SET~2

प्रश्न–पत्र कोड
Q.P. Code **30/1/2**

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
*Time allowed : **3** hours*

अधिकतम अंक : **80**
*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 $\pi = \dfrac{22}{7}$ लें ।

(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 – **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 $\pi = \dfrac{22}{7}$ wherever required if not stated.*
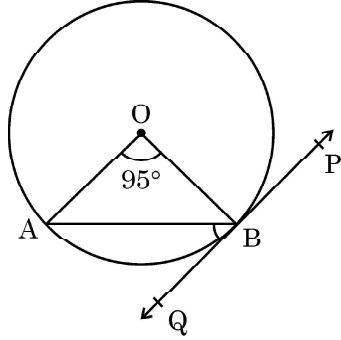
(x) *Use of calculator is NOT allowed.*

खण्ड – क

(बहुविकल्पीय प्रश्न)

प्रत्येक प्रश्न **1** अंक का है ।

1. बिंदुओं A(3, 6) और B(–12, –3) को जोड़ने वाले रेखाखंड को x-अक्ष किस अनुपात में विभाजित करता है ?

   (A)   1 : 2   (B)   1 : 4

   (C)   4 : 1   (D)   2 : 1

2. दी गई आकृति में, केंद्र O वाले वृत्त पर PQ एक स्पर्श–रेखा है । यदि ∠AOB = 95° है, तो ∠ABQ का माप होगा :

   (A)   47.5°   (B)   42.5°

   (C)   85°   (D)   95°

3. यदि $2 \tan A = 3$ है, तो $\dfrac{4 \sin A + 3 \cos A}{4 \sin A - 3 \cos A}$ का मान है

   (A) $\dfrac{7}{\sqrt{13}}$ (B) $\dfrac{1}{\sqrt{13}}$

   (C)   3   (D)   मौजूद नहीं है ।

4. 20 व्यक्तियों के एक समूह में, 5 व्यक्ति तैर नहीं सकते हैं । यदि एक व्यक्ति यादृच्छया चुना जाता है, तो उसके तैर सकने की प्रायिकता होगी :

   (A) $\dfrac{3}{4}$ (B) $\dfrac{1}{3}$
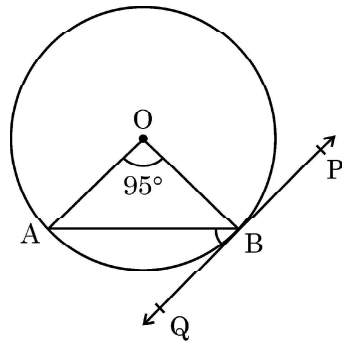
   (C)   1   (D) $\dfrac{1}{4}$

SECTION – A

(Multiple Choice Questions)

Each question is of **1** mark.

1. In what ratio, does *x*-axis divide the line segment joining the points A(3, 6) and B(–12, –3) ?

   (A)   1 : 2   (B)   1 : 4

   (C)   4 : 1   (D)   2 : 1

2. In the given figure, PQ is tangent to the circle centred at O. If $\angle AOB = 95°$, then the measure of $\angle ABQ$ will be

   (A) $47.5°$ (B) $42.5°$

   (C) $85°$ (D) $95°$

3. If $2 \tan A = 3$, then the value of $\dfrac{4 \sin A + 3 \cos A}{4 \sin A - 3 \cos A}$ is

   (A) $\dfrac{7}{\sqrt{13}}$ (B) $\dfrac{1}{\sqrt{13}}$

   (C)   3   (D)   does not exist

4. In a group of 20 people, 5 can't swim. If one person is selected at random, then the probability that he/she can swim, is

   (A) $\dfrac{3}{4}$ (B) $\dfrac{1}{3}$

   (C)   1   (D) $\dfrac{1}{4}$

5. नीचे दिया हुआ बंटन 80 विद्यार्थियों द्वारा, एक परीक्षा में, प्राप्त अंकों को दर्शाता है :

प्राप्तांक	10 से कम	20 से कम	30 से कम	40 से कम	50 से कम	60 से कम
विद्यार्थियों की संख्या	3	12	27	57	75	80

इस बंटन का बहुलक वर्ग है :

(A) 10 – 20   (B) 20 – 30
(C) 30 – 40   (D) 50 – 60

6. त्रिज्या 7 cm और ऊँचाई 24 cm के एक शंकु का वक्र पृष्ठीय क्षेत्रफल है :

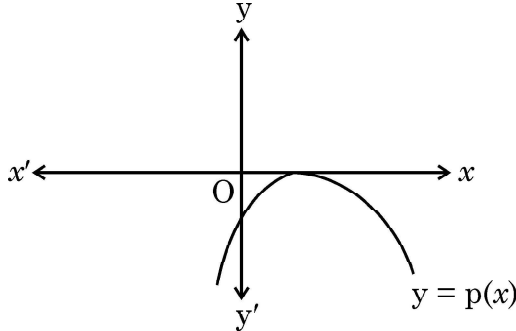(A) 528 cm^2 (B) 1056 cm^2
(C) 550 cm^2 (D) 500 cm^2

7. एक वृत्त के एक व्यास के अंतिम बिंदु (2, 4) और (–3, –1) हैं । वृत्त की त्रिज्या है :

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

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

8. निम्न में से किस द्विघात बहुपद के शून्यक $\frac{5}{3}$ और 0 हैं ?

(A) $3x(3x – 5)$ (B) $3x(x – 5)$
(C) $x^2 – \frac{5}{3}$ (D) $\frac{5}{3}x^2$

9. बहुपद p(x) के लिए y = p(x) का ग्राफ दिया गया है । इस ग्राफ से बहुपद p(x) के शून्यकों की संख्या है :

(A) 3   (B) 1
(C) 2   (D) 0

10. k का वह मान, जिसके लिए समीकरणों के युग्म kx = y + 2 तथा 6x = 2y + 3 के अपरिमित रूप से अनेक हल होते हैं, है :

(A) k = 3 है ।   (B) मौजूद नहीं है ।
(C) k = –3 है ।   (D) k = 4 है ।

5. The distribution below gives the marks obtained by 80 students on a test :

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60
Number of Students	3	12	27	57	75	80

The modal class of this distribution is :

(A) 10 – 20
(B) 20 – 30
(C) 30 – 40
(D) 50 – 60

6. The curved surface area of a cone having height 24 cm and radius 7 cm, is

(A) 528 cm^2
(B) 1056 cm^2
(C) 550 cm^2
(D) 500 cm^2

7. The end-points of a diameter of a circle are (2, 4) and (–3, –1). The radius of the circle is

(A) $2\sqrt{5}$
(B) $\frac{5}{2}\sqrt{5}$
(C) $\frac{5}{2}\sqrt{2}$
(D) $5\sqrt{2}$

8. Which of the following is a quadratic polynomial with zeroes $\frac{5}{3}$ and 0 ?

(A) $3x(3x - 5)$
(B) $3x(x - 5)$
(C) $x^2 - \frac{5}{3}$
(D) $\frac{5}{3}x^2$

9. The graph of y = p(x) is given, for a polynomial p(x). The number of zeroes of p(x) from the graph is
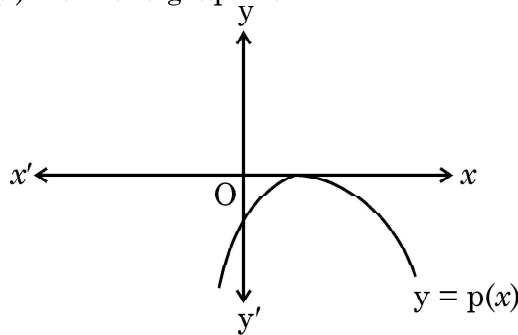
(A) 3
(B) 1
(C) 2
(D) 0

10. The value of k for which the pair of equations kx = y + 2 and 6x = 2y + 3 has infinitely many solutions,

(A) is k = 3
(B) does not exist
(C) is k = –3
(D) is k = 4

11. यदि a, b, c एक A.P. बनाते हैं जिसमें सार्व अन्तर 'd' है, तो (a – 2b – c) का मान होगा
    (A) 2a + 4d
    (B) 0
    (C) –2a – 4d
    (D) –2a – 3d

