Series WX1YZ/6

SET~1

प्रश्न–पत्र कोड
Q.P. Code **30/6/1**

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 (मानक) – सैद्धान्तिक

MATHEMATICS (Standard) – Theory

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

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न–पत्र में मुद्रित पृष्ठ **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 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 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.

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और पालन कीजिए :

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

(ii) *प्रश्नपत्र **पाँच** खण्डों में विभाजित हैं – खण्ड **क, ख, ग, घ** तथा **ङ**।*

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

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

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

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

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

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

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाएँ। यदि आवश्यक हो तो $\pi = \frac{22}{7}$ लें।*

(x) *कैल्कुलेटर का उपयोग वर्जित है।*

खण्ड – क

(बहुविकल्पीय प्रश्न)

खण्ड – क में 20 प्रश्न हैं और प्रत्येक प्रश्न का 1 अंक है।

1. यदि $p^2 = \frac{32}{50}$ है, तो p है एक

(A) पूर्ण संख्या (B) पूर्णांक

(C) परिमेय संख्या (D) अपरिमेय संख्या

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 – **Section A, B, C, D** and **E**.*

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

(iv) *In Section–**B** question number **21** to **25** are Very Short-Answer-I (SA-I) type questions of **2** marks each.*

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

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

(vii) *In Section–**E** question number **36** to **38** are Case Study / Passage based integrated units of assessment questions carrying **4** marks each. Internal choice is provided in **2** marks question in each case-study.*

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

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

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

SECTION – A
(Multiple Choice Questions)

Section – A consists of 20 questions of 1 mark each.

1. If $p^2 = \frac{32}{50}$, then p is a/an

(A) whole number (B) integer

(C) rational number (D) irrational number

2. बिंदु $(-6, 8)$ की x-अक्ष से दूरी है :

(A) 6 इकाई (B) – 6 इकाई

(C) 8 इकाई (D) 10 इकाई

3. द्विघात बहुपदों, जिनके शून्यक –5 और –3 हैं, की संख्या है :

(A) 1 (B) 2

(C) 3 (D) 3 से अधिक

4. $3x - y = 3$ से निरूपित रेखा और y-अक्ष के प्रतिच्छेदन बिन्दु के निर्देशांक हैं :

(A) $(0, -3)$ (B) $(0, 3)$

(C) $(2, 0)$ (D) $(-2, 0)$

5. दो वृत्तों की परिधियों का अनुपात 4 : 5 है । इनकी त्रिज्याओं का अनुपात क्या होगा ?

(A) 16 : 25 (B) 25 : 16

(C) $2 : \sqrt{5}$ (D) 4 : 5

6. यदि बहुपद $x^2 - 1$ के शून्यक α और β हैं, तो $(\alpha + \beta)$ का मान होगा :

(A) 2 (B) 1

(C) –1 (D) 0

7. $\frac{\cos^2\theta}{\sin^2\theta} - \frac{1}{\sin^2\theta}$ का सरलतम रूप है :

(A) $\tan^2\theta$ (B) $\sec^2\theta$

(C) 1 (D) –1

8. यदि $\Delta PQR \sim \Delta ABC$, PQ = 6 cm, AB = 8 cm और ΔABC का परिमाप 36 cm हो, तो ΔPQR का परिमाप होगा :

(A) 20.25 cm (B) 27 cm

(C) 48 cm (D) 64 cm

2. The distance of the point (– 6, 8) from x-axis is

(A) 6 units (B) – 6 units

(C) 8 units (D) 10 units

3. The number of quadratic polynomials having zeroes –5 and –3 is

(A) 1 (B) 2

(C) 3 (D) more than 3

4. The point of intersection of the line represented by $3x - y = 3$ and y-axis is given by

(A) (0, –3) (B) (0, 3)

(C) (2, 0) (D) (–2, 0)

5. The circumferences of two circles are in the ratio 4 : 5. What is the ratio of their radii ?

(A) 16 : 25 (B) 25 : 16

(C) $2 : \sqrt{5}$ (D) 4 : 5

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

(A) 2 (B) 1

(C) –1 (D) 0

7. $\frac{\cos^2\theta}{\sin^2\theta} - \frac{1}{\sin^2\theta}$, in simplified form, is :

(A) $\tan^2\theta$ (B) $\sec^2\theta$

(C) 1 (D) –1

8. If $\Delta PQR \sim \Delta ABC$; PQ = 6 cm, AB = 8 cm and the perimeter of ΔABC is 36 cm, then the perimeter of ΔPQR is

(A) 20.25 cm (B) 27 cm

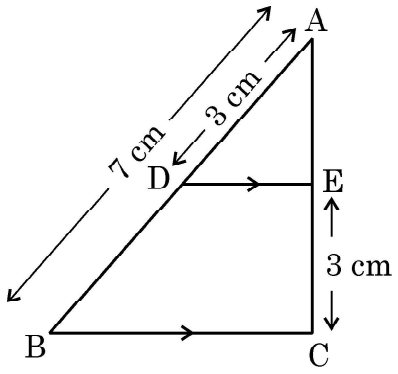
(C) 48 cm (D) 64 cm

9. यदि द्विघात समीकरण $ax^2 + bx + c = 0$ के दो वास्तविक और बराबर मूल हैं, तो 'c' होगा :

(A) $\frac{-b}{2a}$ (B) $\frac{b}{2a}$

(C) $\frac{-b^2}{4a}$ (D) $\frac{b^2}{4a}$

10. दी गई आकृति में, DE||BC है । यदि AD = 3 cm, AB = 7 cm और EC = 3 cm है, तो AE की लंबाई होगी :



(A) 2 cm (B) 2.25 cm

(C) 3.5 cm (D) 4 cm

11. एक थैले में 5 गुलाबी, 8 नीली और 7 पीली गेंदें हैं । इस थैले से एक गेंद यादृच्छया निकाली जाती है । इस निकाली गेंद के न गुलाबी और न ही नीली होने की प्रायिकता होगी :

(A) $\frac{1}{4}$ (B) $\frac{2}{5}$

(C) $\frac{7}{20}$ (D) $\frac{13}{20}$

12. एक लंब-वृत्तीय शंकु का आयतन होगा, जिसके आधार का क्षेत्रफल 156 cm^2 तथा ऊर्ध्वाधर ऊँचाई 8 cm है

(A) 2496 cm^3 (B) 1248 cm^3

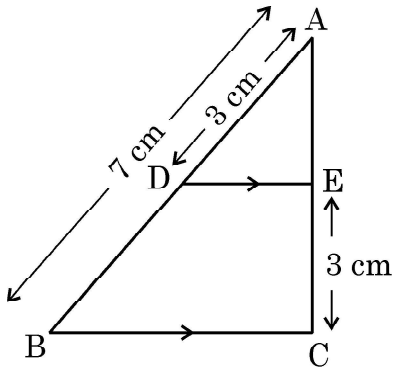
(C) 1664 cm^3 (D) 416 cm^3

9. If the quadratic equation $ax^2 + bx + c = 0$ has two real and equal roots, then 'c' is equal to

(A) $\frac{-b}{2a}$ (B) $\frac{b}{2a}$

(C) $\frac{-b^2}{4a}$ (D) $\frac{b^2}{4a}$

10. In the given figure, DE||BC. If AD = 3 cm, AB = 7 cm and EC = 3 cm, then the length of AE is



(A) 2 cm (B) 2.25 cm

(C) 3.5 cm (D) 4 cm

11. A bag contains 5 pink, 8 blue and 7 yellow balls. One ball is drawn at random from the bag. What is the probability of getting neither a blue nor a pink ball ?

