SET-1

Series JMS/2

कोड नं.
Code No. 30/2/1

रोल नं.
Roll No.

परीक्षार्थी कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **30** प्रश्न हैं ।
- **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें ।**
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains **11** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **30** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित

MATHEMATICS

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

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

सामान्य निर्देश :

(i) ***सभी*** *प्रश्न अनिवार्य हैं ।*

(ii) *इस प्रश्न-पत्र में* ***30*** *प्रश्न हैं जो चार खण्डों — अ, ब, स और द में विभाजित हैं ।*

(iii) *खण्ड अ में* ***एक-एक*** *अंक वाले* ***6*** *प्रश्न हैं । खण्ड ब में* ***6*** *प्रश्न हैं जिनमें से प्रत्येक* ***2*** *अंक का है । खण्ड स में* ***10*** *प्रश्न* ***तीन-तीन*** *अंकों के हैं । खण्ड द में* ***8*** *प्रश्न हैं जिनमें से प्रत्येक* ***4*** *अंक का है ।*

(iv) *प्रश्न-पत्र में कोई समग्र विकल्प नहीं है । तथापि* ***1*** *अंक वाले* ***2*** *प्रश्नों में,* ***2*** *अंकों वाले* ***2*** *प्रश्नों में,* ***3*** *अंकों वाले* ***4*** *प्रश्नों में और* ***4*** *अंकों वाले* ***3*** *प्रश्नों में आंतरिक विकल्प प्रदान किए गए हैं । ऐसे प्रश्नों में आपको दिए गए विकल्पों में से केवल* ***एक*** *प्रश्न ही करना है ।*

(v) *कैलकुलेटरों के प्रयोग की अनुमति* ***नहीं*** *है ।*

General Instructions :

(i) ***All*** *questions are compulsory.*

(ii) *The question paper consists of* ***30*** *questions divided into four sections — A, B, C and D.*

(iii) *Section A contains* ***6*** *questions of* ***1*** *mark each. Section B contains* ***6*** *questions of* ***2*** *marks each, Section C contains* ***10*** *questions of* ***3*** *marks each and Section D contains* ***8*** *questions of* ***4*** *marks each.*

(iv) *There is no overall choice. However, an internal choice has been provided in* ***two*** *questions of* ***1*** *mark each,* ***two*** *questions of* ***2*** *marks each,* ***four*** *questions of* ***3*** *marks each and* ***three*** *questions of* ***4*** *marks each. You have to attempt only* ***one*** *of the alternatives in all such questions.*

(v) *Use of calculators is* ***not*** *permitted.*

खण्ड अ

SECTION A

प्रश्न संख्या 1 से 6 तक प्रत्येक प्रश्न 1 अंक का है ।

Question numbers 1 to 6 carry 1 mark each.

1. यदि म.स. (HCF) (336, 54) = 6 है, तो ल.स. (LCM) (336, 54) ज्ञात कीजिए ।

If HCF (336, 54) = 6, find LCM (336, 54).

2. द्विघात समीकरण $2x^2 - 4x + 3 = 0$ के मूलों की प्रकृति ज्ञात कीजिए ।

Find the nature of roots of the quadratic equation $2x^2 - 4x + 3 = 0$.

3. समान्तर श्रेढ़ी $\frac{1}{a}, \frac{3-a}{3a}, \frac{3-2a}{3a}, \ldots (a \neq 0)$ के लिए सार्व अन्तर ज्ञात कीजिए ।

Find the common difference of the Arithmetic Progression (A.P.)

$$\frac{1}{a}, \frac{3-a}{3a}, \frac{3-2a}{3a}, \ldots \ (a \neq 0)$$

4. मान ज्ञात कीजिए :

$$\sin^2 60° + 2 \tan 45° - \cos^2 30°$$

अथवा

यदि $\sin A = \frac{3}{4}$ है, तो sec A परिकलित कीजिए ।

Evaluate :

$$\sin^2 60° + 2 \tan 45° - \cos^2 30°$$

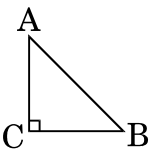
OR

If $\sin A = \frac{3}{4}$, calculate sec A.

5. x-अक्ष पर स्थित बिन्दु P के निर्देशांक लिखिए जो बिन्दु A(– 2, 0) तथा बिन्दु B(6, 0) से समान दूरी पर हो ।

Write the coordinates of a point P on x-axis which is equidistant from the points A(– 2, 0) and B(6, 0).

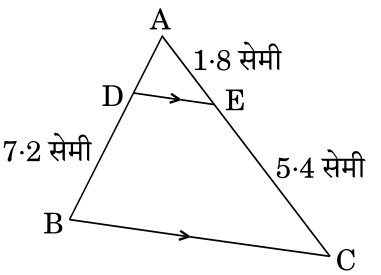
6. आकृति 1 में, ABC एक समद्विबाहु त्रिभुज है जिसका कोण C समकोण है तथा AC = 4 cm है । AB की लंबाई ज्ञात कीजिए ।



आकृति 1

अथवा

आकृति 2 में, DE ∥ BC है । भुजा AD की लम्बाई ज्ञात कीजिए जबकि दिया गया है AE = 1·8 सेमी, BD = 7·2 सेमी तथा CE = 5·4 सेमी ।



आकृति 2

In Figure 1, ABC is an isosceles triangle right angled at C with AC = 4 cm. Find the length of AB.

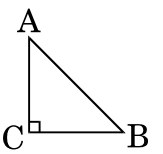


Figure 1

OR

In Figure 2, DE ∥ BC. Find the length of side AD, given that AE = 1·8 cm, BD = 7·2 cm and CE = 5·4 cm.

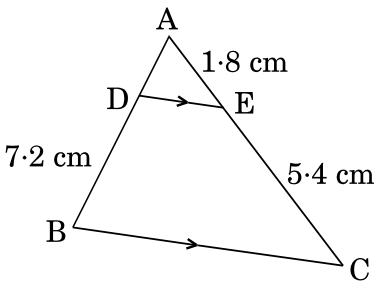


Figure 2

खण्ड ब
SECTION B

प्रश्न संख्या 7 से 12 तक प्रत्येक प्रश्न के 2 अंक हैं ।
Question numbers 7 to 12 carry 2 marks each.

7. वह सबसे छोटी संख्या लिखिए जो 306 तथा 657 दोनों से पूर्णतया विभाजित हो ।
Write the smallest number which is divisible by both 306 and 657.

8. x और y में एक संबंध ज्ञात कीजिए ताकि बिन्दु A(x, y), B(–4, 6) तथा C(–2, 3) संरेखीय हों ।

अथवा

उस त्रिभुज का क्षेत्रफल ज्ञात कीजिए जिसके शीर्ष (1, – 1) (– 4, 6) तथा (– 3, – 5) हैं ।
Find a relation between x and y if the points A(x, y), B(– 4, 6) and C(– 2, 3) are collinear.

OR

Find the area of a triangle whose vertices are given as (1, – 1) (– 4, 6) and (– 3, – 5).

9. एक जार में केवल नीले, काले तथा हरे कंचे हैं । इस जार में से यादृच्छया एक नीले कंचे के निकालने की प्रायिकता $\frac{1}{5}$ है तथा उसी जार में से एक काले कंचे के यादृच्छया निकालने की प्रायिकता $\frac{1}{4}$ है । यदि जार में 11 हरे रंग के कंचे हैं, तो जार में कुल कंचों की संख्या ज्ञात कीजिए ।

The probability of selecting a blue marble at random from a jar that contains only blue, black and green marbles is $\frac{1}{5}$. The probability of selecting a black marble at random from the same jar is $\frac{1}{4}$. If the jar contains 11 green marbles, find the total number of marbles in the jar.

10. k के किन मानों (किस मान) के लिए निम्न समीकरणों के युग्म का एक अद्वितीय हल है :

$x + 2y = 5$ और $3x + ky + 15 = 0$

Find the value(s) of k so that the pair of equations $x + 2y = 5$ and $3x + ky + 15 = 0$ has a unique solution.

11. दो संपूरक कोणों में से बड़े कोण का मान छोटे कोण के मान से 18° अधिक है । दोनों कोणों के मान ज्ञात कीजिए ।

अथवा

सुमित की आयु उसके बेटे की आयु की तीन गुनी है । पाँच वर्ष के बाद, उसकी आयु अपने बेटे की आयु की ढ़ाई गुना हो जाएगी । इस समय सुमित की आयु कितने वर्ष है ?

The larger of two supplementary angles exceeds the smaller by 18°. Find the angles.

OR

Sumit is 3 times as old as his son. Five years later, he shall be two and a half times as old as his son. How old is Sumit at present ?

12. निम्नलिखित बारंबारता बंटन का बहुलक ज्ञात कीजिए :

वर्ग अंतराल :	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
बारंबारता :	25	34	50	42	38	14

Find the mode of the following frequency distribution :

Class Interval :	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Frequency :	25	34	50	42	38	14

खण्ड स

SECTION C

प्रश्न संख्या 13 से 22 तक प्रत्येक प्रश्न के 3 अंक हैं ।

Question numbers 13 to 22 carry 3 marks each.