12. यदि एक सांख्यिकी आँकड़ों के प्रत्येक प्रेक्षण के मान में 3 की वृद्धि कर दी जाए, तो आँकड़ों का माध्य
    (A) बदलता नहीं है ।
    (B) में 3 की वृद्धि हो जाती है ।
    (C) में 6 की वृद्धि हो जाती है ।
    (D) 3n की वृद्धि हो जाती है ।

13. एक घटना के घटित होने की प्रायिकता 'p' और उसके न घटने की प्रायिकता 'q' है, तो 'p' और 'q' का संबंध है
    (A) p + q = 1
    (B) p = 1, q = 1
    (C) p = q – 1
    (D) p + q + 1 = 0

14. एक लड़की गणना करती है कि लॉटरी में उसके प्रथम पुरस्कार जीतने की प्रायिकता 0.08 है । यदि कुल 6000 टिकटें बिकी हो, तो लड़की ने कितनी टिकटें खरीदी थी ?
    (A) 40
    (B) 240
    (C) 480
    (D) 750

15. यदि बहुपद p(x) = $x^2 + x - 1$ के शून्यक α और β हैं, तो $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ बराबर है
    (A) 1
    (B) 2
    (C) –1
    (D) $\dfrac{-1}{2}$

16. k का वह न्यूनतम धनात्मक मान, जिसके लिए द्विघात समीकरण $2x^2 + kx - 4 = 0$ के परिमेय मूल हैं, है :
    (A) $\pm 2\sqrt{2}$
    (B) 2
    (C) ± 2
    (D) $\sqrt{2}$

17. $\left[\dfrac{5}{8} \sec^2 60° - \tan^2 60° + \cos^2 45° \right]$ बराबर है
    (A) $\dfrac{-5}{3}$
    (B) $\dfrac{-1}{2}$
    (C) 0
    (D) $\dfrac{-1}{4}$

18. 5 cm ऊँचाई के एक बेलन का वक्र पृष्ठीय क्षेत्रफल 94.2 cm^2 है । इस बेलन की त्रिज्या है : (π = 3.14 लीजिए ।)
    (A) 2 cm
    (B) 3 cm
    (C) 2.9 cm
    (D) 6 cm

11. If a, b, c form an A.P. with common difference d, then the value of a − 2b − c is equal to
    (A)   2a + 4d
    (B)   0
    (C)   −2a − 4d
    (D)   −2a − 3d

12. If the value of each observation of a statistical data is increased by 3, then the mean of the data
    (A)   remains unchanged
    (B)   increases by 3
    (C)   increases by 6
    (D)   increases by 3n

13. Probability of happening of an event is denoted by p and probability of non-happening of the event is denoted by q. Relation between p and q is
    (A)   p + q = 1
    (B)   p = 1, q = 1
    (C)   p = q − 1
    (D)   p + q + 1 = 0

14. A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, how many tickets has she bought ?
    (A)   40
    (B)   240
    (C)   480
    (D)   750

15. If α, β are the zeroes of a polynomial p(x) = $x^2 + x − 1$, then $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ equals to
    (A)   1
    (B)   2
    (C)   −1
    (D) $\dfrac{-1}{2}$

16. The least positive value of k, for which the quadratic equation $2x^2 + kx − 4 = 0$ has rational roots, is
    (A) $\pm 2\sqrt{2}$
    (B)   2
    (C) ± 2
    (D) $\sqrt{2}$

17. $\left[\dfrac{5}{8} \sec^2 60° − \tan^2 60° + \cos^2 45° \right]$ is equal to
    (A) $\dfrac{-5}{3}$
    (B) $\dfrac{-1}{2}$
    (C)   0
    (D) $\dfrac{-1}{4}$

18. Curved surface area of a cylinder of height 5 cm is 94.2 cm². Radius of the cylinder is (Take π = 3.14)
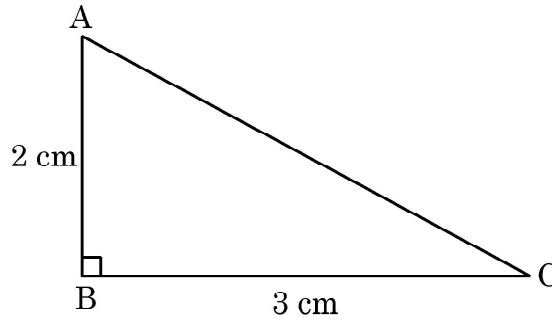   (A)   2 cm
    (B)   3 cm
    (C)   2.9 cm
    (D)   6 cm

प्रश्न संख्या **19** तथा **20** में एक **अभिकथन (A)** के बाद एक **कारण (R)** आधारित कथन दिया है । नीचे दिए गए विकल्पों में से सही विकल्प चुनिए :

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

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

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

(D) (A) असत्य है जबकि (R) सत्य है ।

19. **अभिकथन (A) :** आकृति में दिए गए त्रिभुज ΔABC का परिमाप एक परिमेय संख्या है ।

कारण (R) : दो परिमेय संख्याओं के वर्गों का योगफल एक परिमेय संख्या होती है ।

20. **अभिकथन (A) :** बिंदु P(0, 2), रेखा $3x + 2y = 4$ और y-अक्ष का प्रतिच्छेदन बिंदु है ।

कारण (R) : बिंदु P(0, 2) की दूरी x-अक्ष से 2 इकाई है ।

खण्ड – ख

(इस खण्ड में अति लघु उत्तरीय (SA-I) प्रकार के प्रश्न हैं । प्रत्येक प्रश्न के 2 अंक है ।)

21. वह छोटी से छोटी संख्या ज्ञात कीजिए जिसे 12, 16 और 24 से विभाजित करने पर प्रत्येक स्थिति में 7 शेष बचे ।

22. एक थैले में 4 लाल, 3 नीली और 2 पीली गेंदें हैं । एक गेंद थैले से यादृच्छया निकाली जाती है । प्रायिकता ज्ञात कीजिए कि यह गेंद (i) लाल है (ii) पीली है ।

23. (a) समीकरण युग्म $x = 5$ और $y = 7$ को ग्राफीय विधि से हल कीजिए ।

अथवा

(b) ग्राफीय विधि का प्रयोग करके, ज्ञात कीजिए कि क्या समीकरण युग्म $x = 0$ और $y = -3$ संगत है या नहीं ।

24. (a) यदि $\sin \theta + \cos \theta = \sqrt{3}$ है, तो $\sin \theta \cdot \cos \theta$ का मान ज्ञात कीजिए ।

अथवा

(b) यदि $\sin \alpha = \dfrac{1}{\sqrt{2}}$ और $\cot \beta = \sqrt{3}$ है, तो $\operatorname{cosec} \alpha + \operatorname{cosec} \beta$ का मान ज्ञात कीजिए ।
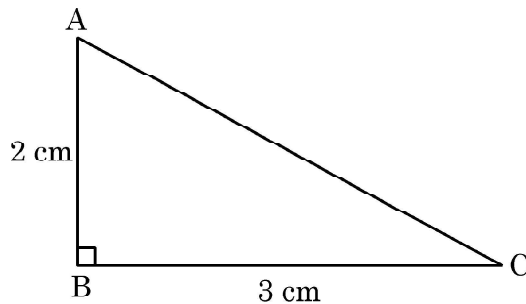
Assertion-Reason Type Questions

In Question **19** and **20**, an **Assertion (A)** statement is followed by a statement of **Reason (R)**. Select 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. **Assertion (A) :** The perimeter of ΔABC is a rational number.

Reason (R) : The sum of the squares of two rational numbers is always rational.

20. **Assertion (A) :** Point P(0, 2) is the point of intersection of y-axis with the line $3x + 2y = 4$.

Reason (R) : The distance of point P(0, 2) from x-axis is 2 units.

SECTION – B

(This section comprises of Very Short Answer (SA-I) type questions. Every question is of 2 marks.)