(A) $\frac{1}{4}$ (B) $\frac{2}{5}$

(C) $\frac{7}{20}$ (D) $\frac{13}{20}$

12. The volume of a right circular cone whose area of the base is 156 cm^2 and the vertical height is 8 cm, is

(A) 2496 cm^3 (B) 1248 cm^3

(C) 1664 cm^3 (D) 416 cm^3

13. 3 कुर्सियों और 1 मेज का मूल्य ₹ 900, जबकि 5 कुर्सियों और 3 मेजों का मूल्य ₹ 2,100 है । यदि 1 कुर्सी का मूल्य ₹ x और 1 मेज का मूल्य ₹ y है, तो इस स्थिति का बीजगणितीय रूप है :

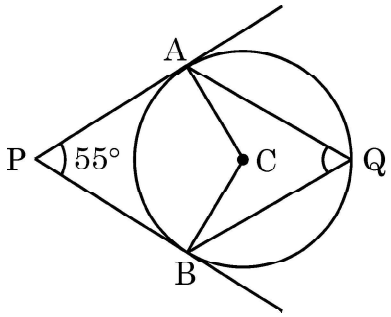
(A) $3x + y = 900,\ 3x + 5y = 2100$

(B) $x + 3y = 900,\ 3x + 5y = 2100$

(C) $3x + y = 900,\ 5x + 3y = 2100$

(D) $x + 3y = 900,\ 5x + 3y = 2100$

14. दी गई आकृति में, केंद्र C वाले वृत्त पर बाह्य बिंदु P से PA और PB स्पर्श रेखाएँ खींची गई हैं । वृत्त पर Q एक अन्य बिंदु है । $\angle AQB$ का माप है :



(A) $62\frac{1}{2}°$ (B) $125°$

(C) $55°$ (D) $90°$

15. 52 ताश के पत्तों की अच्छी प्रकार से फेंटी गई गड्डी से एक पत्ता यादृच्छया निकाला जाता है । इस पत्ते का फेस (face) का पत्ता होने की प्रायिकता है

(A) $\frac{1}{2}$ (B) $\frac{3}{13}$

(C) $\frac{4}{13}$ (D) $\frac{1}{13}$

16. यदि एक समकोण त्रिभुज में θ एक न्यून कोण हो, तो निम्न में कौन सा समीकरण सही **नहीं** है ?

(A) $\sin\theta \cot\theta = \cos\theta$ (B) $\cos\theta \tan\theta = \sin\theta$

(C) $\text{cosec}^2\theta - \cot^2\theta = 1$ (D) $\tan^2\theta - \sec^2\theta = 1$

17. यदि द्विघात बहुपद $x^2 + (a + 1)x + b$ के शून्यक 2 और –3 हैं, तो

(A) $a = -7, b = -1$ (B) $a = 5, b = -1$

(C) $a = 2, b = -6$ (D) $a = 0, b = -6$

13. 3 chairs and 1 table cost ₹ 900; whereas 5 chairs and 3 tables cost ₹ 2,100. If the cost of 1 chair is ₹ x and the cost of 1 table is ₹ y, then the situation can be represented algebraically as

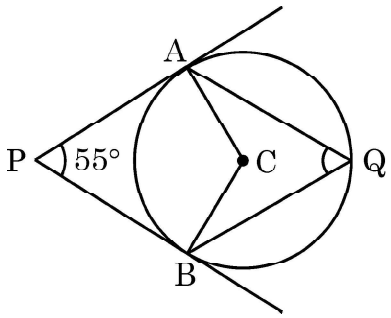
(A) $3x + y = 900,\ 3x + 5y = 2100$

(B) $x + 3y = 900,\ 3x + 5y = 2100$

(C) $3x + y = 900,\ 5x + 3y = 2100$

(D) $x + 3y = 900,\ 5x + 3y = 2100$

14. In the given figure, PA and PB are tangents from external point P to a circle with centre C and Q is any point on the circle. Then the measure of $\angle AQB$ is



(A) 62½°

(B) 125°

(C) 55°

(D) 90°

15. A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of getting a face card is

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

(B) $\frac{3}{13}$

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

(D) $\frac{1}{13}$

16. If θ is an acute angle of a right angled triangle, then which of the following equation is **not** true ?

(A) $\sin\theta \cot\theta = \cos\theta$

(B) $\cos\theta \tan\theta = \sin\theta$

(C) $\text{cosec}^2\theta - \cot^2\theta = 1$

(D) $\tan^2\theta - \sec^2\theta = 1$

17. If the zeroes of the quadratic polynomial $x^2 + (a + 1)x + b$ are 2 and –3, then

(A) $a = -7, b = -1$

(B) $a = 5, b = -1$

(C) $a = 2, b = -6$

(D) $a = 0, b = -6$

18. यदि किसी एक A.P. के पहले n पदों का योग $3n^2 + n$ और उसका सार्व अन्तर 6 हो, तो पहला पद होगा :

(A) 2 (B) 3

(C) 1 (D) 4

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

(A) (A) तथा (R) दोनों सत्य हैं तथा (R), कथन (A) की व्याख्या करता है ।

(B) (A) तथा (R) दोनों सत्य हैं, परन्तु (R) कथन (A) की व्याख्या नहीं करता ।

(C) (A) सत्य है, परन्तु (R) सत्य नहीं है ।

(D) (A) असत्य है, जबकि (R) सत्य है ।

19. **अभिकथन (A) :** यदि $5 + \sqrt{7}$, परिमेय गुणांक वाले द्विघात समीकरण का एक मूल है, तो इसका दूसरा मूल $5 - \sqrt{7}$ होगा ।

तर्क (R) : परिमेय गुणांकों वाले द्विघात समीकरण के करणी मूल संयुग्मी युग्मों में होते हैं ।

20. **अभिकथन (A) :** $0 < \theta \leq 90°$ के लिए, $\text{cosec}\ \theta - \cot\ \theta$ और $\text{cosec}\ \theta + \cot\ \theta$ एक दूसरे के व्युत्क्रम हैं ।

तर्क (R) : $\text{cosec}^2\ \theta - \cot^2\ \theta = 1$

खण्ड – ख

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

21. (A) दर्शाइए कि किसी भी प्राकृत संख्या 'n' के लिए, संख्या 6^n, अंक 0 पर समाप्त नहीं होती है ।

अथवा

(B) 72 और 120 का HCF और LCM ज्ञात कीजिए ।

22. एक रेखा, y-अक्ष और x-अक्ष को क्रमशः बिंदु P और बिंदु Q पर काटती है । यदि R(2, 5), रेखाखंड PQ का मध्य बिंदु है, तो P और Q के निर्देशांक ज्ञात कीजिए ।

18. If the sum of the first n terms of an A.P be $3n^2 + n$ and its common difference is 6, then its first term is

(A) 2 (B) 3

(C) 1 (D) 4

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

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

(B) Both Assertion (A) and Reason (R) are true; but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true but Reason (R) is false.

(D) Assertion (A) is false but Reason (R) is true.

19. **Statement A (Assertion) :** If $5 + \sqrt{7}$ is a root of a quadratic equation with rational co-efficients, then its other root is $5 - \sqrt{7}$.

Statement R (Reason) : Surd roots of a quadratic equation with rational co-efficients occur in conjugate pairs.

20. **Statement A (Assertion) :** For $0 < \theta \leq 90°$, cosec θ – cot θ and cosec θ + cot θ are reciprocal of each other.

Statement R (Reason) : $\text{cosec}^2 \theta - \cot^2 \theta = 1$

SECTION – B

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

21. (A) Show that 6^n can not end with digit 0 for any natural number 'n'.

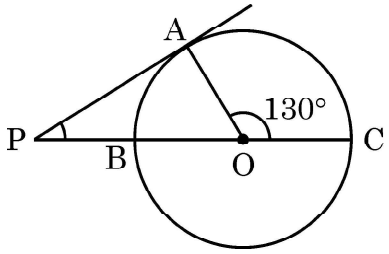
OR

(B) Find the HCF and LCM of 72 and 120.