13. सिद्ध कीजिए कि $2 + 5\sqrt{3}$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

अथवा

यूक्लिड ऐल्गोरिथ्म के प्रयोग से 2048 तथा 960 का म.स. (HCF) ज्ञात कीजिए ।

Prove that $2 + 5\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

OR

Using Euclid's Algorithm, find the HCF of 2048 and 960.

14. कर्ण BC पर एक ही तरफ दो समकोण त्रिभुज ABC तथा DBC बनाए गए हैं । यदि AC तथा BD एक दूसरे को बिंदु P पर प्रतिच्छेद करते हैं, तो सिद्ध कीजिए कि

$AP \times PC = BP \times DP$.

अथवा

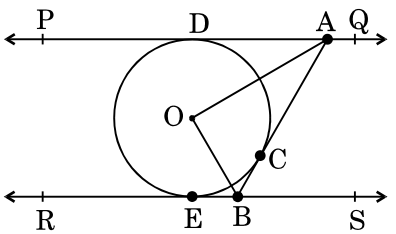
एक समलंब PQRS जिसमें PQ ∥ RS है, के विकर्ण परस्पर बिन्दु O पर प्रतिच्छेद करते हैं । यदि PQ = 3RS हो, तो त्रिभुजों POQ तथा ROS के क्षेत्रफलों का अनुपात ज्ञात कीजिए ।

Two right triangles ABC and DBC are drawn on the same hypotenuse BC and on the same side of BC. If AC and BD intersect at P, prove that $AP \times PC = BP \times DP$.

OR

Diagonals of a trapezium PQRS intersect each other at the point O, PQ ∥ RS and PQ = 3RS. Find the ratio of the areas of triangles POQ and ROS.

15. आकृति 3 में, PQ तथा RS, O केन्द्र वाले किसी वृत्त पर दो समांतर स्पर्श-रेखाएँ हैं और स्पर्श बिन्दु C पर स्पर्श-रेखा AB, PQ को A तथा RS को B पर प्रतिच्छेद करती है । सिद्ध कीजिए कि $\angle AOB = 90°$ है ।



आकृति 3

In Figure 3, PQ and RS are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting PQ at A and RS at B. Prove that $\angle AOB = 90°$.

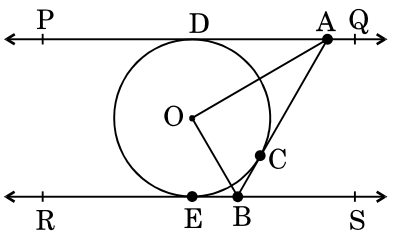


Figure 3

16. रेखा $x - 3y = 0$ बिन्दुओं $(-2, -5)$ तथा $(6, 3)$ को जोड़ने वाले रेखाखंड को किस अनुपात में विभाजित करती है ? इस प्रतिच्छेद बिन्दु के निर्देशांक भी ज्ञात कीजिए ।

Find the ratio in which the line $x - 3y = 0$ divides the line segment joining the points $(-2, -5)$ and $(6, 3)$. Find the coordinates of the point of intersection.

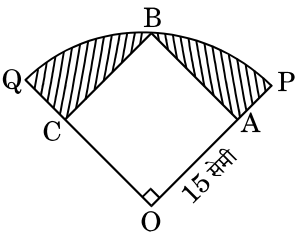
17. मान ज्ञात कीजिए :

$$\left(\frac{3 \sin 43^\circ}{\cos 47^\circ}\right)^2 - \frac{\cos 37^\circ \operatorname{cosec} 53^\circ}{\tan 5^\circ \tan 25^\circ \tan 45^\circ \tan 65^\circ \tan 85^\circ}$$

Evaluate :

$$\left(\frac{3 \sin 43^\circ}{\cos 47^\circ}\right)^2 - \frac{\cos 37^\circ \operatorname{cosec} 53^\circ}{\tan 5^\circ \tan 25^\circ \tan 45^\circ \tan 65^\circ \tan 85^\circ}$$

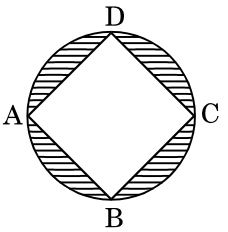
18. आकृति 4 में, एक वृत्त के चतुर्थांश OPBQ के अंतर्गत एक वर्ग OABC बना हुआ है । यदि OA = 15 सेमी है, तो छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए । ($\pi = 3{\cdot}14$ प्रयोग कीजिए)



आकृति 4

अथवा

आकृति 5 में, $2\sqrt{2}$ सेमी भुजा वाला वर्ग ABCD एक वृत्त के अंतर्गत बना हुआ है । छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए । ($\pi = 3{\cdot}14$ प्रयोग कीजिए)



आकृति 5

In Figure 4, a square OABC is inscribed in a quadrant OPBQ. If OA = 15 cm, find the area of the shaded region. (Use $\pi = 3{\cdot}14$)

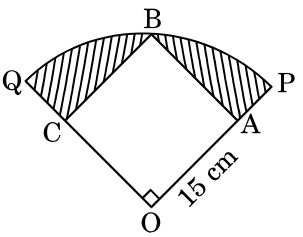


Figure 4

OR

In Figure 5, ABCD is a square with side $2\sqrt{2}$ cm and inscribed in a circle. Find the area of the shaded region. (Use $\pi = 3{\cdot}14$)

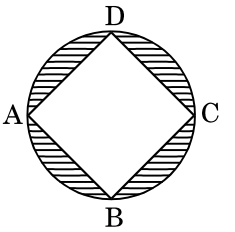


Figure 5

19. एक ठोस बेलन के आकार का है जिसके दोनों सिरे अर्धगोलाकार हैं । ठोस की कुल लम्बाई 20 सेमी है तथा बेलन का व्यास 7 सेमी है । ठोस का कुल आयतन ज्ञात कीजिए । ($\pi = \frac{22}{7}$ प्रयोग कीजिए)

A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. (Use $\pi = \frac{22}{7}$)

20. नीचे दिया हुआ बंटन 100 विद्यार्थियों द्वारा एक परीक्षा में प्राप्त अंकों को दर्शा रहा है :

प्राप्तांक :	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55	55 – 60	60 – 65
विद्यार्थियों की संख्या :	14	16	28	23	18	8	3

विद्यार्थियों के माध्य अंक ज्ञात कीजिए ।

The marks obtained by 100 students in an examination are given below :

Marks :	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55	55 – 60	60 – 65
Number of Students :	14	16	28	23	18	8	3

Find the mean marks of the students.

21. k के किस मान के लिए, बहुपद

$$f(x) = 3x^4 - 9x^3 + x^2 + 15x + k,$$

$3x^2 - 5$ से पूर्णतया विभाजित होता है ?

अथवा

द्विघात बहुपद $7y^2 - \frac{11}{3}y - \frac{2}{3}$ के शून्यक ज्ञात कीजिए और शून्यकों तथा गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिए ।

For what value of k, is the polynomial

$$f(x) = 3x^4 - 9x^3 + x^2 + 15x + k$$

completely divisible by $3x^2 - 5$?

OR

Find the zeroes of the quadratic polynomial $7y^2 - \frac{11}{3}y - \frac{2}{3}$ and verify the relationship between the zeroes and the coefficients.

22. p के ऐसे सभी मान लिखिए कि द्विघात समीकरण $x^2 + px + 16 = 0$ के बराबर मूल हों । प्राप्त समीकरण के मूल ज्ञात कीजिए ।

Write all the values of p for which the quadratic equation $x^2 + px + 16 = 0$ has equal roots. Find the roots of the equation so obtained.

खण्ड द

SECTION D

प्रश्न संख्या 23 से 30 तक प्रत्येक प्रश्न के 4 अंक हैं ।

Question numbers 23 to 30 carry 4 marks each.

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

If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

24. अमित जो कि एक समतल जमीन पर खड़ा है, अपने से 200 मी. दूर उड़ते हुए पक्षी का उन्नयन कोण 30° पाता है । दीपक जो कि 50 मी. ऊँचे भवन की छत पर खड़ा है, उसी पक्षी का उन्नयन कोण 45° पाता है । अमित और दीपक पक्षी के विपरीत दिशा में हैं । दीपक से पक्षी की दूरी ज्ञात कीजिए ।

Amit, standing on a horizontal plane, finds a bird flying at a distance of 200 m from him at an elevation of 30°. Deepak standing on the roof of a 50 m high building, finds the angle of elevation of the same bird to be 45°. Amit and Deepak are on opposite sides of the bird. Find the distance of the bird from Deepak.