21. Find the least number which when divided by 12, 16 and 24 leaves remainder 7 in each case.

22. A bag contains 4 red, 3 blue and 2 yellow balls. One ball is drawn at random from the bag. Find the probability that drawn ball is (i) red (ii) yellow.

23. (a) Solve the pair of equations $x = 5$ and y = 7 graphically.

OR

(b) Using graphical method, find whether pair of equations $x = 0$ and y = –3, is consistent or not.

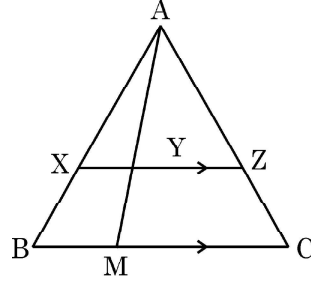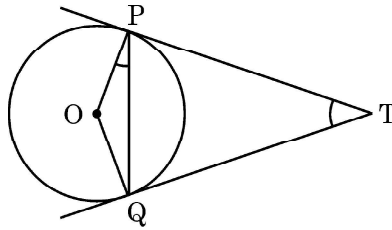24. (a) If $\sin \theta + \cos \theta = \sqrt{3}$, then find the value of $\sin \theta \cdot \cos \theta$.

OR

(b) If $\sin \alpha = \dfrac{1}{\sqrt{2}}$ and $\cot \beta = \sqrt{3}$, then find the value of $\csc \alpha + \csc \beta$.

25. दी गई आकृति में, XZ || BC, AZ = 3 cm, ZC = 2 cm, BM = 3 cm और MC = 5 cm है । XY की लम्बाई ज्ञात कीजिए ।
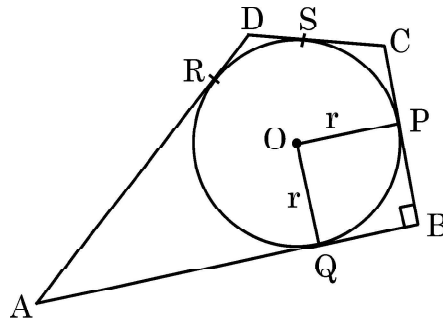

खण्ड – ग

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

26. एक वृत्त का केंद्र (2a, a − 7) है । 'a' का मान ज्ञात कीजिए यदि यह वृत्त बिंदु (11, −9) से होकर गुजरता हो और इसकी त्रिज्या $5\sqrt{2}$ cm हो ।

27. (a) केंद्र O वाले वृत्त पर बाह्य बिंदु T से दो स्पर्श–रेखाएँ TP और TQ खींची गई हैं । सिद्ध कीजिए कि ∠PTQ = 2∠OPQ.

अथवा

(b) एक वृत्त एक चतुर्भुज ABCD में अंकित है, जिसमें ∠B = 90° है । यदि AD = 17 cm, AB = 20 cm और DS = 3 cm हो, तो वृत्त की त्रिज्या ज्ञात कीजिए ।

28. दो संख्याओं के अन्तर का आधा 2 है । बड़ी संख्या का और छोटी संख्या के दुगने का योगफल 13 है । संख्याएँ ज्ञात कीजिए ।

25. In the given figure, XZ is parallel to BC. AZ = 3 cm, ZC = 2 cm, BM = 3 cm and MC = 5 cm. Find the length of XY.
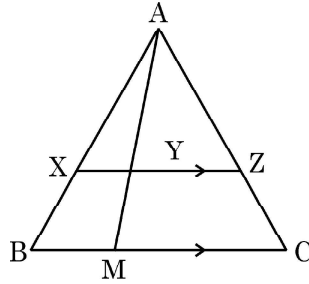

SECTION – C

(This section comprises of Short Answer (SA-II) type questions of 3 marks each.)

26. The centre of a circle is (2a, a – 7). Find the values of 'a' if the circle passes through the point (11, –9). Radius of the circle is $5\sqrt{2}$ cm.

27. (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
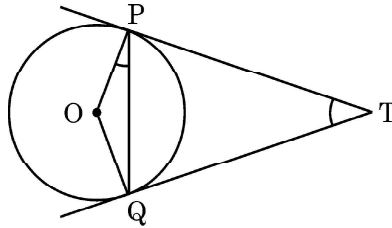
(b) In the given figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90^\circ$. If AD = 17 cm, AB = 20 cm and DS = 3 cm, then find the radius of the circle.
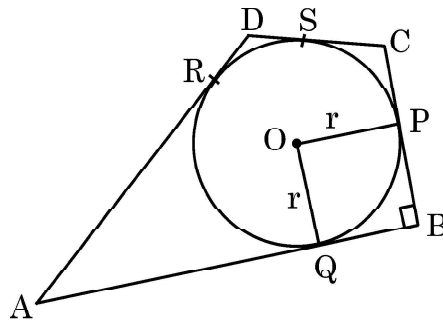
28. Half of the difference between two numbers is 2. The sum of the greater number and twice the smaller number is 13. Find the numbers.
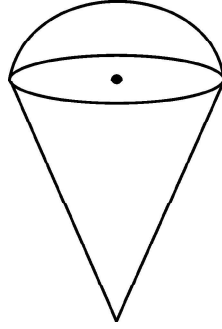
29. (a) एक कमरा एक बेलन के आकार का है जिसके ऊपर एक अर्धगोलीय गुंबद अध्यारोपित है । अर्धगोल के आधार की त्रिज्या, बेलनाकार हिस्से की ऊँचाई की आधी है । यदि कमरे में $\left(\dfrac{1408}{21}\right)m^3$ हवा हो, तो कमरे की ऊँचाई ज्ञात कीजिए । $\left(\pi = \dfrac{22}{7}\ \text{लीजिए ।}\right)$

अथवा

(b) एक खोखले शंकु की त्रिज्या 3 cm और ऊँचाई 12 cm है । इस शंकु में आइसक्रीम इस प्रकार भरी जाती है कि शंकु के निचले हिस्से जो पूरे शंकु के आयतन का $\left(\dfrac{1}{6}\right)$वाँ भाग है, आइसक्रीम नहीं भरी गई है पर शंकु के ऊपर एक अर्ध–गोलीय आकार में आइसक्रीम है । आइसक्रीम का आयतन ज्ञात कीजिए । ($\pi = 3.14$ लीजिए ।)

30. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है ।

31. सिद्ध कीजिए : $(\text{cosec A} - \sin A)\,(\sec A - \cos A) = \dfrac{1}{\cot A + \tan A}$.

खण्ड – घ

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

32. एक सीढ़ी भूमि से $45°$ के कोण पर एक दीवार से सटी हुई है । यदि सीढ़ी का पैर, दीवार से दूरी की दिशा में, 4 m की दूरी से खींचा जाता है, तो यह भूमि से $30°$ का कोण बनाता है जबकि इसका ऊपरी सिरा 3 m नीचे सरक जाता है । भूमि से इसके ऊपरी सिरे की अंतिम ऊँचाई तथा सीढ़ी की लंबाई ज्ञात कीजिए ।

29. (a) A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\dfrac{1408}{21}\right) \text{m}^3$ of air. $\left(\text{Take } \pi = \dfrac{22}{7}\right)$

OR

(b) An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\dfrac{1}{6}\right)^{\text{th}}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$)
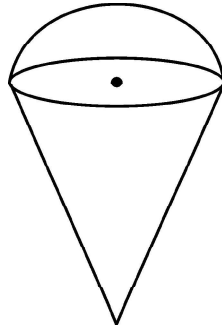
30. Prove that $\sqrt{5}$ is an irrational number.

31. Prove that $(\text{cosec A} - \sin A)(\sec A - \cos A) = \dfrac{1}{\cot A + \tan A}$.

SECTION – D

(This section comprises of Long Answer (LA) type questions of 5 marks each.)