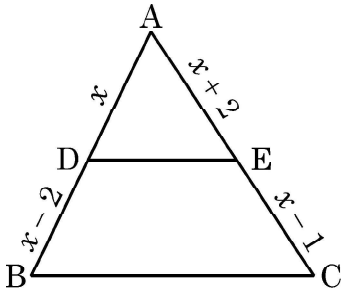
22. A line intersects y-axis and *x*-axis at point P and Q, respectively. If R(2, 5) is the mid-point of line segment PQ, then find the coordinates of P and Q.

23. 18 m ऊँचाई वाले खंभे की भूमि पर छाया की लंबाई ज्ञात करें जब सूर्य का उन्नयन कोण θ ऐसा है कि $\tan\theta = \frac{6}{7}$ है ।

24. दी गई आकृति में, PA बाहरी बिंदु P से खींचे गए वृत्त की स्पर्श रेखा है और BC व्यास के साथ वृत्त की छेदक रेखा PBC है । यदि $\angle AOC = 130°$ है, तो $\angle APB$ की माप ज्ञात कीजिए, जहाँ O वृत्त का केंद्र है ।

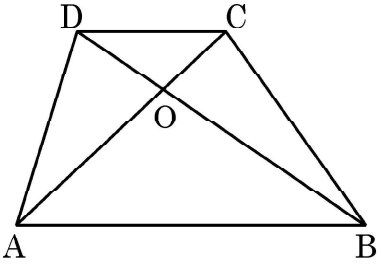


25. (A) दी गई आकृति में, ABC एक त्रिभुज है जिसमें DE||BC । यदि AD = x, DB = $x - 2$, AE = $x + 2$ और EC = $x - 1$ है, तो x का मान ज्ञात कीजिए ।



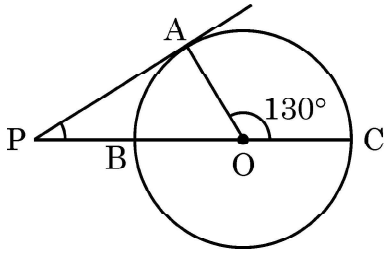
अथवा

(B) समलंब ABCD, जिसमें AB||DC है, के विकर्ण AC और BD एक दूसरे को बिंदु O पर प्रतिच्छेद करते हैं । दर्शाइए कि $\frac{OA}{OC} = \frac{OB}{OD}$ ·

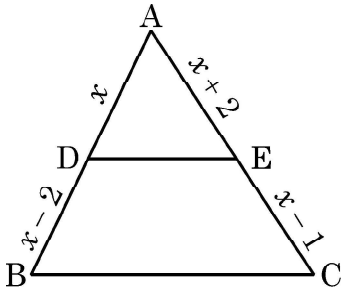


23. Find the length of the shadow on the ground of a pole of height 18 m when angle of elevation θ of the sun is such that $\tan\theta = \frac{6}{7}$.

24. In the given figure, PA is a tangent to the circle drawn from the external point P and PBC is the secant to the circle with BC as diameter.
If $\angle AOC = 130°$, then find the measure of $\angle APB$, where O is the centre of the circle.

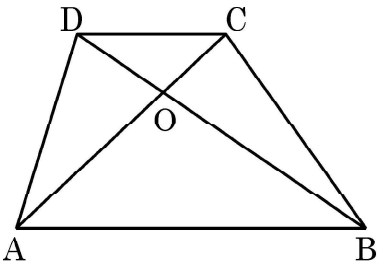


25. (A) In the given figure, ABC is a triangle in which DE||BC. If AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then find the value of x.



OR

(B) Diagonals AC and BD of trapezium ABCD with AB||DC intersect each other at point O. Show that $\frac{OA}{OC} = \frac{OB}{OD}$.



खण्ड – ग

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

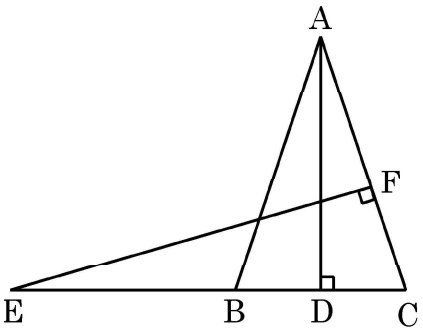
26. वह अनुपात ज्ञात कीजिए जिसमें बिंदुओं A(6, 3) और B(–2, –5) को मिलाने वाला रेखाखंड, x-अक्ष से विभाजित होता है ।

27. (A) अभाज्य गुणनखंड विधि का प्रयोग करके, 26, 65 और 117 का HCF और LCM ज्ञात कीजिए ।

अथवा

(B) सिद्ध कीजिए कि $\sqrt{2}$ एक अपरिमेय संख्या है ।

28. दी गई आकृति में, AB = AC वाले, एक समद्विबाहु त्रिभुज ABC की बढ़ाई गई भुजा CB पर स्थित E एक बिंदु है । यदि AD $\perp$ BC और EF $\perp$ AC है, तो सिद्ध कीजिए कि $\Delta ABD \sim \Delta ECF$ है ।



29. (A) दो संख्याओं का योगफल 15 है । यदि इनके व्युतक्रमों का योगफल $\frac{3}{10}$ है, तो इन संख्याओं को ज्ञात कीजिए ।

अथवा

(B) यदि α और β, द्विघात समीकरण $x^2 - 7x + 10 = 0$ के मूल हैं, तो एक द्विघात समीकरण ज्ञात कीजिए जिसके मूल α^2 और β^2 हों ।

30. सिद्ध कीजिए कि $\frac{1 + \sec A}{\sec A} = \frac{\sin^2 A}{1 - \cos A}$.

31. 21 cm त्रिज्या के एक वृत्त की एक चाप, केंद्र पर $60°$ का कोण अंतरित करती है । चाप द्वारा बनाए गए त्रिज्य खण्ड का क्षेत्रफल ज्ञात कीजिए । इस चाप की लंबाई भी ज्ञात कीजिए ।

SECTION – C

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

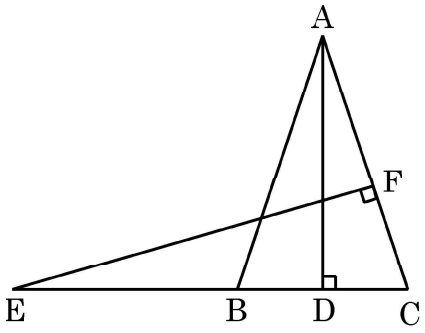
26. Find the ratio in which the line segment joining the points A(6, 3) and B(–2, –5) is divided by x-axis.

27. (A) Find the HCF and LCM of 26, 65 and 117, using prime factorisation.

OR

(B) Prove that $\sqrt{2}$ is an irrational number.

28. In the given figure, E is a point on the side CB produced of an isosceles triangle ABC with AB = AC. If AD $\perp$ BC and EF $\perp$ AC, then prove that $\Delta ABD \sim \Delta ECF$.



29. (A) The sum of two numbers is 15. If the sum of their reciprocals is $\frac{3}{10}$, find the two numbers.

OR

(B) If α and β are roots of the quadratic equation $x^2 - 7x + 10 = 0$, find the quadratic equation whose roots are α^2 and β^2.

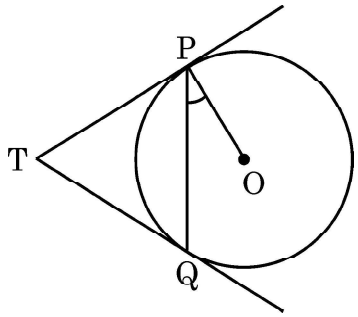
30. Prove that $\frac{1 + \sec A}{\sec A} = \frac{\sin^2 A}{1 - \cos A}$.

31. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the area of the sector formed by the arc. Also, find the length of the arc.