25. लोहे के एक ठोस खंभे में 220 सेमी ऊँचाई के एक बेलन जिसके आधार का व्यास 24 सेमी है, के ऊपर 60 सेमी ऊँचाई का एक अन्य बेलन अध्यारोपित है जिसकी त्रिज्या 8 सेमी है । इस खंभे का भार ज्ञात कीजिए, जबकि दिया गया है कि 1 घन सेमी लोहे का लगभग भार 8 ग्राम है । ($\pi = 3{\cdot}14$ प्रयोग कीजिए)

A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 gm mass. (Use $\pi = 3{\cdot}14$)

26. 5 सेमी भुजा वाले समबाहु त्रिभुज ABC की रचना कीजिए । फिर एक अन्य त्रिभुज की रचना कीजिए जिसकी भुजाएँ दिए हुए त्रिभुज ABC की संगत भुजाओं की $\frac{2}{3}$ गुनी हों ।

अथवा

2 सेमी त्रिज्या के वृत्त पर 5 सेमी त्रिज्या का एक संकेन्द्री वृत्त खींचिए । बाह्य वृत्त पर लिए गए एक बिन्दु P से छोटे वृत्त पर दो स्पर्श-रेखाओं PA तथा PB की रचना कीजिए । PA की लंबाई मापिए ।

Construct an equilateral Δ ABC with each side 5 cm. Then construct another triangle whose sides are $\frac{2}{3}$ times the corresponding sides of Δ ABC.

OR

Draw two concentric circles of radii 2 cm and 5 cm. Take a point P on the outer circle and construct a pair of tangents PA and PB to the smaller circle. Measure PA.

27. निम्नलिखित बंटन को 'से कम प्रकार' के बंटन में बदलिए और फिर उसका तोरण खींचिए :

वर्ग अंतराल :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
बारंबारता :	7	5	8	10	6	6	8

Change the following data into 'less than type' distribution and draw its ogive :

Class Interval :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Frequency :	7	5	8	10	6	6	8

28. सिद्ध कीजिए कि :

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

अथवा

सिद्ध कीजिए कि :

$$\frac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} = 2 + \frac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$$

Prove that :

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

OR

Prove that :

$$\frac{\sin\theta}{\cot\theta + \operatorname{cosec}\theta} = 2 + \frac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$$

29. समांतर श्रेढ़ी –7, –12, –17, –22, ... का कौन-सा पद –82 होगा ? क्या –100 इस समांतर श्रेढ़ी का कोई पद होगा ? सकारण उत्तर बताइए ।

अथवा

समांतर श्रेढ़ी 45, 39, 33, ... के कितने पदों का योगफल 180 होगा ? दोहरे उत्तर की व्याख्या कीजिए ।

Which term of the Arithmetic Progression –7, –12, –17, –22, ... will be –82 ? Is –100 any term of the A.P. ? Give reason for your answer.

OR

How many terms of the Arithmetic Progression 45, 39, 33, ... must be taken so that their sum is 180 ? Explain the double answer.

30. हिन्दी तथा अंग्रेज़ी की कक्षा परीक्षा में अरुण के प्राप्त अंकों का योगफल 30 है । यदि उसके हिन्दी में 2 अंक अधिक होते और अंग्रेज़ी में 3 अंक कम होते, तो प्राप्त अंकों का गुणनफल 210 होता । दोनों विषयों में उसके द्वारा प्राप्त अंकों को ज्ञात कीजिए ।

In a class test, the sum of Arun's marks in Hindi and English is 30. Had he got 2 marks more in Hindi and 3 marks less in English, the product of the marks would have been 210. Find his marks in the two subjects.

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Secondary School Certificate Examination

March 2019

Marking Scheme — Mathematics 30/2/1, 30/2/2, 30/2/3

General Instructions:

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage

2. 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.

3. Alternative methods are accepted. Proportional marks are to be awarded.

4. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.

5. A full scale of marks - 0 to 80 has to be used. Please do not hesitate to award full marks if the answer deserves it.

6. Separate Marking Scheme for all the three sets has been given.

7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All 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.

QUESTION PAPER CODE 30/2/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. LCM (336, 54) = $\frac{336 \times 54}{6}$ $\frac{1}{2}$

$= 336 \times 9 = 3024$ $\frac{1}{2}$

2. $\frac{3-a}{3a} - \frac{1}{a} = \frac{3-a-3}{3a} = -\frac{1}{3}$ 1

3. $2x^2 - 4x + 3 = 0 \Rightarrow D = 16 - 24 = -8$ $\frac{1}{2}$

$\therefore$ Equation has NO real roots $\frac{1}{2}$

4. $\sin^2 60° + 2 \tan 45° - \cos^2 30 = \left(\frac{\sqrt{3}}{2}\right)^2 + 2(1) - \left(\frac{\sqrt{3}}{2}\right)^2$ [For any two correct values] $\frac{1}{2}$

$= 2$ $\frac{1}{2}$

OR

$\sin A = \frac{3}{4} \Rightarrow \cos A = \sqrt{1 - \frac{9}{16}} = \frac{\sqrt{7}}{4}$ $\frac{1}{2}$

$\sec A = \frac{4}{\sqrt{7}}$ $\frac{1}{2}$

5. Point on x-axis is (2, 0) 1

6. ΔABC: Isosceles $\Delta \Rightarrow AC = BC = 4$ cm. $\frac{1}{2}$

$AB = \sqrt{4^2 + 4^2} = 4\sqrt{2}$ cm $\frac{1}{2}$

OR

$\frac{AD}{BD} = \frac{AE}{CE} \Rightarrow \frac{AD}{7.2} = \frac{1.8}{5.4}$ $\frac{1}{2}$

$\therefore$ $AD = \frac{7.2 \times 1.8}{5.4} = 2.4$ cm. $\frac{1}{2}$

SECTION B

7. Smallest number divisible by 306 and 657 = LCM (306, 657) 1

LCM (306, 657) = 22338 1

8. A, B, C are collinear $\Rightarrow$ ar. (ΔABC) = 0 $\frac{1}{2}$

$\therefore \quad \frac{1}{2}[x(6-3)-4(3-y)-2(y-6)] = 0$ 1

$\Rightarrow \quad 3x + 2y = 0$ $\frac{1}{2}$

OR

Area of triangle $= \frac{1}{2}[1(6+5)-4(-5+1)-3(-1-6)]$ 1

$= \frac{1}{2}[11+16+21] = \frac{48}{2} = 24$ sq. units. 1

9. P(blue marble) $= \frac{1}{5}$, P(black marble) $= \frac{1}{4}$

$\therefore \quad$ P(green marble) $= 1-\left(\frac{1}{5}+\frac{1}{4}\right) = \frac{11}{20}$ 1

Let total number of marbles be x

then $\frac{11}{20} \times x = 11 \Rightarrow x = 20$ 1

10. For unique solution $\frac{1}{3} \neq \frac{2}{k}$ 1

$\Rightarrow \quad k \neq 6$ 1

11. Let larger angle be x°

$\therefore \quad$ Smaller angle = 180° – x° $\frac{1}{2}$

$\therefore \quad$ (x) – (180 – x) = 18 $\frac{1}{2}$

2x = 180 + 18 = 198 $\Rightarrow$ x = 99 $\frac{1}{2}$

$\therefore \quad$ The two angles are 99°, 81° $\frac{1}{2}$

OR

Let Son's present age be x years

Then Sumit's present age = 3x years. $\frac{1}{2}$

$\therefore$ 5 Years later, we have, $3x + 5 = \frac{5}{2}(x + 5)$ $\frac{1}{2}$

$6x + 10 = 5x + 25 \Rightarrow x = 15$ $\frac{1}{2}$

$\therefore$ Sumit's present age = 45 years $\frac{1}{2}$

12. Maximum frequency = 50, class (modal) = 35 – 40. $\frac{1}{2}$

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

$$= 35 + \frac{50 - 34}{100 - 34 - 42} \times 5$$ 1

$$= 35 + \frac{16}{24} \times 5 = 38.33$$ $\frac{1}{2}$

SECTION C

13. Let $2 + 5\sqrt{3} = a$, where 'a' is a rational number. $\frac{1}{2}$

than $\sqrt{3} = \frac{a - 2}{5}$ 1

Which is a contradiction as LHS is irrational and RHS is rational 1

$\therefore$ $2 + 5\sqrt{3}$ can not be rational $\frac{1}{2}$

Hence $2 + 5\sqrt{3}$ is irrational.

Alternate method:

Let $2 + 5\sqrt{3}$ be rational $\frac{1}{2}$

$\therefore$ $2 + 5\sqrt{3} = \frac{p}{q}$, p, q are integers, $q \neq 0$

$\Rightarrow \sqrt{3} = \left(\frac{p}{q} - 2\right) \div 5 = \frac{p - 2q}{5q}$ 1

LHS is irrational and RHS is rational

which is a contradiction. 1

$\therefore\ 2 + 5\sqrt{3}$ is irrational. $\frac{1}{2}$

OR

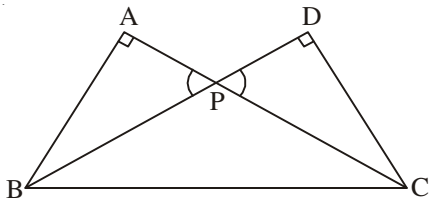
2048 = 960 × 2 + 128

960 = 128 × 7 + 64 2

128 = 64 × 2 + 0

$\therefore$ HCF (2048, 960) = 64 1

14.