32. A ladder set against a wall at an angle 45° to the ground. If the foot of the ladder is pulled away from the wall through a distance of 4 m, its top slides a distance of 3 m down the wall making an angle 30° with the ground. Find the final height of the top of the ladder from the ground and length of the ladder.
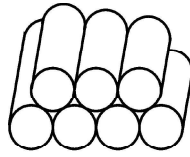
33. (a) एक A.P. के 11वाँ पद का 17वें पद से अनुपात 3 : 4 है । इस A.P. के 5वें पद का 21वें पद से अनुपात ज्ञात कीजिए । पहले 5 पदों के योग से पहले 21 पदों के योग का अनुपात भी ज्ञात कीजिए ।

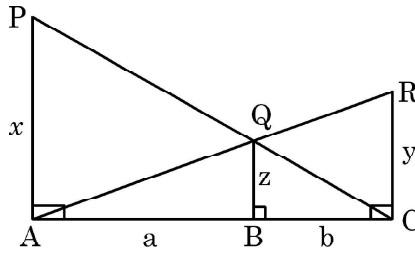<div align="center">अथवा</div>

(b) 250 लट्ठों (logs) को ढेरी के रूप में इस प्रकार रखा जाता है :

सबसे नीचे वाली पंक्ति में 22 लट्ठे, उससे अगली पंक्ति में 21 लट्ठे, उससे अगली पंक्ति में 20 लट्ठे, इत्यादि (आकृति देखिए) ये 250 लट्ठे कितनी पंक्तियों में रखे गए हैं तथा सबसे ऊपरी पंक्ति में कितने लट्ठे हैं ?
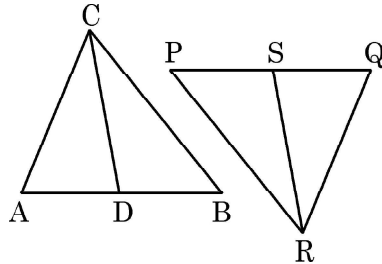

(Example)

34. (a) PA, QB और RC प्रत्येक AC के लंबवत् हैं । यदि AP = x, QB = z, RC = y, AB = a और BC = b है, तो सिद्ध कीजिए कि $\dfrac{1}{x} + \dfrac{1}{y} = \dfrac{1}{z}$.

<div align="center">अथवा</div>

(b) दी गई आकृति में, CD और RS क्रमशः त्रिभुज ABC और त्रिभुज PQR की माध्यिकाएँ हैं । यदि ∆ABC ~ ∆PQR है, तो सिद्ध कीजिए कि

(i) ∆ADC ~ ∆PSR

(ii) AD × PR = AC × PS

35. 14 cm त्रिज्या वाले एक वृत्त की एक जीवा वृत्त के केंद्र पर 60° का कोण बनाती है । संगत लघु वृत्त खण्ड का क्षेत्रफल ज्ञात कीजिए । अतः दीर्घ वृत्त खण्ड का क्षेत्रफल भी ज्ञात कीजिए ।

33. (a) The ratio of the 11th term to 17th term of an A.P. is 3 : 4. Find the ratio of 5th term to 21st term of the same A.P. Also, find the ratio of the sum of first 5 terms to that of first 21 terms.
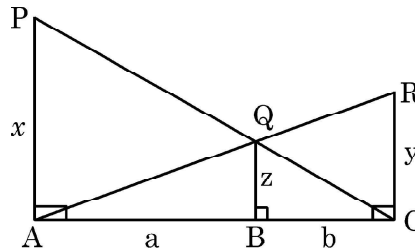
OR

(b) 250 logs are stacked in the following manner :

22 logs in the bottom row, 21 in the next row, 20 in the row next to it and so on (as shown by an example). In how many rows, are the 250 logs placed and how many logs are there in the top row ?
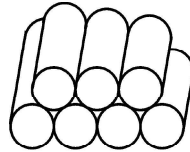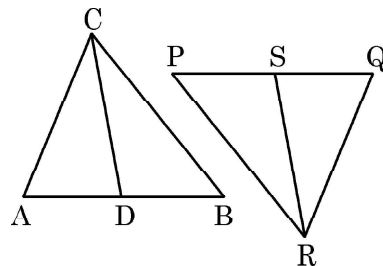

(Example)

34. (a) PA, QB and RC are each perpendicular to AC. If AP = x, QB = z, RC = y, AB = a and BC = b, then prove that $\dfrac{1}{x} + \dfrac{1}{y} = \dfrac{1}{z}$.

OR

(b) In the given figure, CD and RS are respectively the medians of ΔABC and ΔPQR. If ΔABC ~ ΔPQR then prove that :
(i) ΔADC ~ ΔPSR
(ii) AD × PR = AC × PS

35. A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment of the circle. Also find the area of the major segment of the circle.
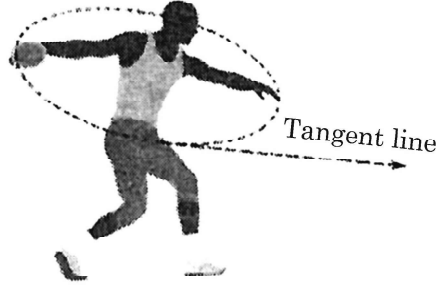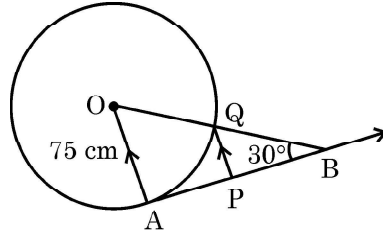
प्रकरण अध्ययन

36. चक्का फेंक एक ऐसी घटना है जिसमें एक एथलीट चक्का फेंकने का प्रयास करता है । एथलीट एक सर्कल में लगभग डेढ़ बार वामावर्त्त घूमता है, फिर चक्का छोड़ता है । छोड़ने पर, चक्का स्पर्श–रेखा के साथ वृत्ताकार स्पिन कक्षा में चला जाता है ।

दी गई आकृति में, केंद्र O वाले और 75 cm त्रिज्या वाले वृत्त पर AB ऐसी ही एक स्पर्श–रेखा है, $\angle ABO = 30°$ और PQ || OA.

उपरोक्त सूचना के आधार पर :

(a) AB की लम्बाई ज्ञात कीजिए ।   **1**

(b) OB की लम्बाई ज्ञात कीजिए ।   **1**

(c) AP की लम्बाई ज्ञात कीजिए ।   **2**

अथवा

PQ की लम्बाई ज्ञात कीजिए ।

SECTION – E

(In this section, there are 3 case study/passage based questions. Each question is of 4 marks.)

Case Study

36. The discus throw is an event in which an athlete attempts to throw a discus. The athlete spins anti-clockwise around one and a half times through a circle, then releases the throw. When released, the discus travels along tangent to the circular spin orbit.

Tangent line
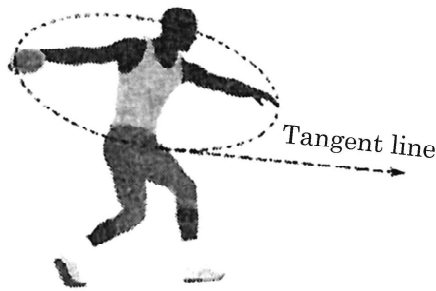
In the given figure, AB is one such tangent to a circle of radius 75 cm. Point O is centre of the circle and ∠ABO = 30°. PQ is parallel to OA.

O
75 cm
Q
30°
B
P
A
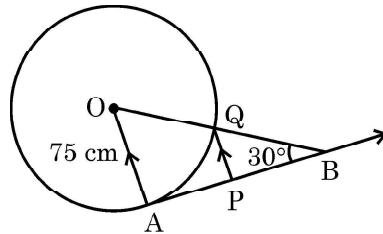
Based on above information :

(a) find the length of AB.   **1**

(b) find the length of OB.   **1**

(c) find the length of AP.   **2**

       OR

      find the length of PQ.