खण्ड – घ

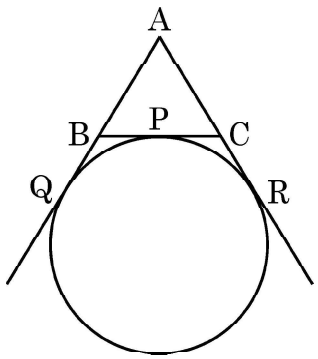
इस खण्ड में दीर्घ–उत्तरीय (LA) प्रकार के प्रश्न हैं । प्रत्येक प्रश्न के **5** अंक हैं ।

32. (A) केंद्र O वाले वृत्त पर बाह्य बिंदु T से दो स्पर्श रेखाएँ TP तथा TQ खींची गई हैं । सिद्ध कीजिए कि $\angle PTQ = 2\ \angle OPQ$ है ।



अथवा

(B) एक वृत्त, त्रिभुज ABC की भुजा BC को एक बिंदु P पर स्पर्श करता है और क्रमशः Q और R पर उत्पन्न AB और AC को स्पर्श करता है । दर्शाइए कि $AQ = \frac{1}{2}$ (ΔABC का परिमाप)



33. एक ठोस, एक लंब–वृत्तीय शंकु के आकार है, जो उसी त्रिज्या वाले एक अर्धगोले पर अध्यारोपित है । प्रत्येक की त्रिज्या 7 cm और शंकु की ऊँचाई, इसके व्यास के बराबर है । ठोस का आयतन ज्ञात कीजिए ।

34. (A) एक A.P. में, 11वें पद का अनुपात 18वें पद से 2 : 3 है । 5वें पद का अनुपात 21वें पद से ज्ञात कीजिए । इस A.P. के पहले 5 पदों के योग का अनुपात इसके 21 पदों के योग से भी ज्ञात कीजिए ।

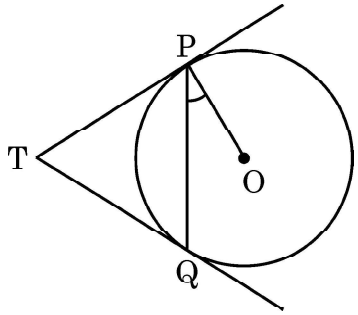
अथवा

(B) यदि किसी A.P. के प्रथम 6 पदों का योग 36 है और प्रथम 16 पदों का योग 256 है, तो प्रथम 10 पदों का योग ज्ञात कीजिए ।

SECTION – D

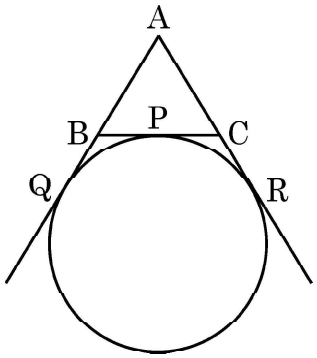
Section – D consists of Long Answer (LA) type questions of **5** marks each.

32. (A) Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\ \angle OPQ$.



OR

(B) A circle touches the side BC of a ΔABC at a point P and touches AB and AC when produced at Q and R respectively. Show that $AQ = \frac{1}{2}$ (Perimeter of ΔABC).



33. A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.

34. (A) The ratio of the 11^{th} term to the 18^{th} term of an A.P. is 2 : 3. Find the ratio of the 5^{th} term to the 21^{st} term. Also, find the ratio of the sum of first 5 terms to the sum of first 21 terms.

OR

(B) If the sum of first 6 terms of an A.P. is 36 and that of the first 16 terms is 256, find the sum of first 10 terms.

35. एक बॉक्स में रखे 250 सेबों को तोला गया । इन सेबों के भारों का बंटन नीचे दी गई तालिका में दिया गया है :

भार (ग्रा. में)	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
सेबों की संख्या	20	60	70	x	60

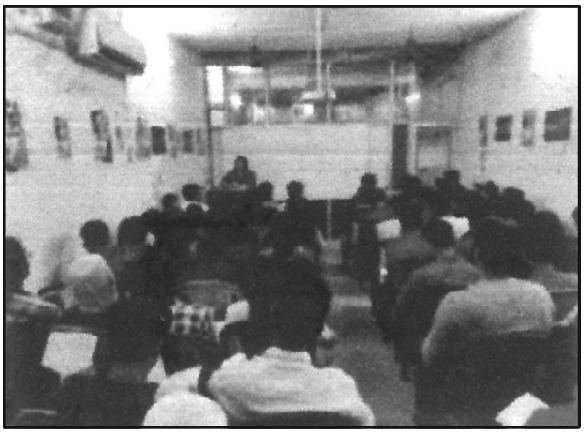
(i) x का मान ज्ञात कीजिए और सेबों के भारों का माध्य ज्ञात कीजिए । **3**

(ii) सेबों का बहुलक भार भी ज्ञात कीजिए । **2**

खण्ड – ङ

इस खण्ड में **3** स्रोत/प्रकरण इकाई आधारित प्रश्न हैं । प्रत्येक प्रश्न के **4** अंक हैं ।

36. गणित का एक कोचिंग संस्थान दो बैचों I और II में कक्षाएँ संचालित करता है और अमीर और गरीब बच्चों की फीस अलग-अलग होती है । बैच I में 20 गरीब और 5 अमीर बच्चे हैं, जबकि बैच II में 5 गरीब और 25 अमीर बच्चे हैं । बैच I से फीस का कुल मासिक संग्रह ₹ 9000 है और बैच II से ₹ 26,000 है । मान लीजिए कि प्रत्येक गरीब बच्चा ₹ x प्रति माह का भुगतान करता है और प्रत्येक अमीर बच्चा ₹ y प्रति माह का भुगतान करता है ।



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

(i) उपरोक्त सूचना को x और y में व्यक्त कीजिए । **1**

(ii) प्रत्येक गरीब बच्चे द्वारा प्रति माह भुगतान करने वाली फीस ज्ञात कीजिए । **2**

अथवा

एक गरीब और एक अमीर बच्चे की प्रति माह की फीस का अन्तर ज्ञात कीजिए ।

(iii) यदि बैच II में, 10 गरीब और 20 अमीर बच्चे हों, तो इस बैच से प्रति माह कितनी फीस राशि प्राप्त होगी ? **1**

35. 250 apples of a box were weighed and the distribution of masses of the apples is given in the following table :

Mass (in grams)	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
Number of apples	20	60	70	x	60

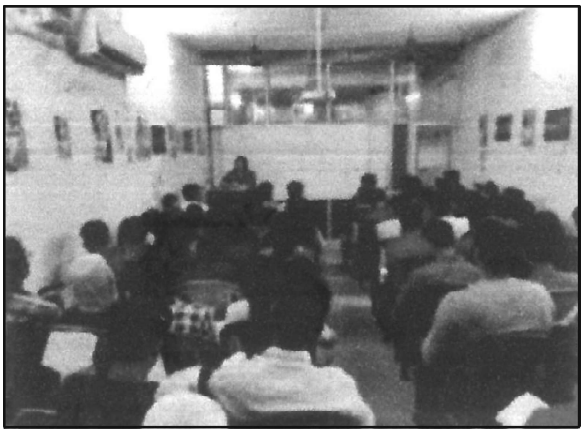
(i) Find the value of x and the mean mass of the apples. **3**

(ii) Find the modal mass of the apples. **2**

SECTION – E

3 Case Study Based Questions. Each question is of **4** marks.

36. A coaching institute of Mathematics conducts classes in two batches I and II and fees for rich and poor children are different. In batch I, there are 20 poor and 5 rich children, whereas in batch II, there are 5 poor and 25 rich children. The total monthly collection of fees from batch I is ₹ 9000 and from batch II is ₹ 26,000. Assume that each poor child pays ₹ x per month and each rich child pays ₹ y per month.



Based on the above information, answer the following questions :

(i) Represent the information given above in terms of x and y. **1**

(ii) Find the monthly fee paid by a poor child. **2**

OR

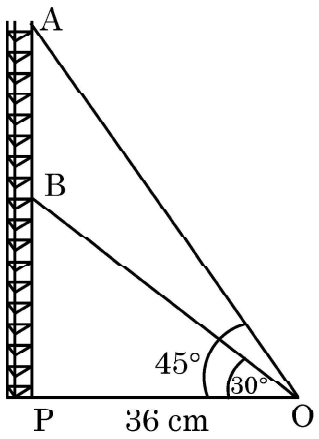
Find the difference in the monthly fee paid by a poor child and a rich child.