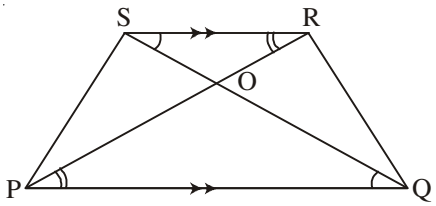
Correct Figure $\frac{1}{2}$

$\Delta APB \sim \Delta DPC$ [AA similarity] 1

$\frac{AP}{DP} = \frac{BP}{PC}$ 1

$\Rightarrow$ AP × PC = BP × DP $\frac{1}{2}$

OR



Correct Figure $\frac{1}{2}$

In ΔPOQ and ΔROS

$\left.\begin{matrix}\angle P = \angle R \\ \angle Q = \angle S\end{matrix}\right\}$ alt. $\angle$s

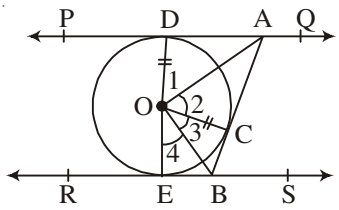
$\therefore$ $\Delta POQ \sim \Delta ROS$ [AA similarity] 1

$\therefore\ \frac{ar(\Delta POQ)}{ar(\Delta ROS)} = \left(\frac{PQ}{RS}\right)^2$ 1

$= \left(\frac{3}{1}\right)^2 = \frac{9}{1}$ $\frac{1}{2}$

$\therefore$ ar(ΔPOQ) : ar(ΔROS) = 9 : 1

15.



Correct Figure $\frac{1}{2}$

$\Delta AOD \cong AOC$ [SAS] 1

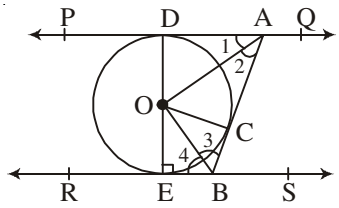
$\Rightarrow \angle 1 = \angle 2$ $\frac{1}{2}$

Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

$\Rightarrow \angle 1 + \angle 4 = \angle 2 + \angle 3 = \frac{1}{2}(180°)$

$\Rightarrow \angle 2 + \angle 3 = 90°$ or $\angle AOB = 90°$ $\frac{1}{2}$

Alternate method:



Correct Figure $\frac{1}{2}$

$\Delta OAD \cong \Delta AOC$ [SAS]

$\Rightarrow \angle 1 = \angle 2$ 1

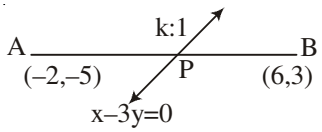
Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

But $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ [$\because$ PQ || RS]

$\Rightarrow \angle 2 + \angle 3 = \angle 1 + \angle 4 = \frac{1}{2}(180°) = 90°$ $\frac{1}{2}$

$\therefore$ In ΔAOB, $\angle AOB = 180° - (\angle 2 + \angle 3) = 90°$ $\frac{1}{2}$

16.



Let the line $x - 3y = 0$ intersect the segment

joining A(–2, –5) and B(6, 3) in the ratio k : 1 $\frac{1}{2}$

$\therefore$ Coordinates of P are $\left(\frac{6k-2}{k+1}, \frac{3k-5}{k+1}\right)$ 1

P lies on $x - 3y = 0 \Rightarrow \frac{6k-2}{k+1} = 3\left(\frac{3k-5}{k+1}\right) \Rightarrow k = \frac{13}{3}$

$\therefore$ Ratio is 13 : 3 1

$\Rightarrow$ Coordinates of P are $\left(\frac{9}{2}, \frac{3}{2}\right)$ $\frac{1}{2}$

17. $\left(\frac{3\sin 43°}{\cos 47°}\right)^2 - \frac{\cos 37° \operatorname{cosec} 53°}{\tan 5° \tan 25° \tan 45° \tan 65° \tan 85°}$

$= \left(\frac{3\sin 43°}{\cos(90° - 43°)}\right)^2 - \frac{\cos 37° . \operatorname{cosec}(90° - 37°)}{\tan 5° \tan 25°(1) \tan(90° - 25°) \tan(90° - 5°)}$ 1

$= \left(\frac{3\sin 43°}{\sin 43°}\right)^2 - \frac{\cos 37° . \sec 37°}{\tan 5° . \tan 25°(1) \cot 25° \cot 5°}$ 1

$= 9 - \frac{1}{1} = 8$ 1

18. Radius of quadrant = OB $= \sqrt{15^2 + 15^2} = 15\sqrt{2}$ cm. 1

Shaded area = Area of quadrant – Area of square $\frac{1}{2}$

$= \frac{1}{4}(3.14)[(15\sqrt{2})^2 - (15)^2]$ 1

$= (15)^2 (1.57 - 1) = 128.25 \text{ cm}^2$ $\frac{1}{2}$

OR

$BD = \sqrt{(2\sqrt{2})^2 + (2\sqrt{2})^2} = \sqrt{16} = 4 \text{ cm}$ 1

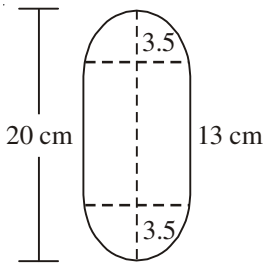
$\therefore$ Radius of circle = 2 cm $\frac{1}{2}$

$\therefore$ Shaded area = Area of circle – Area of square $\frac{1}{2}$

$= 3.14 \times 2^2 - (2\sqrt{2})^2$

$= 12.56 - 8 = 4.56 \text{ cm}^2$ 1

19.



Height of cylinder = 20 – 7 = 13 cm. 1

Total volume = $\pi\left(\frac{7}{2}\right)^2 \cdot 13 + \frac{4}{3}\pi\left(\frac{7}{2}\right)^3 \text{ cm}^3$ 1

$= \frac{22}{7} \times \frac{49}{4}\left(13 + \frac{4}{3} \cdot \frac{7}{2}\right) \text{cm}^3$

$= \frac{77 \times 53}{6} = 680.17 \text{ cm}^3$ 1

20.

x_i :	32.5	37.5	42.5	47.5	52.5	57.5	62.5		$\frac{1}{2}$
f_i :	14	16	28	23	18	8	3	$\Sigma f_i = 110$	$\frac{1}{2}$
u_i :	–3	–2	–1	0	1	2	3		
f_iu_i :	–42	–32	–28	0	18	16	9,	$\Sigma f_iu_i = -59$	1

Mean $= 47.5 - \frac{59 \times 5}{110} = 47.5 - 2.68 = 44.82$ 1

Note: If N is taken as 100, Ans. 44.55 Accept.

If some one write, data is wrong, give full 3 marks.

21.

$$3x^2 - 5 \overline{)3x^4 - 9x^3 + x^2 + 15x + k} \; x^2 - 3x + 2$$

$3x^4 \quad -5x^2$

$-9x^3 + 6x^2 + 15x + k$

$-9x^3 \quad +15x$

$6x^2 + k$

$6x^2 - 10$

$k + 10$ 2

$\therefore \quad k + 10 = 0 \Rightarrow k = -10$ 1

OR

$$p(y) = 7y^2 - \frac{11}{3}y - \frac{2}{3} = \frac{1}{3}(21y^2 - 11y - 2)$$

$$= \frac{1}{3}[(7y + 1)(3y - 2)]$$ 1

$\therefore$ Zeroes are 2/3, –1/7 $\frac{1}{2}$

Sum of zeroes $= \frac{2}{3} - \frac{1}{7} = \frac{11}{21}$

$\frac{-b}{a} = \frac{11}{21} \quad \therefore$ sum of zeroes $= \frac{-b}{a}$ 1

Product of zeroes $= \left(\frac{2}{3}\right)\left(-\frac{1}{7}\right) = -\frac{2}{21}$

$\frac{c}{a} = -\frac{2}{3}\left(\frac{1}{7}\right) = -\frac{2}{21}$ $\therefore$ Product $= \frac{c}{a}$ $\frac{1}{2}$

22. $x^2 + px + 16 = 0$ have equal roots if $D = p^2 - 4(16)(1) = 0$ 1

$p^2 = 64 \Rightarrow p = \pm 8$ $\frac{1}{2}$

$\therefore$ $x^2 \pm 8x + 16 = 0 \Rightarrow (x \pm 4)^2 = 0$ 1

$x \pm 4 = 0$

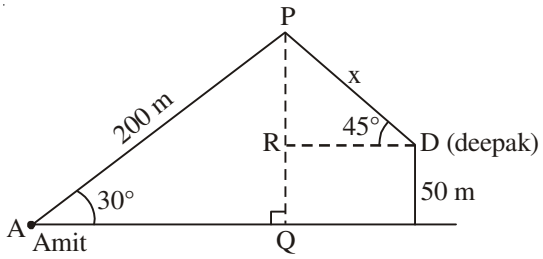
$\therefore$ Roots are $x = -4$ and $x = 4$ $\frac{1}{2}$

SECTION D

23. For correct, given, to prove, construction and figure $\frac{1}{2} \times 4 = 2$

For correct proof. 2

24.