37. स्कूल वर्ष की एक पुस्तक डिज़ाइन करते समय, एक शिक्षक ने एक छात्र से कहा कि फोटो के क्षेत्रफल को दुगुना करने के लिए किसी विशेष फोटो की लंबाई और चौड़ाई को x इकाई बढ़ा दिया जाता है । मूल फोटो 18 cm लम्बी और 12 cm चौड़ी है ।

उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(I)   उपरोक्त जानकारी को दर्शाने वाला एक बीजीय समीकरण लिखिए ।   **1**

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

(III) बढ़े हुए फोटो के आयाम क्या होने चाहिए ?   **2**
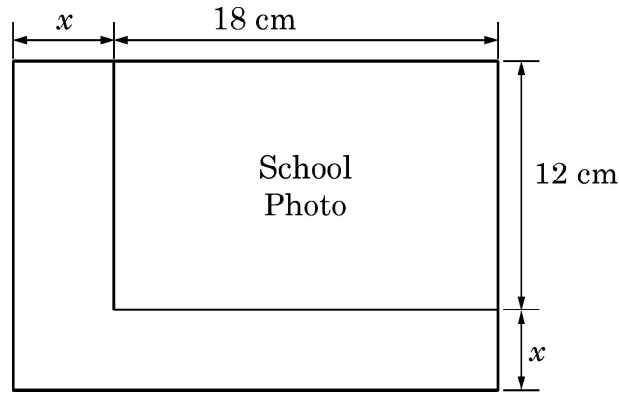
अथवा

क्या x का कोई परिमेय मान, नए क्षेत्रफल को 220 cm^2 के बराबर बना सकता है ?

38. भारत मौसम विज्ञान विभाग हमारे देश के विभिन्न उप–मंडलों में हर वर्ष मौसमी और वार्षिक वर्षा देखता है ।

37. While designing the school year book, a teacher asked the student that the length and width of a particular photo is increased by x units each to double the area of the photo. The original photo is 18 cm long and 12 cm wide.

Based on the above information, answer the following questions :

(I) Write an algebraic equation depicting the above information. **1**

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

(III) What should be the new dimensions of the enlarged photo ? **2**

OR
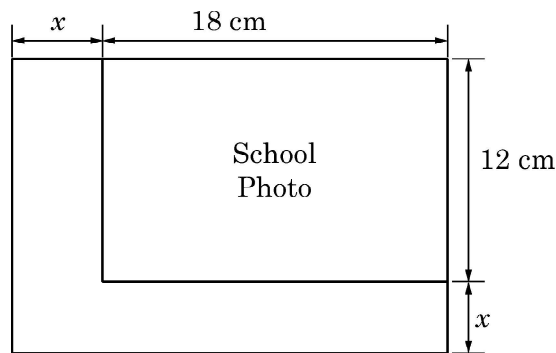
Can any rational value of x make the new area equal to 220 cm^2 ?

38. India meteorological department observes seasonal and annual rainfall every year in different sub-divisions of our country.

यह उन्हें परिणामों की तुलना और विश्लेषण करने में मदद करता है । नीचे दी गई तालिका उप–मंडलवार 2018 में मौसमी (मानसून) वर्षा (मि.मी. में) दिखाती है :

वर्षा (mm में)	उप–मंडलों की संख्या
200-400	2
400-600	4
600-800	7
800-1000	4
1000-1200	2
1200-1400	3
1400-1600	1
1600-1800	1

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

(I) बहुलक वर्ग लिखिए । **1**

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

<div align="center">अथवा</div>

इस मौसम में हुई माध्य वर्षा ज्ञात कीजिए ।

(III) यदि मानसून के मौसम में कम से कम 1000 mm वर्षा वाले उप–मंडल को अच्छी वर्षा वाला उप–मंडल माना जाता है, तो कितने उप–मंडलों में अच्छी वर्षा हुई ? **1**

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It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018 :

Rainfall (mm)	Number of Sub-divisions
200-400	2
400-600	4
600-800	7
800-1000	4
1000-1200	2
1200-1400	3
1400-1600	1
1600-1800	1

Based on the above information, answer the following questions :

(I) Write the modal class. **1**

(II) Find the median of the given data. **2**

OR

Find the mean rainfall in this season.

(III) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall ? **1**

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	Marking Scheme **Strictly Confidential** **(For Internal and Restricted use only)** **Secondary School Examination, 2023** **MATHEMATICS PAPER CODE 30/1/2**

<table>
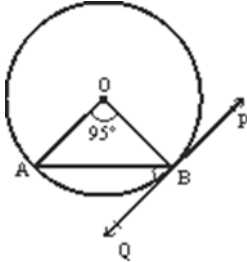<tr><td colspan="2"><u>**General Instructions: -**</u></td></tr>
<tr><td>**1**</td><td>You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, 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.</td></tr>
<tr><td>**2**</td><td>**"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."**</td></tr>
<tr><td>**3**</td><td>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.**</td></tr>
<tr><td>**4**</td><td>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.</td></tr>
<tr><td>**5**</td><td>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.</td></tr>
<tr><td>**6**</td><td>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.**</td></tr>
<tr><td>**7**</td><td>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.</td></tr>
<tr><td>**8**</td><td>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.</td></tr>
<tr><td>**9**</td><td><u>**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".**</u></td></tr>
</table>

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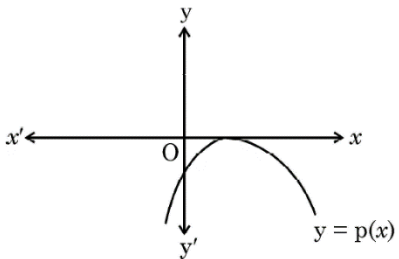|	
10	<u>**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**</u>
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	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.

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.	In what ratio, does x-axis divide the line segment joining the points $A(3,6)$ and $B(-12,-3)$? (A) $1:2$ (B) $1:4$ (C) $4:1$ (D) $2:1$	
Sol.	(D) $2:1$	1
2.	In the given figure, PQ is tangent to the circle centered at O. If $\angle AOB = 95°$, then the measure of $\angle ABQ$ will be (A) $47.5°$ (B) $42.5°$ (C) $85°$ (D) $95°$ 	
Sol.	(A) $47·5°$	1
3.	If $2\tan A = 3$, then the value of $\dfrac{4\sin A + 3\cos A}{4\sin A - 3\cos A}$ (A) $\dfrac{7}{\sqrt{13}}$ (B) $\dfrac{1}{\sqrt{13}}$ (C) 3 (D) does not exist	
Sol.	(C) 3	1

3

4.	In a group of 20 people, 5 can't swim. If one person is selected at random, then the probability that he/she can swim, is (A) $\dfrac{3}{4}$ (B) $\dfrac{1}{3}$ (C) 1 (D) $\dfrac{1}{4}$	
Sol.	(A) 3/4	1
5.	The distribution below gives the marks obtained by 80 students on a test:	

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60
Number of Students	3	12	27	57	75	80

The modal class of this distribution is :

     (A) 10-20   (B) 20 - 30
     (C) 30-40   (D) 50 - 60

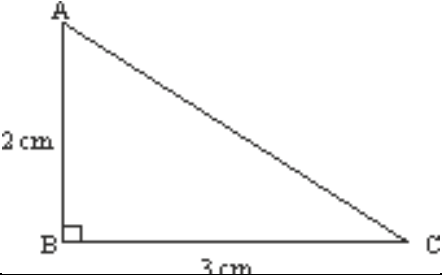|		
Sol.	(C) 30 – 40	1
6.	The curved surface area of a cone having height 24 cm and radius 7 cm, is (A) 528 cm^2 (B) 1056 cm^2 (C) 550 cm^2 (D) 500 cm^2	
Sol.	(C) 550 cm^2	1
7.	The end-points of a diameter of a circle are (2, 4) and (-3, -1). The radius of the circle is (A) $2\sqrt{5}$ (B) $\dfrac{5}{2}\sqrt{5}$ (C) $\dfrac{5}{2}\sqrt{2}$ (D) $5\sqrt{2}$	
Sol.	(C) $\dfrac{5}{2}\sqrt{2}$	1
8.	Which of the following is a quadratic polynomial with zeroes $\dfrac{5}{3}$ and 0? (A) $3x\,(3x-5)$ (B) $3x\,(x-5)$ (C) $x^2 - \dfrac{5}{3}$ (D) $\dfrac{5}{3}x^2$	
Sol.	(A) $3x\,(3x-5)$	1