(iii) If there are 10 poor and 20 rich children in batch II, what is the total monthly collection of fees from batch II ? **1**

37. रेडियो टॉवरों का उपयोग रेडियो और टेलीविज़न सहित संचार सेवाओं की एक शृंखला को प्रसारित करने के लिए किया जाता है । टॉवर या तो स्वयं एंटीना के रूप में कार्य करेगा या इसकी संरचना पर एक या अधिक एंटेना का समर्थन करेगा ।

इसी तरह की अवधारणा पर, दो खंडों A और B में एक रेडियो स्टेशन टॉवर बनाया गया था । टॉवर एक बिंदु O से तारों द्वारा समर्थित है ।

टॉवर के पाद और बिंदु O के बीच की दूरी 36 cm है । बिंदु O से खंड B के शिखर का उन्नयन कोण $30°$ तथा खंड A के शिखर का उन्नयन कोण $45°$ है ।



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

(i) बिंदु O से खंड B के शिखर तक लगी तार की लम्बाई ज्ञात कीजिए । **1**

(ii) AB की दूरी ज्ञात कीजिए । **2**

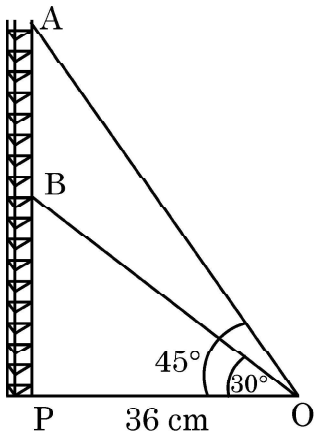
अथवा

ΔOPB का क्षेत्रफल ज्ञात कीजिए ।

(iii) टॉवर के पाद से खंड A की ऊँचाई ज्ञात कीजिए । **1**

37. Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two Sections A and B. Tower is supported by wires from a point O.

Distance between the base of the tower and point O is 36 cm. From point O, the angle of elevation of the top of the Section B is 30° and the angle of elevation of the top of Section A is 45°.



Based on the above information, answer the following questions :

(i) Find the length of the wire from the point O to the top of Section B. **1**

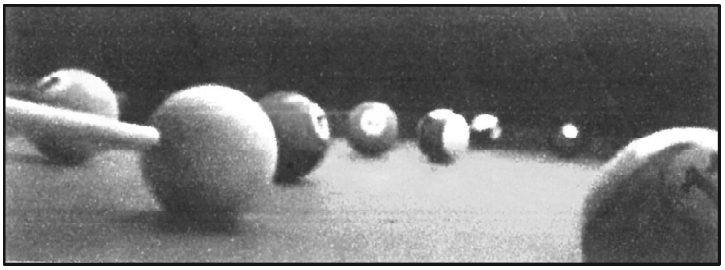
(ii) Find the distance AB. **2**

OR

Find the area of ΔOPB.

(iii) Find the height of the Section A from the base of the tower. **1**

38. "आठ गेंद" एक पूल टेबल पर खेला जाने वाला खेल है, जिसमें संख्या 1 से 15 तक लिखी 15 गेंदें और एक "क्यू गेंद" होती है, जो ठोस सफेद होती है । संख्या 1 से 15 तक लिखी 15 गेंदों में से, 8 ठोस (गैर–सफेद) रंग की हैं जिन पर संख्या 1 से 8 लिखी है और 7 धारीदार गेंदें हैं, जिन पर संख्या 9 से 15 लिखी है ।



संख्या 1 से 15 लिखी पूल बॉलों (नो क्यू बॉल) को एक बड़े कटोरे में डालकर मिला दिया जाता है, और बाद में एक गेंद यादृच्छया निकाली जाती है ।

उपरोक्त सूचना पर आधारित होकर, निम्न प्रश्नों के उत्तर दीजिए :

(i) संख्या 8 लिखी गेंद होने की प्रायिकता क्या है ?

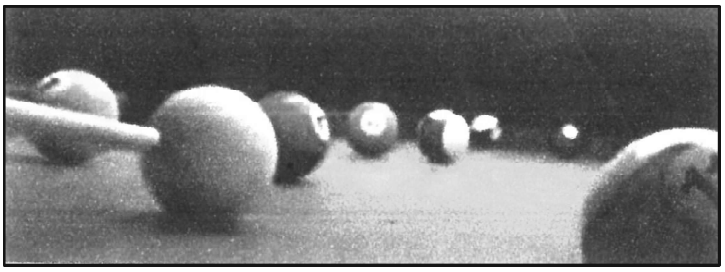
(ii) निकाली गई गेंद पर एक सम संख्या लिखी होने की प्रायिकता क्या है ?

अथवा

निकाली गई गेंद पर '3 का गुणन' संख्या लिखी होने की प्रायिकता क्या है ?

(iii) निकाली गई गेंद एक ठोस रंगीन और सम संख्या लिखी होने की प्रायिकता क्या है ?

38. "Eight Ball" is a game played on a pool table with 15 balls numbered 1 to 15 and a "cue ball" that is solid and white. Of the 15 numbered balls, eight are solid (non-white) coloured and numbered 1 to 8 and seven are striped balls numbered 9 to 15.



The 15 numbered pool balls (no cue ball) are placed in a large bowl and mixed, then one ball is drawn out at random.

Based on the above information, answer the following questions :

(i) What is the probability that the drawn ball bears number 8 ?

(ii) What is the probability that the drawn ball bears an even number ?

OR

What is the probability that the drawn ball bears a number, which is a multiple of 3 ?

(iii) What is the probability that the drawn ball is a solid coloured and bears an even number ?

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
MATHEMATICS PAPER CODE 30/6/1

General Instructions: -

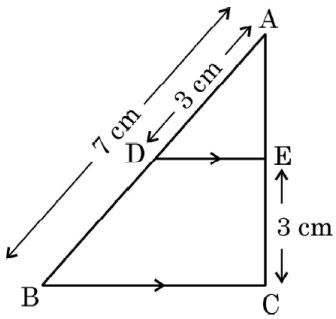
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (√) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right **(✓)** while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

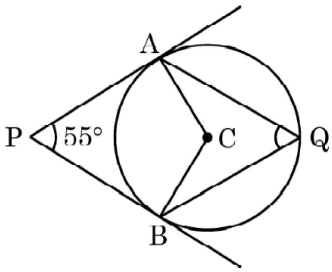
9	**In Q1-Q20, if a candidate attempts the question more than once (without canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/6/1)

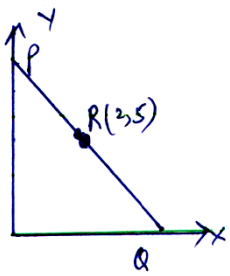
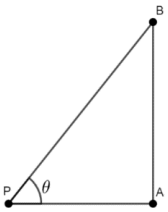
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each	
1.	If $p^2 = \frac{32}{50}$, then p is a/an (A) whole number (B) integer (C) rational number (D) irrational number	
Sol.	(C) rational	1
2.	The distance of the point $(-6, 8)$ from x-axis is (A) 6 units (B) -6 units (C) 8 units (D) 10 units	
Sol.	(C)8 units	1
3.	The number of quadratic polynomials having zeroes -5 and -3 is (A) 1 (B) 2 (C) 3 (D) more than 3	
Sol.	(D)more than 3	1
4.	The point of intersection of the line represented by $3x - y = 3$ and y-axis is given by (A) $(0, -3)$ (B) $(0, 3)$ (C) $(2, 0)$ (D) $(-2, 0)$	
Sol.	(A) $(0, -3)$	1