Correct Figure 1

In ΔAPQ

$\frac{PQ}{AP} = \sin 30° = \frac{1}{2}$ $\frac{1}{2}$

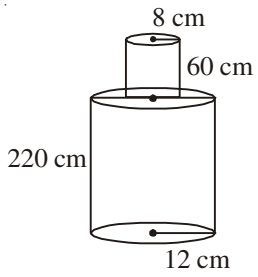
$PQ = (200)\left(\frac{1}{2}\right) = 100\text{ m}$ 1

$PR = 100 - 50 = 50$ m $\frac{1}{2}$

In ΔPRD, $\frac{PR}{PD} = \sin 45° = \frac{1}{\sqrt{2}}$

$PD = (PR)(\sqrt{2}) = 50\sqrt{2}$ m 1

25.



Total volume = $3.14\ (12)^2\ (220) + 3.14(8)^2(60)\ \text{cm}^3$ 1

$= 99475.2 + 12057.6 = 111532.8\ \text{cm}^3$ 1

Mass $= \frac{111532.8 \times 8}{1000}$ kg 1

$= 892.262$ kg 1

26. Constructing an equilateral triangle of side 5 cm 1

Constructing another similar Δ with scale factor $\frac{2}{3}$ 3

OR

Constructing two concentric circle of radii 2 cm and 5 cm 1

Drawing two tangents PA and PB 2

PA = 4.5 cm (approx) 1

27.

Less than	40	less than 50	less than 60	less than 70	less than 80	less than 90	less than 100	$\frac{1}{2}$
cf.	7	12	20	30	36	42	50	1

Plotting of points (40, 7), (50, 12), (60, 20), (70, 30), (80, 36), (90, 42) and (100, 50) $1\frac{1}{2}$

Joining the points to get the curve 1

28. LHS $= \dfrac{\tan\theta}{1-\dfrac{1}{\tan\theta}} + \dfrac{\dfrac{1}{\tan\theta}}{1-\tan\theta} = \dfrac{\tan^2\theta}{\tan\theta - 1} - \dfrac{1}{\tan\theta(\tan\theta - 1)}$ 1

$= \dfrac{\tan^3\theta - 1}{\tan\theta(\tan\theta - 1)} = \dfrac{(\tan\theta - 1)(\tan^2\theta + \tan\theta + 1)}{\tan\theta(\tan\theta - 1)}$ 1

$= \tan\theta + 1 + \cot\theta = 1 + \dfrac{\sin\theta}{\cos\theta} + \dfrac{\cos\theta}{\sin\theta} = 1 + \dfrac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ 1

$= 1 + \dfrac{1}{\sin\theta\cos\theta} = 1 + \operatorname{cosec}\theta\sec\theta = \text{RHS}$ 1

OR

Consider

$\dfrac{\sin\theta}{\operatorname{cosec}\theta + \cot\theta} - \dfrac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta} = \dfrac{\sin\theta}{\operatorname{cosec}\theta + \cot\theta} + \dfrac{\sin\theta}{\operatorname{cosec}\theta - \cot\theta}$ 1+1

$= \dfrac{\sin\theta[\operatorname{cosec}\theta - \cot\theta + \operatorname{cosec}\theta + \cot\theta]}{\operatorname{cosec}^2\theta - \cot^2\theta} = \dfrac{\sin\theta(2\operatorname{cosec}\theta)}{1} = 2$ $1\frac{1}{2}$

Hence $\dfrac{\sin\theta}{\operatorname{cosec}\theta + \cot\theta} = 2 + \dfrac{\sin\theta}{\cot\theta - \operatorname{cosec}\theta}$ $\frac{1}{2}$

29. Let $-82 = a_n \therefore -82 = -7 + (n-1)(-5)$ 1

$\Rightarrow \quad 15 = n - 1$ or $n = 16$ 1

Again $-100 = a_m = -7 + (m - 1)(-5)$ 1

$\Rightarrow$ $(m - 1)(-5) = -93$

$m - 1 = \frac{93}{5}$ or $m = \frac{93}{5} + 1 \notin N$ 1

$\therefore$ -100 is not a term of the AP.

OR

$S_n = 180 = \frac{n}{2} \cdot [90 + (n - 1)(-6)]$ 1

$360 = 90n - 6n^2 + 6n \Rightarrow 6n^2 - 96n + 360 = 0$ 1

$\Rightarrow$ $6[(n - 6)(n - 10)] = 0 \Rightarrow n = 6, n = 10$ 1

Sum of $a_7, a_8, a_9, a_{10} = 0$ $\therefore$ $n = 6$ or $n = 10$ 1

30. Let marks in Hindi be x

Then marks in Eng $= 30 - x$ $\frac{1}{2}$

$\therefore$ $(x + 2)(30 - x - 3) = 210$ 1

$\Rightarrow$ $x^2 - 25x + 156 = 0$ or $(x - 13)(x - 12) = 0$ 1

$\Rightarrow$ $x = 13$ or $x = 12$

$\therefore$ $30 - 13 = 17$ or $30 - 12 = 18$ 1

$\therefore$ Marks in Hindi & English are

(13, 17) or (12, 18) $\frac{1}{2}$

QUESTION PAPER CODE 30/2/2

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. Point on x-axis is (2, 0) 1

2. $\sin^2 60° + 2 \tan 45° - \cos^2 30 = \left(\frac{\sqrt{3}}{2}\right)^2 + 2(1) - \left(\frac{\sqrt{3}}{2}\right)^2$ [For any two correct values] $\frac{1}{2}$

$= 2$ $\frac{1}{2}$

OR

$\sin A = \frac{3}{4} \Rightarrow \cos A = \sqrt{1 - \frac{9}{16}} = \frac{\sqrt{7}}{4}$ $\frac{1}{2}$

$\sec A = \frac{4}{\sqrt{7}}$ $\frac{1}{2}$

3. ΔABC: Isosceles $\Delta \Rightarrow AC = BC = 4$ cm. $\frac{1}{2}$

$AB = \sqrt{4^2 + 4^2} = 4\sqrt{2}$ cm $\frac{1}{2}$

OR

$\frac{AD}{BD} = \frac{AE}{CE} \Rightarrow \frac{AD}{7.2} = \frac{1.8}{5.4}$ $\frac{1}{2}$

$\therefore \quad AD = \frac{7.2 \times 1.8}{5.4} = 2.4$ cm. $\frac{1}{2}$

4. $\frac{3 - a}{3a} - \frac{1}{a} = \frac{3 - a - 3}{3a} = -\frac{1}{3}$ 1

5. LCM (336, 54) $= \frac{336 \times 54}{6}$ $\frac{1}{2}$

$= 336 \times 9 = 3024$ $\frac{1}{2}$

6. $a = -4\frac{1}{2}, \ d = 1\frac{1}{2}, \ \therefore \ a_{21} = -\frac{9}{2} + 20\left(\frac{3}{2}\right)$ $\frac{1}{2}$

$= \frac{51}{2}$ $\frac{1}{2}$

SECTION B

7. For infinitely many solutions,

$$\frac{2}{k+2} = \frac{3}{-3(1-k)} = \frac{7}{5k+1}$$ 1

$\Rightarrow$ $2k - 2 = k + 2$ or $5k + 1 = 7k - 7$

$\Rightarrow$ $k = 4$ $\Rightarrow 2k = 8$ $\Rightarrow k = 4$

Hence $k = 4$. 1

8. Maximum frequency = 50, class (modal) = 35 – 40. $\frac{1}{2}$

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

$$= 35 + \frac{50 - 34}{100 - 34 - 42} \times 5$$ 1

$$= 35 + \frac{16}{24} \times 5 = 38.33$$ $\frac{1}{2}$

9. Let larger angle be x°

$\therefore$ Smaller angle = 180° – x° $\frac{1}{2}$

$\therefore$ $(x) - (180 - x) = 18$ $\frac{1}{2}$

$2x = 180 + 18 = 198 \Rightarrow x = 99$ $\frac{1}{2}$

$\therefore$ The two angles are 99°, 81° $\frac{1}{2}$

OR

Let Son's present age be x years

Then Sumit's present age = 3x years. $\frac{1}{2}$

$\therefore$ 5 Years later, we have, $3x + 5 = \frac{5}{2}(x + 5)$ $\frac{1}{2}$

$6x + 10 = 5x + 25 \Rightarrow x = 15$ $\frac{1}{2}$

$\therefore$ Sumit's present age = 45 years $\frac{1}{2}$

10. P(blue marble) = $\frac{1}{5}$, P(black marble) = $\frac{1}{4}$

$\therefore$ P(green marble) = $1-\left(\frac{1}{5}+\frac{1}{4}\right)=\frac{11}{20}$ 1