9.	The graph of $y = p(x)$ is given, for a polynomial $p(x)$. The number of zeroes of $p(x)$ from the graph is: (A) 3 (B) 1 (C) 2 (D) 0	
Sol.	(B) 1	1
10.	The value of k for which the pair of equations $kx = y + 2$ and $6x = 2y + 3$ has infinitely many solutions, (A) is $k = 3$ (B) does not exist (C) is $k = -3$ (D) is $k = 4$	
Sol.	(B) does not exist	1
11.	If a, b, c form a A.P. with common difference d, then the value of $a - 2b - c$ is equal to (A) $2a + 4d$ (B) 0 (C) $-2a - 4d$ (D) $-2a - 3d$	
Sol.	(C) $-2a - 4d$	1
12.	If the value of each observation of a statistical data is increased by 3, then the mean of the data (A) remains unchanged (B) increases by 3 (C) increases by 6 (D) increases by $3n$	
Sol.	(B) increases by 3	1
13.	Probability of happening of an event is denoted by p and probability of non-happening of the event is denoted by q. Relation between p and q is (A) $p + q = 1$ (B) $p = 1, q = 1$ (C) $p = q - 1$ (D) $p + q + 1 = 0$	
Sol.	(A) $p + q = 1$	1
14.	A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, how many tickets has she bought? (A) 40 (B) 240 (C) 480 (D) 750	

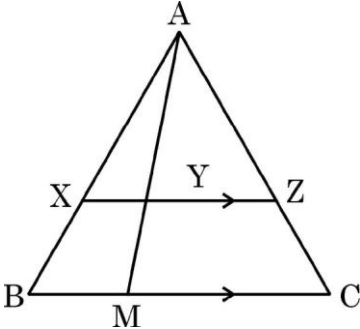|		
Sol.	(C) 480	1
15.	If α, β are the zeroes of a polynomial $p(x) = x^2 + x - 1$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ equals to (A) 1 (B) 2 (C) -1 (D) $\frac{-1}{2}$	
Sol.	(A) 1	1
16.	The least positive value of k, for which the quadratic equation $2x^2 + kx - 4 = 0$ has rational roots, is (A) $\pm 2\sqrt{2}$ (B) 2 (C) ± 2 (D) $\sqrt{2}$	
Sol.	(B) 2	1
17.	$\left[\frac{5}{8} \sec^2 60° - \tan^2 60° + \cos^2 45° \right]$ is equal to (A) $\frac{-5}{3}$ (B) $\frac{-1}{2}$ (C) 0 (D) $\frac{-1}{4}$	
Sol.	(C) 0	1
18.	Curved surface area of a cylinder of height 5 cm is 94.2 cm^2. Radius of the cylinder is (Take $\pi = 3.14$) (A) 2 cm (B) 3 cm (C) 2.9 cm (D) 6 cm	
Sol.	(B) 3cm	1
	Assertion-Reason Type Questions In Question **19** and **20**, an **Assertion (A)** statement is followed by a statement of **Reason (R)**. Select 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.	

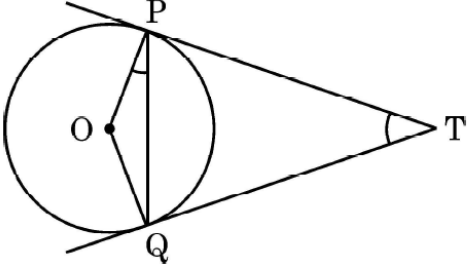|		
19.	Assertion (A) : The perimeter of ΔABC is a rational number. Reason (R) : The sum of the squares of two rational numbers is always rational. 	
Sol.	(D) Assertion (A) is false but Reason (R) is true	1
20.	Assertion (A): Point $P\,(0,\,2)$ is the point of intersection of y-axis with the line $3x\,+\,2y\,=\,4$. Reason (R): The distance of point $P\,(0,\,2)$ from x-axis is 2 units.	
Sol.	(B) Both Assertion (A) and Reason (R) are correct but Reason (R) is not the correct explanation of Assertion (A)	1
	SECTION B This section comprises of Very Short Answer (VSA) type questions of 2 marks each.	
21.	Find the least number which when divided by 12, 16 and 24 leaves remainder 7 in each case	
Sol.	LCM of 12, 16, 24 = 48 Required number is 48 + 7 = 55.	1 1
22.	A bag contains 4 red, 3 blue and 2 yellow balls. One ball is drawn at random from the bag. Find the probability that drawn ball is (i) red (ii) yellow.	
Sol.	Total No of Balls=9 (i) P(drawn ball is red) $=\dfrac{4}{9}$	 1

	(ii) P(drawn ball is yellow) = $\dfrac{2}{9}$	1
23(a).	Solve the pair of equations x=5 and y=7 graphically.	
Sol.	Drawing correct graph	1
	Solution is x = 5, y = 7	1
	OR	
23(b).	Using graphical method, find whether pair of equations x=0 and y = -3 is consistent or not	
Sol.	Drawing correct graph	1
	As $x = 0$ and $y = -3$ are intersecting	
	$\therefore$ Pair of equations is consistent	1
24(a).	If $sin\theta + cos\theta = \sqrt{3}$, then find the value of $sin\theta \cdot cos\theta$.	
Sol.	$\sin\theta + \cos\theta = \sqrt{3}$ squaring both sides $\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$ $\Rightarrow 1 + 2\sin\theta\cos\theta = 3$ $\Rightarrow \sin\theta\cos\theta = 1$	1 $\dfrac{1}{2}$ $\dfrac{1}{2}$
	OR	
24(b).	If $\sin\alpha = \dfrac{1}{\sqrt{2}}$ and $\cot\beta = \sqrt{3}$, then find the value of cosecα+ cosecβ	

8
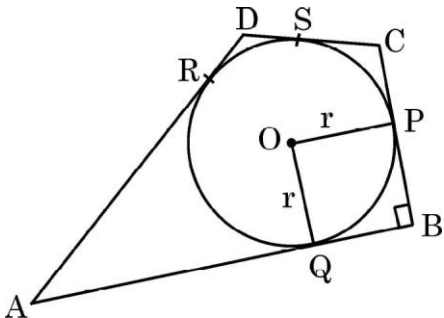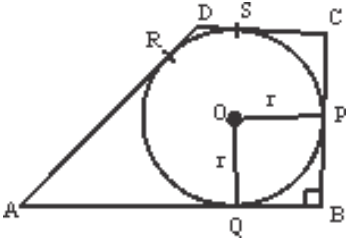
Sol.	$\csc \alpha = \dfrac{1}{\sin \alpha} = \sqrt{2}$	$\dfrac{1}{2}$
	$\csc \beta = \sqrt{1 + \cot^2 \beta} = \sqrt{1+3} = 2$	1
	$\therefore \quad \csc \alpha + \csc \beta = \sqrt{2} + 2$ or $\sqrt{2}(\sqrt{2}+1)$	$\dfrac{1}{2}$
25.	In the given figure, XZ is parallel to BC. AZ = 3 cm, ZC = 2 cm, BM = 3 cm and MC = 5 cm. Find the length of XY.	
Sol.	As $XZ \mid\mid BC$ Therefore, $\dfrac{AX}{XB} = \dfrac{3}{2} = \dfrac{AZ}{ZC}$ (i)	½
	$\Delta\,AXY \sim \Delta\,ABM$	½
	$\Rightarrow \dfrac{AX}{AB} = \dfrac{XY}{BM}$ or $\dfrac{3}{5} = \dfrac{XY}{3}$	½
	$\Rightarrow XY = \dfrac{9}{5}$ or 1·8 cm	½

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SECTION C

This section comprises of Short Answer (SA) type questions of 3 marks each.