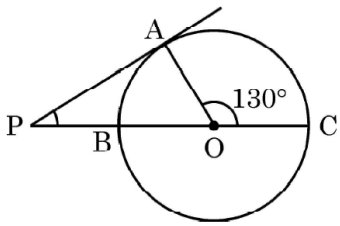
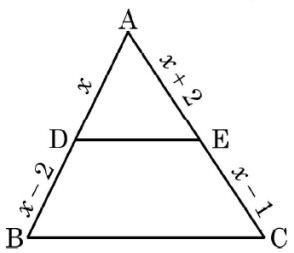
5.	The circumferences of two circles are in the ratio 4 : 5. What is the ratio of their radii ? (A) 16 : 25 (B) 25 : 16 (C) $2:\sqrt{5}$ (D) 4 : 5	
Sol.	(D) 4 : 5	1
6.	If α and β are the zeroes of the polynomial $x^2 - 1$, then the value of $(\alpha + \beta)$ is (A) 2 (B) 1 (C) –1 (D) 0	
Sol.	(D) 0	1
7.	$\frac{\cos^2\theta}{\sin^2\theta} - \frac{1}{\sin^2\theta}$, in simplified form, is : (A) $\tan^2\theta$ (B) $\sec^2\theta$ (C) 1 (D) –1	
Sol.	(D) – 1	1
8.	If $\Delta PQR \sim \Delta ABC$; PQ = 6 cm, AB = 8 cm and the perimeter of ΔABC is 36 cm, then the perimeter of ΔPQR is (A) 20.25 cm (B) 27 cm (C) 48 cm (D) 64 cm	
Sol.	(B) 27 cm	1
9.	If the quadratic equation $ax^2 + bx + c = 0$ has two real and equal roots, then 'c' is equal to (A) $\frac{-b}{2a}$ (B) $\frac{b}{2a}$ (C) $\frac{-b^2}{4a}$ (D) $\frac{b^2}{4a}$	
Sol.	(D) $\frac{b^2}{4a}$	1

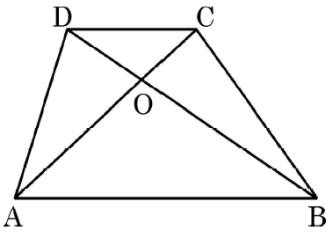
10.	In the given figure, DE‖BC. If AD = 3 cm, AB = 7 cm and EC = 3 cm, then the length of AE is  (A) 2 cm (B) 2.25 cm (C) 3.5 cm (D) 4 cm	
Sol.	(B) 2·25 cm	1
11.	A bag contains 5 pink, 8 blue and 7 yellow balls. One ball is drawn at random from the bag. What is the probability of getting neither a blue nor a pink ball ? (A) $\frac{1}{4}$ (B) $\frac{2}{5}$ (C) $\frac{7}{20}$ (D) $\frac{13}{20}$	
Sol.	(C) $\frac{7}{20}$	1
12.	The volume of a right circular cone whose area of the base is 156 cm^2 and the vertical height is 8 cm, is (A) 2496 cm^3 (B) 1248 cm^3 (C) 1664 cm^3 (D) 416 cm^3	
Sol.	(D) 416 cm^3	1
13.	3 chairs and 1 table cost ₹ 900; whereas 5 chairs and 3 tables cost ₹ 2,100. If the cost of 1 chair is ₹ x and the cost of 1 table is ₹ y, then the situation can be represented algebraically as (A) $3x + y = 900,\ 3x + 5y = 2100$ (B) $x + 3y = 900,\ 3x + 5y = 2100$ (C) $3x + y = 900,\ 5x + 3y = 2100$ (D) $x + 3y = 900,\ 5x + 3y = 2100$	
Sol.	(C) $3x + y = 900, 5x + 3y = 2100$	1

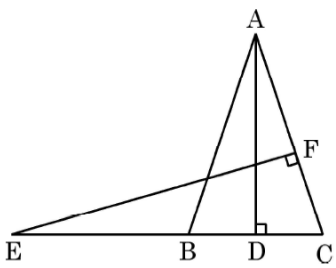
14.	In the given figure, PA and PB are tangents from external point P to a circle with centre C and Q is any point on the circle. Then the measure of ∠AQB is  (A) 62½° (B) 125° (C) 55° (D) 90°	
Sol.	(A) $62\frac{1}{2}^{\circ}$	1
15.	A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of getting a face card is (A) $\frac{1}{2}$ (B) $\frac{3}{13}$ (C) $\frac{4}{13}$ (D) $\frac{1}{13}$	
Sol.	(B) $\frac{3}{13}$	1
16.	If θ is an acute angle of a right angled triangle, then which of the following equation is **not** true ? (A) $\sin\theta \cot\theta = \cos\theta$ (B) $\cos\theta \tan\theta = \sin\theta$ (C) $\text{cosec}^2\theta - \cot^2\theta = 1$ (D) $\tan^2\theta - \sec^2\theta = 1$	
Sol.	(D) $\tan^2\theta - \sec^2\theta = 1$	1
17.	If the zeroes of the quadratic polynomial $x^2 + (a + 1)x + b$ are 2 and –3, then (A) $a = -7, b = -1$ (B) $a = 5, b = -1$ (C) $a = 2, b = -6$ (D) $a = 0, b = -6$	
Sol.	(D) $a = 0, b = -6$	1
18.	If the sum of the first n terms of an A.P be $3n^2 + n$ and its common difference is 6, then its first term is (A) 2 (B) 3 (C) 1 (D) 4	
Sol.	(D) 4	1

	Assertion – Reason Based Questions : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option out of the following : (A) Both Assertion (A) and Reason (R) are true; and Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true; but Reason (R) is not the correct explanation of Assertion (A). (C) Assertion (A) is true but Reason (R) is false. (D) Assertion (A) is false but Reason (R) is true.	
19.	**Statement A (Assertion) :** If $5+\sqrt{7}$ is a root of a quadratic equation with rational co-efficients, then its other root is $5-\sqrt{7}$. **Statement R (Reason) :** Surd roots of a quadratic equation with rational co-efficients occur in conjugate pairs.	
Sol.	(A)	1
20.	**Statement A (Assertion) :** For $0 < \theta \leq 90°$, cosec θ – cot θ and cosec θ + cot θ are reciprocal of each other. **Statement R (Reason) :** $\text{cosec}^2\theta - \cot^2\theta = 1$	
Sol.	(A)	1
	SECTION – B Section – **B** consists of Very Short Answer (VSA) type of questions of **2** marks each.	
21(A).	(A) Show that 6^n can not end with digit 0 for any natural number 'n'.	
Sol.	If 6^n ends with digit 0, it would be divisible by 5. So, prime factorization of 6^n would contain 5. But $6^n = (2 \times 3)^n$, the only prime factorization of 6^n are 2 and 3 as per fundamental theorem of Arithmetic . There is no other prime in the factorization of 6^n. So, there is no natural number n for which 6^n ends with digit zero.	2
	OR	
21(B)	Find the HCF and LCM of 72 and 120.	