Let total number of marbles be x

then $\frac{11}{20}\times x = 11 \Rightarrow x = 20$ 1

11. A, B, C are collinear $\Rightarrow$ ar. (ΔABC) = 0 $\frac{1}{2}$

$\therefore$ $\frac{1}{2}[x(6-3)-4(3-y)-2(y-6)] = 0$ 1

$\Rightarrow$ $3x + 2y = 0$ $\frac{1}{2}$

OR

Area of triangle = $\frac{1}{2}[1(6+5)-4(-5+1)-3(-1-6)]$ 1

$= \frac{1}{2}[11+16+21]=\frac{48}{2}=24$ sq. units. 1

12. Smallest number divisible by 306 and 657 = LCM (306, 657) 1

LCM (306, 657) = 22338 1

SECTION C

13. $\frac{XA}{XY} = \frac{2}{5} \Rightarrow \frac{XA}{AY}=\frac{2}{3}$ 1

$\therefore$ Coords. of A are $\left(\frac{-8+18}{5}, \frac{-2-18}{5}\right)$ i.e. $(2, -4)$ 1

A lies on $3x + k(y + 1) = 0$

$\Rightarrow$ $6 + k(-3) = \Rightarrow k = 2$. 1

14. $x^2 + 5x - (a + 3)(a - 2) = 0$

$x^2 + (a + 3)x - (a - 2)x - (a + 3)(a - 2) = 0$ $1\frac{1}{2}$

$[x + (a + 3)][x - (a - 2)] = 0$

$\Rightarrow$ $x = (a - 2)$ or $x = -(a + 3)$ $1\frac{1}{2}$

Alternate method:

$x^2 + 5x - (a^2 + a - 6) = 0$

$x = \dfrac{-5 \pm \sqrt{25 + 4(a^2 + a - 6)}}{2}$ 1

$= \dfrac{-5 \pm (2a + 1)}{2}$ 1

$x = (a - 2), -(a + 3)$ 1

15. $A + 2B = 60°$ and $A + 4B = 90°$ 1+1

Solving to get $B = 15°$ and $A = 30°$ 1

16. Let $2 + 5\sqrt{3} = a$, where 'a' is a rational number. $\frac{1}{2}$

than $\sqrt{3} = \dfrac{a - 2}{5}$ 1

Which is a contradiction as LHS is irrational and RHS is rational 1

$\therefore$ $2 + 5\sqrt{3}$ can not be rational $\frac{1}{2}$

Hence $2 + 5\sqrt{3}$ is irrational.

Alternate method:

Let $2 + 5\sqrt{3}$ be rational $\frac{1}{2}$

$\therefore$ $2 + 5\sqrt{3} = \dfrac{p}{q}$, p, q are integers, $q \neq 0$

$\Rightarrow \sqrt{3} = \left(\dfrac{p}{q} - 2\right) \div 5 = \dfrac{p - 2q}{5q}$ 1

LHS is irrational and RHS is rational

which is a contradiction 1

$\therefore$ $2 + 5\sqrt{3}$ is irrational. $\frac{1}{2}$

OR

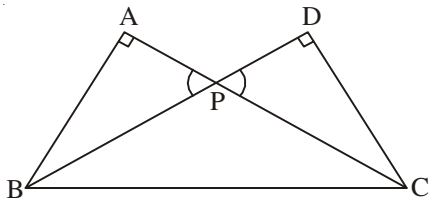
$2048 = 960 \times 2 + 128$

$960 = 128 \times 7 + 64$ 2

$128 = 64 \times 2 + 0$

$\therefore$ HCF (2048, 960) = 64 1

17.



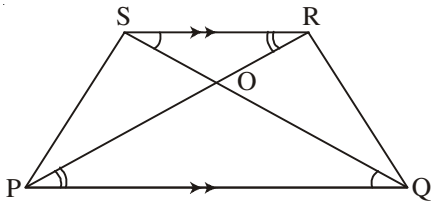
Correct Figure $\frac{1}{2}$

$\Delta APB \sim \Delta DPC$ [AA similarity] 1

$\frac{AP}{DP} = \frac{BP}{PC}$ 1

$\Rightarrow AP \times PC = BP \times DP$ $\frac{1}{2}$

OR



Correct Figure $\frac{1}{2}$

In ΔPOQ and ΔROS

$\left.\begin{matrix}\angle P = \angle R \\ \angle Q = \angle S\end{matrix}\right\}$ alt. $\angle$s

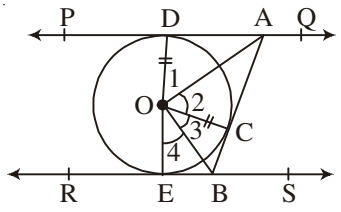
$\therefore$ $\Delta POQ \sim \Delta ROS$ [AA similarity] 1

$\therefore \quad \frac{ar(\Delta POQ)}{ar(\Delta ROS)} = \left(\frac{PQ}{RS}\right)^2$ 1

$= \left(\frac{3}{1}\right)^2 = \frac{9}{1}$ $\frac{1}{2}$

$\therefore$ ar(ΔPOQ) : ar(ΔROS) = 9 : 1

18.



Correct Figure $\frac{1}{2}$

$\Delta AOD \cong AOC$ [SAS] 1

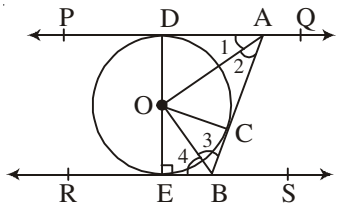
$\Rightarrow \angle 1 = \angle 2$ $\frac{1}{2}$

Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

$\Rightarrow \angle 1 + \angle 4 = \angle 2 + \angle 3 = \frac{1}{2}(180°)$

$\Rightarrow \angle 2 + \angle 3 = 90°$ or $\angle AOB = 90°$ $\frac{1}{2}$

Alternate method:



Correct Figure $\frac{1}{2}$

$\Delta OAD \cong \Delta AOC$ [SAS]

$\Rightarrow \angle 1 = \angle 2$ 1

Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

But $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ [$\because$ PQ || RS]

$\Rightarrow \angle 2 + \angle 3 = \angle 1 + \angle 4 = \frac{1}{2}(180°) = 90°$ $\frac{1}{2}$

$\therefore$ In ΔAOB, $\angle AOB = 180° - (\angle 2 + \angle 3) = 90°$ $\frac{1}{2}$

19. Radius of quadrant = $OB = \sqrt{15^2 + 15^2} = 15\sqrt{2}$ cm. 1

Shaded area = Area of quadrant – Area of square $\frac{1}{2}$

$= \frac{1}{4}(3.14)[(15\sqrt{2})^2 - (15)^2]$ 1

$= (15)^2\,(1.57 - 1) = 128.25\ \text{cm}^2$ $\frac{1}{2}$

OR

$BD = \sqrt{(2\sqrt{2})^2 + (2\sqrt{2})^2} = \sqrt{16} = 4\ \text{cm}$ 1

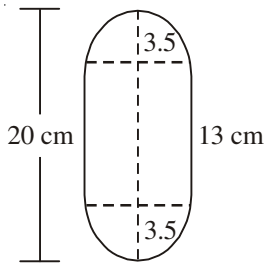
$\therefore$ Radius of circle = 2 cm $\frac{1}{2}$

$\therefore$ Shaded area = Area of circle – Area of square $\frac{1}{2}$

$= 3.14 \times 2^2 - (2\sqrt{2})^2$

$= 12.56 - 8 = 4.56\ \text{cm}^2$ 1

20. Height of cylinder = 20 – 7 = 13 cm. 1



Total volume = $\pi\left(\frac{7}{2}\right)^2 \cdot 13 + \frac{4}{3}\pi\left(\frac{7}{2}\right)^2\ \text{cm}^3$ 1

$= \frac{22}{7} \times \frac{49}{4}\left(13 + \frac{4}{3} \cdot \frac{7}{2}\right)\text{cm}^3$

$= \frac{77 \times 53}{6} = 680.17\ \text{cm}^3$ 1

21.

x_i :	32.5	37.5	42.5	47.5	52.5	57.5	62.5		$\frac{1}{2}$
f_i :	14	16	28	23	18	8	3	$\Sigma f_i = 110$	$\frac{1}{2}$
u_i :	–3	–2	–1	0	1	2	3		
f_iu_i :	–42	–32	–28	0	18	16	9,	$\Sigma f_iu_i = -59$	1

Mean $= 47.5 - \frac{59 \times 5}{110} = 47.5 - 2.68 = 44.82$ 1

Note: If N is taken as 100, Ans. 44.55 Accept.

If some one write, data is wrong, give full 3 marks.