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26.	The centre of a circle is (2a, a-7). Find the values of 'a' if the circle passes through the point (11,-9). Radius of the circle is $5\sqrt{2}$ cm.	
Sol.	$(2a - 11)^2 + (a - 7 + 9)^2 = (5\sqrt{2})^2$	1
	$\Rightarrow 5a^2 - 40a + 75 = 0$	1
	$\Rightarrow (a - 5)(5a - 15) = 0$	
	$a = 5, a = 3$	1

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27(a).	(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	1
	Let $\angle$ PTQ be θ	
	$\Rightarrow \angle$ TPQ = $\angle$ TQP = $\frac{180° - \theta}{2}$ = $90° - \frac{\theta}{2}$	1
	Now $\angle$ OPT = 90°	
	$\Rightarrow \angle$OPQ = $90° - (90° - \frac{\theta}{2}) = \frac{\theta}{2}$	
	$\angle$ PTQ = 2 $\angle$ OPQ	1
	OR	

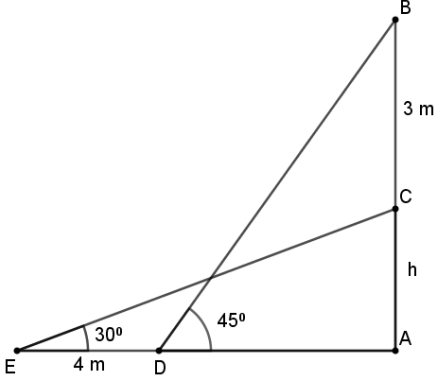| 27(b).	In the given figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90^0$ .If AD=17 cm, AB = 20 cm and DS = 3 cm, then find the radius of the circle.	

Sol.		
	DR = DS = 3 cm	½
	∴ AR = AD – DR = 17 – 3 = 14 cm	
	⇒ AQ = AR = 14 cm	1
	∴ QB = AB – AQ = 20 – 14 = 6 cm	½
	Since QB = OP = r	½
	∴ radius = 6 cm	½

28.	Half of the difference between two numbers is 2. The sum of the greater number and twice the smaller number is 13. Find the numbers.	
Sol.	Let the numbers be x and y, x > y	
	Therefore $\frac{1}{2}$ (x – y) = 2 — (i)	1
	and 2y + x = 13 — (ii) Solving equations (i) and (ii)	1
	x = 7, y = 3	1

29(a).	A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\frac{1408}{21}\right)m^3$ of air. Take $\left(\pi = \frac{22}{7}\right)$	
Sol.	Let h be height of cylindrical part and r be radius of hemisphere	½
	Volume of room $= 2\pi r^3 + \frac{2}{3}\pi r^3$ $= \frac{1408}{21}$	1
	$\Rightarrow r = 2$	½
	Therefore, h=4	½
	Height of the room is = 6m	½

11

		OR	

29(b).	An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\dfrac{1}{6}\right)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$)	
Sol.	Volume of the cone $= \dfrac{1}{3} \times \pi \times 9 \times 12 = 36\pi cm^3$	1
	Volume of ice-cream in the cone $= \dfrac{5}{6} \times 36 \times \pi = 30\pi cm^3$	½
	Volume of ice-cream on top $= \dfrac{2}{3} \times 27 \times \pi = 18\pi cm^3$	1
	Total volume of the ice-cream $= (30\pi + 18\pi) = 48\pi cm^3$	
	$= 48 \times 3.14 = 150.72 cm^3$	½
30.	Prove that $\sqrt{5}$ is an irrational number	
Sol.	Let $\sqrt{5}$ be a rational number.	
	$\therefore \sqrt{5} = \dfrac{p}{q}$, where q≠0 and let p & q be co-primes.	½
	$5q^2 = p^2 \implies p^2$ is divisible by 5 $\implies$ p is divisible by 5 $\implies$ p = 5a, where 'a' is some integer ----- (i)	1
	$25a^2 = 5q^2 \implies q^2 = 5a^2 \implies q^2$ is divisible by 5 $\implies$ q is divisible by 5 $\implies$ q = 5b, where 'b' is some integer ----- (ii)	½
	(i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{5}$ is an irrational number.	1
31.	Prove that $(cos\,e\,cA - sin\,A)(sec\,A - cos\,A) = \dfrac{1}{cot\,A - tan\,A}$	

Sol.	LHS $=\left(\dfrac{1}{\sin A} - \sin A\right)\left(\dfrac{1}{\cos A} - \cos A\right)$	½
	$= \dfrac{1 - \sin^2 A}{\sin A} \times \dfrac{1 - \cos^2 A}{\cos A}$	½
	$= \sin A \cos A$	½
	RHS $= \dfrac{1}{\dfrac{\cos A}{\sin A} + \dfrac{\sin A}{\cos A}}$	½
	$= \dfrac{\sin A \cos A}{\sin^2 A + \cos^2 A}$	½
	$= \sin A \cos A = $ LHS	½

<table>
<tr><td colspan="3" align="center">SECTION D

This section comprises of Long Answer (LA) type questions of 5 marks each.</td></tr>
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32.	A ladder set against a wall at an angle 45^0 to the ground. If the foot of the ladder is pulled away from the wall through a distance of 4 m, its top slides a distance of 3 m down the wall making an angle 30^0 with the ground. Find the final height of the top of the ladder from the ground and length of the ladder.	
Sol.		1 for correct figure
	$\sin 45° = \dfrac{AB}{BD} = \dfrac{h+3}{BD}$	
	$\Rightarrow BD = (h+3)\sqrt{2}$ ------ (i)	1
	$\sin 30° = \dfrac{1}{2} = \dfrac{h}{CE}$	
	$\Rightarrow CE = 2h$ ------ (ii)	1

13

	length of ladder remains same	
	Therefore $BD = CE \Rightarrow (h + 3)\sqrt{2} = 2h$	
	$\Rightarrow h = \dfrac{3\sqrt{2}}{2 - \sqrt{2}} = 3(\sqrt{2} + 1)$	1
	Final height of the top of the ladder $= 3(\sqrt{2} + 1)$ m	
	and length of ladder $= 2h = 6(\sqrt{2} + 1)$ m	1
33(a).	The ratio of the 11th term to 17th term of an A.P. is 3:4. Find the ratio of 5th term to 21st term of the same A.P. Also, find the ratio of the sum of first 5 terms to that of first 21 terms.	
Sol.	Given $\dfrac{a + 10d}{a + 16d} = \dfrac{3}{4}$	1
	$\Rightarrow 4a + 40d = 3a + 48d$ $\Rightarrow a = 8d \qquad$ (i)	1
	therefore $\dfrac{a_5}{a_{21}} = \dfrac{a + 4d}{a + 20d} = \dfrac{3}{7} \qquad$ using(i)	1
	$a_5 : a_{21} = 3 : 7$ $\dfrac{s_5}{s_{21}} = \dfrac{\dfrac{5}{2}(2a + 4d)}{\dfrac{21}{2}(2a + 20d)} = \dfrac{5 \times 20d}{21 \times 36d} = \dfrac{25}{189}$	2
	Therefore, $S_5:S_{21}=25:189$	
	OR	

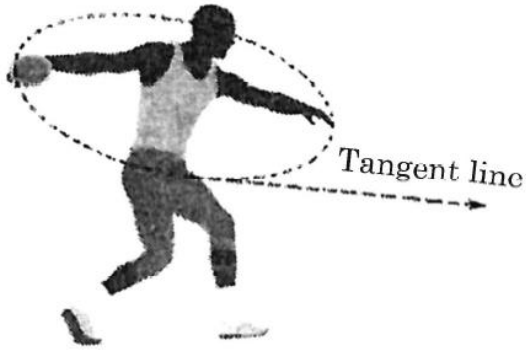|		
33(b).	250 logs are stacked in the following manner: 22 logs in the bottom row, 21 in the next row, 20 in the row next to it and so on (as shown by an example). In how many rows, are the 250 logs placed and how many logs are there in the top row? (Example)	
Sol.	Let the number of rows be n. A.P. formed is 22, 21, 20, 19, ... Here a = 22, d = – 1 Sn = 250 $\therefore\ 250 = \dfrac{n}{2}[44 + (n-1)(-1)]$ $\Rightarrow n^2 - 45n + 500 = 0$ $\Rightarrow (n-25)(n-20) = 0$ $n \neq 25 \ \therefore\ n = 20$ logs in top row $= a_{20} = 22 + 19(-1) = 3$	1 1 1 1 1
34(a).	PA, QB and RC are each perpendicular to AC. If AP = x, QB = z, RC = Y, AB = a and BC = b, then prove that $\dfrac{1}{x}+\dfrac{1}{y}=\dfrac{1}{z}$ 	
Sol.	(a)Δ CQB ~ Δ CPA	