Sol.	$72=2^3 \times 3^2$ $120=2^3 \times 3 \times 5$ HCF = 24 LCM=360	 1 1
22.	A line intersects y-axis and x-axis at point P and Q, respectively. If R(2, 5) is the mid-point of line segment PQ, then find the coordinates of P and Q.	
Sol.	 Let the coordinates of P and Q be (0, y) and (x, 0) respectively. $\because$ R(2, 5) is the midpoint of PQ $\frac{0+x}{2} = 2$ and $\frac{y+0}{2} = 5$ $\therefore$ x = 4, y = 10 P(0, 10) and Q(4, 0)	$\frac{1}{2}$ $\frac{1}{2}+\frac{1}{2}$ $\frac{1}{2}$
23.	Find the length of the shadow on the ground of a pole of height 18 m when angle of elevation θ of the sun is such that $\tan\theta = \frac{6}{7}$.	
Sol.	 Pole of height AB = 18 m AP = length of shadow In Δ APB, $\tan\theta = \frac{18}{AP}$ $\frac{6}{7} = \frac{18}{AP}$ $\Rightarrow$ AP = 21 m	 1 $\frac{1}{2}$ $\frac{1}{2}$

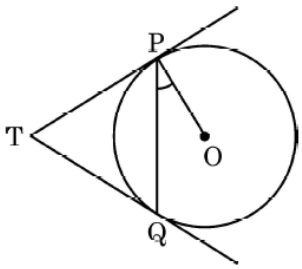
24.	In the given figure, PA is a tangent to the circle drawn from the external point P and PBC is the secant to the circle with BC as diameter. If $\angle AOC = 130°$, then find the measure of $\angle APB$, where O is the centre of the circle.  	
Sol.	$\angle AOB = 180° - 130° = 50°$ $\angle OAP = 90°$ $\therefore \angle APB = 180 - (50° + 90°) = 40°$	$\frac{1}{2}$ $\frac{1}{2}$ 1
25(A).	In the given figure, ABC is a triangle in which DE‖BC. If AD = x, DB = $x-2$, AE = $x+2$ and EC = $x-1$, then find the value of x.  	
Sol.	In ΔABC, $DE \parallel BC$ $\therefore \frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{x}{x-2} = \frac{x+2}{x-1}$ $x(x-1) = (x+2)(x-2)$ $x^2 - x = x^2 - 4 \Rightarrow x = 4$	1 1
	OR	

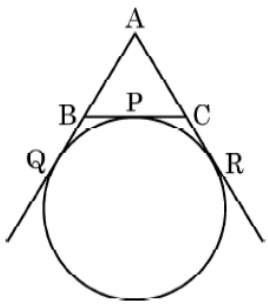
25(B).	Diagonals AC and BD of trapezium ABCD with AB‖DC intersect each other at point O. Show that $\frac{OA}{OC}=\frac{OB}{OD}$.  	
Sol.	In Δ AOB and Δ COD, $\angle$ OAB = $\angle$ OCD $\angle$ OBA = $\angle$ ODC Therefore, Δ AOB ~ Δ COD $\therefore \frac{OA}{OC}=\frac{OB}{OD}$	$1\frac{1}{2}$ $\frac{1}{2}$
	SECTION – C Section – **C** consists of Short Answer (SA) type of questions of **3** marks each.	
26.	Find the ratio in which the line segment joining the points A(6, 3) and B(–2, –5) is divided by x-axis.	
Sol.	Let P(x, 0) be the point on x axis which divides AB in the ratio k : 1 A(6, 3) — P — B(– 2, – 5) (k : 1) $\frac{-5k+3}{k+1}=0 \Rightarrow k=\frac{3}{5}$ Ratio is 3 : 5	$\frac{1}{2}$ 2 $\frac{1}{2}$
27(A).	Find the HCF and LCM of 26, 65 and 117, using prime factorisation.	
Sol.	26= 13 x 2 65= 13 x 5 117= 13 x 3 x 3	1

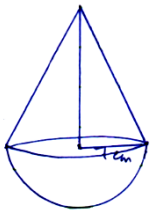
	∴ HCF = 13 LCM = 13 x 2 x 3 x 5 x 3 = 1170	1 1
	OR	
27(B)	Prove that $\sqrt{2}$ is an irrational number.	
Sol.	Let $\sqrt{2}$ be a rational number. $\therefore \sqrt{2} = \frac{p}{q}$, where q≠0 and let p & q be co-primes. $2q^2 = p^2 \Longrightarrow p^2$ is divisible by 2 $\Longrightarrow$ p is divisible by 2 $\Longrightarrow p = 2a$, where 'a' is some integer ----- (i) $4a^2 = 2q^2 \Longrightarrow q^2 = 2a^2 \Longrightarrow q^2$ is divisible by 2 $\Longrightarrow$ q is divisible by 2 $\Longrightarrow q = 2b$, where 'b' is some integer ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{2}$ is an irrational number.	½ 1 ½ 1
28.	In the given figure, E is a point on the side CB produced of an isosceles triangle ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, then prove that ΔABD ~ ΔECF.  	
Sol.	ABC is an isosceles triangle $\therefore AB = AC \Rightarrow \angle B = \angle C$ In Δ ABD and Δ ECF, ∠ ADB = ∠ EFC ∠ ABD = ∠ ECF ∴ Δ ABD ~ Δ ECF	1 1 1

29(A).	The sum of two numbers is 15. If the sum of their reciprocals is $\frac{3}{10}$, find the two numbers.	
Sol.	Let one number be x $\Rightarrow$ another number = 15 – x Therefore, $\frac{1}{x} + \frac{1}{15 - x} = \frac{3}{10}$ $\frac{15 - x + x}{x(15 - x)} = \frac{3}{10} \Rightarrow 150 = 3x(15 - x)$ $3x^2 - 45x + 150 = 0$ $x^2 - 15x + 50 = 0 \Rightarrow (x - 10)(x - 5) = 0$ $\Rightarrow x = 10, 5$ Numbers are 10, 5 or 5, 10	$\frac{1}{2}$ 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
	OR	
29(B).	If α and β are roots of the quadratic equation $x^2 - 7x + 10 = 0$, find the quadratic equation whose roots are α^2 and β^2.	
Sol.	$x^2 - 7x + 10 = 0$ $\alpha + \beta = 7, \alpha\beta = 10$ $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 49 - 20 = 29$ $\alpha^2\beta^2 = (10)^2 = 100$ Quadratic Equation with roots α^2, β^2 is	$\frac{1}{2}$ 1 1

	$\therefore x^2 - (\alpha^2 + \beta^2)x + \alpha^2\beta^2 = 0$ i.e. $x^2 - 29x + 100 = 0$	$\frac{1}{2}$
30.	Prove that $\frac{1 + \sec A}{\sec A} = \frac{\sin^2 A}{1 - \cos A}$.	
Sol.	LHS = $\frac{1 + \sec A}{sec\ A} = \frac{1 + \frac{1}{\cos A}}{\frac{1}{cos\ A}}$ $= 1 + \cos A$ $= \frac{(1 - \cos A)(1 + \cos A)}{(1 - \cos A)}$ $= \frac{1 - cos^2 A}{1 - \cos A}$ $= \frac{sin^2 A}{1 - \cos A}$ = RHS	1 1 1
31.	In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the area of the sector formed by the arc. Also, find the length of the arc.	
Sol.	A $= \frac{60}{360} \times \frac{22}{7} \times 21 \times 21 = 231\ cm^2$ Length of arc $= \frac{60}{360} \times 2 \times \frac{22}{7} \times 21$ $= 22$ cm	$1\frac{1}{2}$ $1\frac{1}{2}$
	SECTION – D Section – D consists of Long Answer (LA) type questions of **5** marks each.	

32(A).	Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$.  	
Sol.	TP = TQ $\Rightarrow \angle TPQ = \angle TQP$ Let $\angle PTQ$ be θ $\Rightarrow \angle TPQ = \angle TQP = \frac{180° - \theta}{2} = 90° - \frac{\theta}{2}$ Now $\angle OPT = 90°$ $\Rightarrow \angle OPQ = 90° - (90° - \frac{\theta}{2}) = \frac{\theta}{2}$ $\angle PTQ = 2\angle OPQ$	1 $1\frac{1}{2}$ $1\frac{1}{2}$ 1
	OR	

32(B).	A circle touches the side BC of a ΔABC at a point P and touches AB and AC when produced at Q and R respectively. Show that $AQ = \frac{1}{2}$ (Perimeter of ΔABC).  	
Sol.	$AQ = AR$ $2AQ = AQ + AR$ $= AB + BQ + AC + CR$ $= AB + AC + (BP + CP)$ $= AB + AC + BC$ $AQ = \frac{1}{2}(AB + AC + BC) = \frac{1}{2}$ (Perimeter of $\triangle ABC$)	1 1 $\frac{1}{2}$ $\frac{1}{2}$ 1 1
33.	A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.	
Sol.	Radius of cone = radius of hemisphere = 7 cm $\therefore$Height of cone = 14 cm Volume of solid = Volume of hemisphere + volume of cone	1