22.

$$3x^2 - 5 \overline{)3x^4 - 9x^3 + x^2 + 15x + k} \; x^2 - 3x + 2$$

$3x^4 \quad -5x^2$ (– +)

$-9x^3 + 6x^2 + 15x + k$

$-9x^3 \quad +15x$ (+ –)

$6x^2 + k$

$6x^2 - 10$ (– +)

$k + 10$ 2

$\therefore \quad k + 10 = 0 \Rightarrow k = -10$ 1

OR

$p(y) = 7y^2 - \frac{11}{3}y - \frac{2}{3} = \frac{1}{3}(21y^2 - 11y - 2)$

$= \frac{1}{3}[(7y + 1)(3y - 2)]$ 1

$\therefore \quad$ Zeroes are 2/3, –1/7 $\frac{1}{2}$

Sum of zeroes $= \frac{2}{3} - \frac{1}{7} = \frac{11}{21}$

$\frac{-b}{a} = \frac{11}{21} \quad \therefore$ sum of zeroes $= \frac{-b}{a}$ 1

Product of zeroes $= \left(\frac{2}{3}\right)\left(-\frac{1}{7}\right) = -\frac{2}{21}$

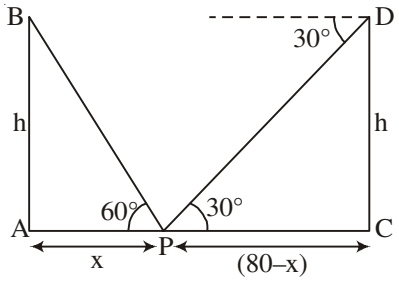
$\frac{c}{a} = -\frac{2}{3}\left(\frac{1}{7}\right) = -\frac{2}{21}$ $\therefore$ Product $= \frac{c}{a}$ $\frac{1}{2}$

SECTION D

23. For correct given, to prove, construction and figure $4\times\frac{1}{2}=2$

For correct proof. 2

24.



Correct Figure 1

In ΔABP, $\frac{h}{x} = \tan 60° = \sqrt{3}$ ...(i) $\frac{1}{2}$

In ΔCDP, $\frac{h}{80-x} = \tan 30° = \frac{1}{\sqrt{3}}$ ...(ii) $\frac{1}{2}$

dividing (i) by (ii) we get $\frac{80-x}{x} = \frac{3}{1}$

$\Rightarrow$ $3x = 80 - x$ or $4x = 80 \Rightarrow x = 20$ m. 1

and $h = 20\sqrt{3}$ m. $\frac{1}{2}$

$\therefore$ Height of poles is $20\sqrt{3}$ m

and P is at distances 20 m and 60 m from poles $\frac{1}{2}$

25. Let total length of cloth = l m.

$\therefore$ Rate per metre = ₹ $\frac{200}{l}$ $\frac{1}{2}$

$\Rightarrow$ $(l+5)\left(\frac{200}{l}-2\right) = 200$ 1

$\Rightarrow$ $(l + 5)\ (200 - 2l) = 200l \Rightarrow l^2 + 5l - 500 = 0$ 1

$\Rightarrow$ $(l + 25)(l - 20) = \Rightarrow l = 20$ m. 1

$\therefore$ Rate per metre = ₹ $\frac{200}{20} = ₹10$ per metre $\frac{1}{2}$

26. Let $-82 = a_n \therefore -82 = -7 + (n-1)(-5)$ 1

$\Rightarrow \quad 15 = n - 1$ or $n = 16$ 1

Again $-100 = a_m = -7 + (m-1)(-5)$ 1

$\Rightarrow \quad (m-1)(-5) = -93$

$m - 1 = \frac{93}{5}$ or $m = \frac{93}{5} + 1 \notin N$ 1

$\therefore$ -100 is not a term of the AP.

OR

$S_n = 180 = \frac{n}{2} \cdot [90 + (n-1)(-6)]$ 1

$360 = 90n - 6n^2 + 6n \Rightarrow 6n^2 - 96n + 360 = 0$ 1

$\Rightarrow \quad 6[(n-6)(n-10)] = 0 \Rightarrow n = 6, n = 10$ 1

Sum of $a_7, a_8, a_9, a_{10} = 0 \therefore n = 6$ or $n = 10$ 1

27. $\text{LHS} = \frac{\tan\theta}{1 - \frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1 - \tan\theta} = \frac{\tan^2\theta}{\tan\theta - 1} - \frac{1}{\tan\theta(\tan\theta - 1)}$ 1

$= \frac{\tan^3\theta - 1}{\tan\theta(\tan\theta - 1)} = \frac{(\tan\theta - 1)(\tan^2\theta + \tan\theta + 1)}{\tan\theta(\tan\theta - 1)}$ 1

$= \tan\theta + 1 + \cot\theta = 1 + \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = 1 + \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ 1

$= 1 + \frac{1}{\sin\theta\cos\theta} = 1 + \text{cosec}\,\theta\sec\theta = \text{RHS}$ 1

OR

Consider

$\frac{\sin\theta}{\text{cosec}\,\theta + \cot\theta} - \frac{\sin\theta}{\cot\theta - \text{cosec}\,\theta} = \frac{\sin\theta}{\text{cosec}\,\theta + \cot\theta} + \frac{\sin\theta}{\text{cosec}\,\theta - \cot\theta}$ 1+1

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

Hence $\frac{\sin\theta}{\text{cosec}\,\theta + \cot\theta} = 2 + \frac{\sin\theta}{\cot\theta - \text{cosec}\,\theta}$ $\frac{1}{2}$

28.

Less than 40	less than 50	less than 60	less than 70	less than 80	less than 90	less than 100	$\frac{1}{2}$
cf. 7	12	20	30	36	42	50	1

Plotting of points (40, 7), (50, 12), (60, 20), (70, 30), (80, 36), (90, 42) and (100, 50) $1\frac{1}{2}$

Joining the points to get the curve 1

29. Constructing an equilateral triangle of side 5 cm 1

Constructing another similar Δ with scale factor $\frac{2}{3}$ 3

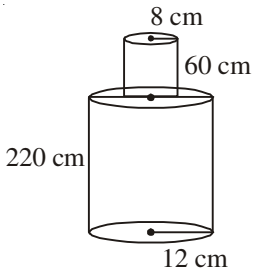
OR

Constructing two concentric circle of radii 2 cm and 5 cm 1

Drawing two tangents PA and PB 2

PA = 4.5 cm (approx) 1

30.



Total volume = $3.14\ (12)^2\ (220) + 3.14(8)^2(60)\ cm^3$ 1

$= 99475.2 + 12057.6 = 111532.8\ cm^3$ 1

Mass = $\frac{111532.8 \times 8}{1000}$ kg 1

= 892.262 kg 1

QUESTION PAPER CODE 30/2/3

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. $D = (4\sqrt{3})^2 - 4(4)(3) = 0$ $\frac{1}{2}$

$\therefore$ Roots are real and equal. $\frac{1}{2}$

2. $\sin^2 60° + 2 \tan 45° - \cos^2 30 = \left(\frac{\sqrt{3}}{2}\right)^2 + 2(1) - \left(\frac{\sqrt{3}}{2}\right)^2$ [For any two correct values] $\frac{1}{2}$

$= 2$ $\frac{1}{2}$

OR

$\sin A = \frac{3}{4} \Rightarrow \cos A = \sqrt{1 - \frac{9}{16}} = \frac{\sqrt{7}}{4}$ $\frac{1}{2}$

$\sec A = \frac{4}{\sqrt{7}}$ $\frac{1}{2}$

3. Point on x-axis is (2, 0) 1

4. ΔABC: Isosceles $\Delta \Rightarrow AC = BC = 4$ cm. $\frac{1}{2}$

$AB = \sqrt{4^2 + 4^2} = 4\sqrt{2}$ cm $\frac{1}{2}$

OR

$\frac{AD}{BD} = \frac{AE}{CE} \Rightarrow \frac{AD}{7.2} = \frac{1.8}{5.4}$ $\frac{1}{2}$