$\Rightarrow \dfrac{b}{a + b} = \dfrac{z}{x}$ —— (i)

Also Δ AQB ~ Δ ARC

$\Rightarrow \dfrac{a}{a + b} = \dfrac{z}{y}$ —— (ii)

from (i) and (ii) $\dfrac{z}{x} + \dfrac{z}{y} = \dfrac{a + b}{a + b} = 1$

$\Rightarrow \dfrac{1}{x} + \dfrac{1}{y} = \dfrac{1}{z}$

$1\frac{1}{2}$

$1\frac{1}{2}$

1

1

| | **OR** | |

| 34(b). | In the given figure, CD and RS are respectively the medians of ΔABC and ΔPQR . If $\Delta ABC \sim \Delta PQR$ then prove that:

(i) Δ ADC~ΔPSR

(ii) $AD \times PR = AC \times PS$

 | |

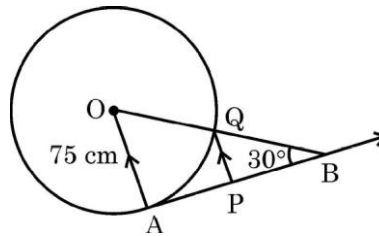| Sol. | (i) Δ ABC ~ Δ PQR

$\Rightarrow \angle$ A = $\angle$ P

and $\dfrac{AB}{PQ} = \dfrac{AC}{PR}$

$\Rightarrow \dfrac{2AD}{2PS} = \dfrac{AC}{PR}$ | 1

$\dfrac{1}{2}$

$\dfrac{1}{2}$ |

16

	$\Rightarrow \dfrac{AD}{PS} = \dfrac{AC}{PR}$ and $\angle A = \angle P$ Therefore Δ ADC $\sim$ Δ PSR (ii)Hence $\dfrac{AD}{PS} = \dfrac{AC}{PR}$ $\Rightarrow$ AD $\times$ PR = AC $\times$ PS		1 1 1
35.	A chord of a circle of radius 14 cm subtends an angle of 60^0 at the center. Find the area of the corresponding minor segment of the circle. Also find the area of the major segment of the circle.		
Sol.	Area of minor segment $= \dfrac{22}{7} \times 14 \times 14 \times \dfrac{60}{360} - \dfrac{1}{2} \times 14 \times 14 \times \dfrac{\sqrt{3}}{2}$ $= \left(\dfrac{308}{3} - 49\sqrt{3} \right) cm^2$ or 17.9cm^2 Area of major segment $= \dfrac{22}{7} \times 14 \times 14 - \left(\dfrac{308}{3} - 49\sqrt{3} \right)$ $= 616 - \dfrac{308}{3} + 49\sqrt{3}$ $= \left(\dfrac{1540}{3} + 49\sqrt{3} \right) cm^2$ or 598.1cm^2		1+1 1 1 1
	<center>SECTION E</center> <center>This section comprises of 3 case-study based questions of 4 marks each.</center>		
36.	The discus throw is an event in which an athlete attempts to throw a discus. The athlete spins anti-clockwise around one and a half times through a circle, then releases the throw. When released, the discus travels along tangent to the circular spin orbit.		

Tangent line

In the given figure, AB is one such tangent to a circle of radius 75 cm. Point O is centre of the circle and $\angle ABO = 30^0$. PQ is parallel to OA.

O
Q
75 cm
30°
B
P
A

Based on above information:

   (a)   find the length of AB.

   (b)   find the length of OB.

   (c)   find the length of AP.

       OR

      Find the length of PQ

Sol.		
	(i) $\tan 30° = \dfrac{1}{\sqrt{3}} = \dfrac{75}{AB}$	$\dfrac{1}{2}$
	$\Rightarrow AB = 75\sqrt{3}$ cm	$\dfrac{1}{2}$
	(ii) $\sin 30° = \dfrac{1}{2} = \dfrac{75}{OB}$	$\dfrac{1}{2}$
	$\Rightarrow OB = 150$ cm	$\dfrac{1}{2}$
	(iii) $QB = 150 – 75 = 75$ cm $\Rightarrow Q$ is mid-point. of OB	1
	Since PQ ll AO therefore P is mid-point of AB Hence $AP = \dfrac{75\sqrt{3}}{2}$ cm.	1
	OR	
	(iii) $QB = 150 – 75 = 75$ cm Now, $\Delta\,BQP \sim \Delta\,BOA$	$\dfrac{1}{2}$
	$\Rightarrow \dfrac{QB}{OB} = \dfrac{PQ}{OA}$	
	$\Rightarrow \dfrac{1}{2} = \dfrac{PQ}{75}$	1
	$\Rightarrow PQ = \dfrac{75}{2}$ cm	$\dfrac{1}{2}$
37.	While designing the school year book, a teacher asked the student that the length and width of a particular photo is increased by x units each to double the area of the photo. The original photo is 18 cm long and 12 cm wide. Based on the above information, answer the following questions: (I) Write an algebraic equation depicting the above information. (II) Write the corresponding quadratic equation in standard form. (III) What should be the new dimensions of the enlarged photo?	

OR
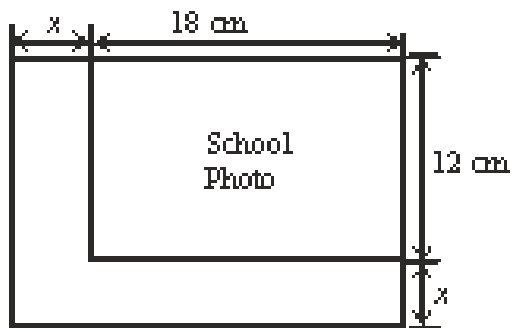
Can any rational value of x make the new area equal to $220 cm^2$

Sol.	(i) $(18 + x)(12 + x) = 2(18 \times 12)$	1
	(ii) $x^2 + 30x - 216 = 0$	1
	(iii) Solving: $x^2 + 30x - 216 = 0$	
	$\Rightarrow (x + 36)(x - 6) = 0$	
	$x \neq -36 \therefore \Rightarrow x = 6.$	1
	new dimensions are 24 cm × 18 cm	1
	OR	
	(iii) If $(18 + x)(12 + x) = 220$	
	then $x^2 + 30x - 4 = 0$	1
	Here D = 900 + 16 = 916 which is not a perfect square.	1
	Thus, we can't have any such rational value of x.	
38.	India meteorological department observes seasonal and annual rainfall every year in different sub-divisions of our country.	

It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018:

Rainfall (mm)	Number of Sub-divisions
200-400	2
400-600	4
600-800	7
800-1000	4
1000-1200	2
1200-1400	3
1400 -1600	1
1600-1800	1

Based on the above information, answer the following questions:

(I) Write the modal class.

(II) Find the median of the given data.

<div align="center">OR</div>

   Find the mean rainfall in this season.

(III) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall?

Sol.	(i) Modal Class is 600-800	1

(ii) $\frac{N}{2} = 12$, median class is $600 - 800$ ½

Rainfall	x_i	f_i	cf.
200 – 400	300	2	2
400 – 600	500	4	6
600 – 800	700	7	13
800 – 1000	900	4	17
1000 – 1200	1100	2	19
1200 – 1400	1300	3	22
1400 – 1600	1500	1	23
1600 – 1800	1700	1	24
		24	

½ for correct table

Median $= 600 + \dfrac{200}{7} (12 - 6)$

$= \frac{5400}{7}$ or $771 \cdot 4$ 1

OR

(ii)

Rainfall	x_i	f_i	$f_i x_i$
200 – 400	300	2	600
400 – 600	500	4	2000
600 – 800	700	7	4900
800 – 1000	900	4	3600
1000 – 1200	1100	2	2200
1200 – 1400	1300	3	3900
1400 – 1600	1500	1	1500

22

1600 – 1800	1700	1	1700		1 for correct table
		24	20400		

Mean $= \dfrac{20400}{24} = 850$

1

(iii) Sub-divisions having good rainfall = 2 + 3 + 1 + 1 = 7.

1