	 $= \frac{2}{3}\pi(7)^3 + \frac{1}{3}\pi(7)^2 14$ $= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7(14 + 14)$ $= \frac{154}{3} \times 28 = \frac{4312}{3} cm^2$ or $1437.33\ cm^2$	$1\frac{1}{2} + 1\frac{1}{2}$ 1
34(A).	The ratio of the 11th term to the 18th term of an A.P. is 2 : 3. Find the ratio of the 5th term to the 21st term. Also, find the ratio of the sum of first 5 terms to the sum of first 21 terms.	
Sol.	$\frac{a + 10d}{a + 17d} = \frac{2}{3}$ $3a + 30d = 2a + 34d \Rightarrow a = 4d$ Therefore, $\frac{a + 4d}{a + 20d} = \frac{4d + 4d}{4d + 20d} = \frac{8d}{24d} = \frac{1}{3}$ $\frac{S_5}{S_{21}} = \frac{\frac{5}{2}[2a + 4d]}{\frac{21}{2}[2a + 20d]} = \frac{5[8d + 4d]}{21[8d + 20d]}$ $= \frac{5 \times 12d}{21 \times 28d} = \frac{5}{49}$ or $S_5 : S_{21} = 5 : 49$	1 1 1 1 1
	OR	
34(B).	If the sum of first 6 terms of an A.P. is 36 and that of the first 16 terms is 256, find the sum of first 10 terms.	
Sol.	$S_6 = 36 \Rightarrow \frac{6}{2}[2a + 5d] = 36$	1

$\Rightarrow 2a + 5d = 12$ ---------- (1) — 1

$S_{16} = 256 \Rightarrow \frac{16}{2}[2a + 15d] = 256$

$\Rightarrow 2a + 15d = 32$ ---------- (2) — 1

Solving (1) and (2)

$d = 2$ — 1

$a = 1$

$S_{10} = \frac{10}{2}[2(1) + 9(2)]$

$= 100$ — 1

35. 250 apples of a box were weighed and the distribution of masses of the apples is given in the following table :

Mass (in grams)	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
Number of apples	20	60	70	x	60

(i) Find the value of x and the mean mass of the apples. **3**

(ii) Find the modal mass of the apples. **2**

Sol.

(i) $20 + 60 + 70 + x + 60 = 250$ — 1

$x = 250 - 210 = 40$

Mass	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180	Total
No. of apples f_i	20	60	70	x = 40	60	250
x_i	90	110	130	150	170	
$x_i f_i$	1800	6600	9100	6000	10200	33700

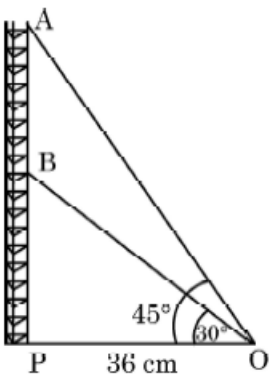
1 for correct table

Mean mass $= \frac{33700}{250} = 134{\cdot}8$ — 1

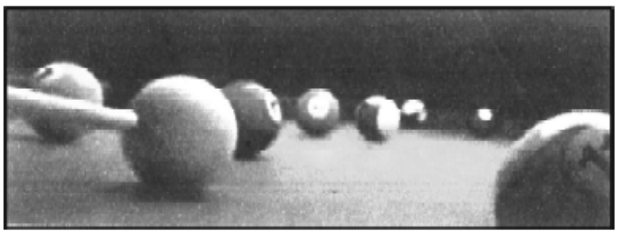
Mean mass = 134.8 g — $\frac{1}{2}$

	(ii) Modal class = 120-140 Mode = $120 + \frac{(70-60)}{(140-60-40)} \times 20$ = 125 Hence modal mass = 125 gm	1 $\frac{1}{2}$
	SECTION – E **3** Case Study Based Questions. Each question is of **4** marks.	
36.	A coaching institute of Mathematics conducts classes in two batches I and II and fees for rich and poor children are different. In batch I, there are 20 poor and 5 rich children, whereas in batch II, there are 5 poor and 25 rich children. The total monthly collection of fees from batch I is ₹ 9000 and from batch II is ₹ 26,000. Assume that each poor child pays ₹ x per month and each rich child pays ₹ y per month.  Based on the above information, answer the following questions : (i) Represent the information given above in terms of x and y. (ii) Find the monthly fee paid by a poor child. **OR** Find the difference in the monthly fee paid by a poor child and a rich child. (iii) If there are 10 poor and 20 rich children in batch II, what is the total monthly collection of fees from batch II ?	

Sol.	(i) $20x + 5y = 9000$ $5x + 25y = 26000$	1
	(ii) Solving the equations $x = 200$ Monthly fee paid by poor child = ₹200	2
	OR	
	(ii) getting $x=200$ and $y= 1000$	$1+\frac{1}{2}$
	Difference in the fee = 1000 – 200 = ₹ 800	$\frac{1}{2}$
	(iii)$10x + 20y = 10(200) + 20(1000)$ = ₹ 22000	1

37.	Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two Sections A and B. Tower is supported by wires from a point O. Distance between the base of the tower and point O is 36 cm. From point O, the angle of elevation of the top of the Section B is 30° and the angle of elevation of the top of Section A is 45°.  Based on the above information, answer the following questions : (i) Find the length of the wire from the point O to the top of Section B. (ii) Find the distance AB. **OR** Find the area of ΔOPB. (iii) Find the height of the Section A from the base of the tower.	
Sol.	(i) In Δ OBP, $\cos 30° = \frac{OP}{OB}$ $\frac{\sqrt{3}}{2} = \frac{36}{OB} \Rightarrow OB = \frac{72}{\sqrt{3}}$ $= 24\sqrt{3}$ cm	$\frac{1}{2}$ $\frac{1}{2}$

	(ii)In Δ OBP, $\tan 30° = \frac{PB}{36} \Rightarrow PB = \frac{36}{\sqrt{3}}$ $PB = 12\sqrt{3}$ In Δ OAP, $\tan 45° = \frac{AP}{36} \Rightarrow AP = 36$ cm $AB = AP - PB = 36 - 12\sqrt{3} = 12(3 - \sqrt{3})$ cm **OR** (ii)Area of Δ OPB $= \frac{1}{2} \times OP \times PB$ $= \frac{1}{2} \times 36 \times 12\sqrt{3} = 216\sqrt{3}$ cm^2 (iii) AP = 36 cm	1 $\frac{1}{2}$ $\frac{1}{2}$ 1+1 1

38.	"Eight Ball" is a game played on a pool table with 15 balls numbered 1 to 15 and a "cue ball" that is solid and white. Of the 15 numbered balls, eight are solid (non-white) coloured and numbered 1 to 8 and seven are striped balls numbered 9 to 15.  The 15 numbered pool balls (no cue ball) are placed in a large bowl and mixed, then one ball is drawn out at random. Based on the above information, answer the following questions : (i) What is the probability that the drawn ball bears number 8 ? (ii) What is the probability that the drawn ball bears an even number ? **OR** What is the probability that the drawn ball bears a number, which is a multiple of 3 ? (iii) What is the probability that the drawn ball is a solid coloured and bears an even number ?	
Sol.	(i)P (drawing ball bearing number 8) = $\frac{1}{15}$	1
	(ii)Even numbers = 2, 4, 6, 8, 10, 12, 14	$\frac{1}{2}$
	No. of favourable outcomes = 7	
	P (even number ball) = $\frac{7}{15}$	$1\frac{1}{2}$
	OR	
	(ii)Multiples of 3 are 3, 6, 9, 12, 15	$\frac{1}{2}$

	No. of favourable outcomes = 5 $\therefore$ P(multiple of 3) = $\frac{5}{15} = \frac{1}{3}$ (iii) Solid colour and even number 2, 4, 6, 8 P(solid colour and bear an even no.) = $\frac{4}{15}$	$1\frac{1}{2}$ 1