal distance $x$ metre from the origin.




Based on the above, answer the following questions :

(i) What are the zeroes of $p(x)$ ? **(1)**

(ii) What is the height of the fountain at a horizontal distance of 2 metres from origin ? **(1)**

(iii) (a) If $q(x)$ is a reflection of $p(x)$, that is $q(x) = -p(x)$, write its value as polynomial and draw its figure. **(2)**

**OR**

(b) At what horizontal distance from the origin does water hit the ground ? **(2)**

Solution: (i) $p(x) = -x^2 + 6x - 5$

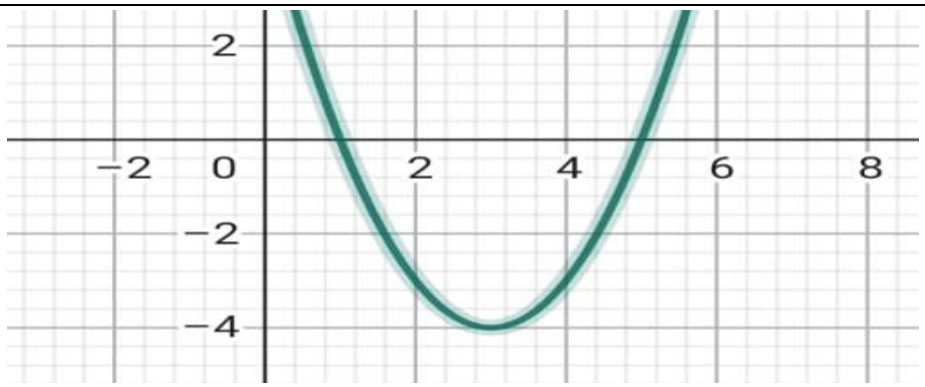
$= (x - 5)(x - 1)$

Zeroes of $p(x)$ are 5 & 1 — 1

(ii) $p(2) = -(2)^2 + 6(2) - 5$

$= 12 - 9 = 3$m — 1

(iii) (a)




1

Reflection of p($x$) is q($x$) = −p($x$)

$= x^2 - 6x + 5$

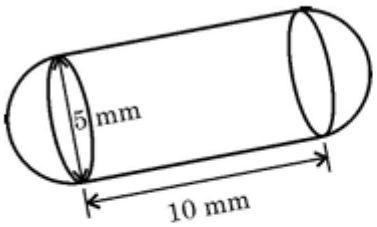
1

**OR**

(b) Water hits the ground when p($x$) = 0 at 1 metre or 5 metre away from origin water hits the ground.

2

37. A hospital stores medicine capsules shaped like cylinders with hemispherical ends. Each capsule has length of the cylindrical part of 10 mm and a diameter of 5 mm.




Based on the above, answer the following questions :

(i) Find the total surface area of one capsule. **(1)**

(ii) What is the capacity of the capsule ? **(1)**

(iii) (a) If the capsule is filled with medicine, which costs ₹ 0.05/mm$^3$, calculate the cost of medicine per capsule. **(2)**

**OR**

(b) How much extra medicine (in volume) can be stored in the capsule, if the capsule length is doubled ? **(2)**

Solution: (i) Surface Area = $2\pi rh + 4\pi r^2 = 2\pi r(h + 2r)$

$= 2 \times \frac{22}{7} \times \frac{5}{2}(10 + 5)$ ½

$= \frac{110}{7} \times 15 = \frac{1650}{7}\text{ mm}^2$ or 235.71 mm$^2$ ½

(ii) Capacity $= \pi r^2\left(h + \frac{4}{3}r\right)$

½

$$= \frac{22}{7} \times \frac{5}{2} \times \frac{5}{2}\left(10 + \frac{4}{3} \times \frac{5}{2}\right)$$ ½

$$= \frac{11000}{42} \text{ mm}^3 \text{ or } 261.9 \text{ mm}^3$$ 1

(iii) (a) Cost of medicine = 0.05 x 261.9 1

= ₹ 13.10

**OR**

(b) Extra medicine $= \left(\pi r^2 (2h) + \frac{4}{3}\pi r^3\right) - \frac{11000}{42}$

$= \left(\frac{275}{14} \text{ x } \frac{70}{3} + \frac{2750}{6}\right) - \frac{11000}{42}$ 1½

$= \frac{8250}{42} \text{ mm}^3$ or 196.43 $\text{mm}^3$. ½

38. A school conducted a lucky draw during its annual function. The draw box contained 100 chits, each with a unique number from 1 to 100. The distribution of the chits is as follows :

- 30 chits had red markings.
- 20 chits were having numbers which are multiples of 5.
- 15 chits had both red markings and numbers which are multiples of 5.
- The rest were plain having no marking and no number.

One chit is drawn at random from the box.

Based on the above, answer the following questions :

(i) What are the total number of outcomes ? **(1)**

(ii) What is the probability that the chit drawn has a red marking only ? **(1)**

(iii) (a) What is the probability that the chit has a multiple of 5 but no red marking ? **(2)**

**OR**

(b) What is the probability that the chit drawn is neither of red marking nor a multiple of 5 ? **(2)**

Solution: (i) Total number of outcomes = 100 1

(ii) Chits having Red marking only = 30 - 15 = 15 ½

P(Red marking only) $= \frac{15}{100} = \frac{3}{20}$ ½

(iii) (a) Chits which are multiple of 5 only = 20 – 15 = 5 1

P(Multiple of 5 but no red marking) $= \frac{5}{100} = \frac{1}{20}$ 1

**OR**

(b) Chits drawn is neither of red marking nor multiple of 5 = 100 - 35 = 65 1

P(neither of red marking nor a multiple of 5) $= \frac{65}{100} = \frac{13}{20}$ 1