$\therefore$ $AD = \frac{7.2 \times 1.8}{5.4} = 2.4$ cm. $\frac{1}{2}$

5. $2x^2 - 4x + 3 = 0 \Rightarrow D = 16 - 24 = -8$ $\frac{1}{2}$

$\therefore$ Equation has NO real roots $\frac{1}{2}$

6. LCM (336, 54) $= \frac{336 \times 54}{6}$ $\frac{1}{2}$

$= 336 \times 9 = 3024$ $\frac{1}{2}$

SECTION B

7. E_1 : {(1, 5), (2, 5), (3, 5), (4, 5), (5, 5), (6, 5), (5, 1), (5, 2), (5, 3), (5, 4), (5, 6)}

$\therefore$ P(5 will come at least once) = $P(E_1) = \frac{11}{36}$ 1

P(5 will not come either time) = $1 - \frac{11}{36} = \frac{25}{36}$ 1

8. Maximum frequency = 50, class (modal) = 35 – 40. $\frac{1}{2}$

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

= $35 + \frac{50 - 34}{100 - 34 - 42} \times 5$ 1

= $35 + \frac{16}{24} \times 5 = 38.33$ $\frac{1}{2}$

9. Let larger angle be x°

$\therefore$ Smaller angle = 180° – x° $\frac{1}{2}$

$\therefore$ (x) – (180 – x) = 18 $\frac{1}{2}$

2x = 180 + 18 = 198 $\Rightarrow$ x = 99 $\frac{1}{2}$

$\therefore$ The two angles are 99°, 81° $\frac{1}{2}$

OR

Let Son's present age be x years

Then Sumit's present age = 3x years. $\frac{1}{2}$

$\therefore$ 5 Years later, we have, $3x + 5 = \frac{5}{2}(x + 5)$ $\frac{1}{2}$

$6x + 10 = 5x + 25 \Rightarrow x = 15$ $\frac{1}{2}$

$\therefore$ Sumit's present age = 45 years $\frac{1}{2}$

10. A, B, C are collinear $\Rightarrow$ ar. (ΔABC) = 0 $\frac{1}{2}$

$\therefore \quad \frac{1}{2}[x(6-3)-4(3-y)-2(y-6)] = 0$ 1

$\Rightarrow \quad 3x + 2y = 0$ $\frac{1}{2}$

OR

Area of triangle $= \frac{1}{2}[1(6+5)-4(-5+1)-3(-1-6)]$ 1

$= \frac{1}{2}[11+16+21] = \frac{48}{2} = 24$ sq. units. 1

11. For unique solution $\frac{1}{3} \neq \frac{2}{k}$ 1

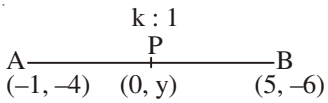
$\Rightarrow \quad k \neq 6$ 1

12. Smallest number divisible by 306 and 657 = LCM (306, 657) 1

LCM (306, 657) = 22338 1

SECTION C

13. Any point on y-axis is P(0, y) 1



Let P divides AB in k : 1

$\Rightarrow 0 = \frac{5k-1}{k+1} \Rightarrow k = \frac{1}{5}$ i.e. 1:5 1

$\Rightarrow \quad y = \frac{-6k-4}{k+1} = \frac{-\frac{6}{5}-4}{\frac{1}{5}+1} = \frac{-26}{6} = \frac{-13}{3}$ 1

$\Rightarrow \quad P$ is $\left(0, \frac{-13}{3}\right)$

14. Given expression $= \left(\frac{3\tan 41^\circ}{\tan 41^\circ}\right)^2 - \left(\frac{\sin 35^\circ \operatorname{cosec} 35^\circ}{\tan 10^\circ \tan 20^\circ (\sqrt{3}) \cot 20^\circ \cot 10^\circ}\right)^2$ $1\frac{1}{2}$

$= 9 - \frac{1}{3} = \frac{26}{3}$ $1\frac{1}{2}$

15. Radius of first sphere = 3 cm $\therefore \frac{4}{3}\pi(3)^3 d = 1 \quad \{d = \text{density}\}$ $\frac{1}{2}$

let radius of 2nd sphere be r cm $\therefore \frac{4}{3}\pi(r)^3.d = 7 \Rightarrow r^3 = 7(3)^3$ $\frac{1}{2}$

$\Rightarrow \quad \frac{4}{3}\pi(3)^3 + \frac{4}{3}\pi\cdot(3)^3\cdot 7 = \frac{4}{3}\pi R^3$ 1

$\Rightarrow \quad R^3 = (3)^3\ (1 + 7) \Rightarrow R = 3(2) = 6$ $\frac{1}{2}$

$\therefore \quad$ Diameter = 12 cm. $\frac{1}{2}$

16. Let $2+5\sqrt{3} = a$, where 'a' is a rational number. $\frac{1}{2}$

then $\sqrt{3} = \frac{a-2}{5}$ 1

Which is a contradiction as LHS is irrational and RHS is rational 1

$\therefore \quad 2+5\sqrt{3}$ can not be rational $\frac{1}{2}$

Hence $2+5\sqrt{3}$ is irrational.

Alternate method:

Let $2+5\sqrt{3}$ be rational $\frac{1}{2}$

$\therefore\ 2+5\sqrt{3} = \frac{p}{q}$, p, q are integers, $q \neq 0$

$\Rightarrow \sqrt{3} = \left(\frac{p}{q} - 2\right) \div 5 = \frac{p-2q}{5q}$ 1

LHS is irrational and RHS is rational

which is a contradiction 1

$\therefore\ 2+5\sqrt{3}$ is irrational. $\frac{1}{2}$

OR

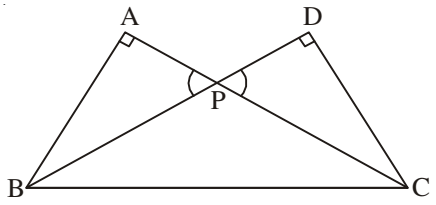
2048 = 960 × 2 + 128

960 = 128 × 7 + 64 2

$128 = 64 \times 2 + 0$

$\therefore$ HCF (2048, 960) = 64 — 1

17.



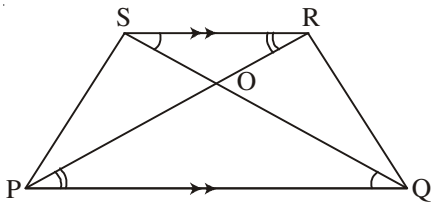
Correct Figure — $\frac{1}{2}$

$\Delta APB \sim \Delta DPC$ [AA similarity] — 1

$\frac{AP}{DP} = \frac{BP}{PC}$ — 1

$\Rightarrow AP \times PC = BP \times DP$ — $\frac{1}{2}$

OR



Correct Figure — $\frac{1}{2}$

In ΔPOQ and ΔROS

$\left.\begin{matrix}\angle P = \angle R \\ \angle Q = \angle S\end{matrix}\right\}$ alt. $\angle$s

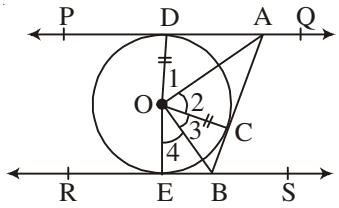
$\therefore$ $\Delta POQ \sim \Delta ROS$ [AA similarity] — 1

$\therefore \quad \frac{ar(\Delta POQ)}{ar(\Delta ROS)} = \left(\frac{PQ}{RS}\right)^2$ — 1

$= \left(\frac{3}{1}\right)^2 = \frac{9}{1}$ — $\frac{1}{2}$

$\therefore$ ar(ΔPOQ) : ar(ΔROS) = 9 : 1

18.



Correct Figure — $\frac{1}{2}$

$\Delta AOD \cong AOC$ [SAS] — 1

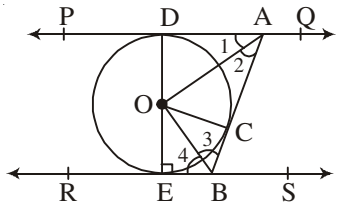
$\Rightarrow \angle 1 = \angle 2$ — $\frac{1}{2}$

Similarly $\angle 4 = \angle 3$ — $\frac{1}{2}$

$\Rightarrow \angle 1 + \angle 4 = \angle 2 + \angle 3 = \frac{1}{2}(180°)$

$\Rightarrow \angle 2 + \angle 3 = 90°$ or $\angle AOB = 90°$ — $\frac{1}{2}$

Alternate method:



Correct Figure $\frac{1}{2}$

$\Delta OAD \cong \Delta AOC$ [SAS]

$\Rightarrow \angle 1 = \angle 2$ 1

Similarly $\angle 4 = \angle 3$ $\frac{1}{2}$

But $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ [$\because$ PQ $\parallel$ RS]

$\Rightarrow \angle 2 + \angle 3 = \angle 1 + \angle 4 = \frac{1}{2}(180°) = 90°$ $\frac{1}{2}$

$\therefore$ In ΔAOB, $\angle AOB = 180° - (\angle 2 + \angle 3) = 90°$ $\frac{1}{2}$

19. Radius of quadrant = $OB = \sqrt{15^2 + 15^2} = 15\sqrt{2}$ cm. 1

Shaded area = Area of quadrant – Area of square $\frac{1}{2}$

$$= \frac{1}{4}(3.14)[(15\sqrt{2})^2 - (15)^2]$$

$= (15)^2 (1.57 - 1) = 128.25 \text{ cm}^2$ $\frac{1}{2}$

OR

$BD = \sqrt{(2\sqrt{2})^2 + (2\sqrt{2})^2} = \sqrt{16} = 4$ cm 1

$\therefore$ Radius of circle = 2 cm $\frac{1}{2}$

$\therefore$ Shaded area = Area of circle – Area of square $\frac{1}{2}$

$$= 3.14 \times 2^2 - (2\sqrt{2})^2$$

$= 12.56 - 8 = 4.56 \text{ cm}^2$ 1

20. $x^2 + px + 16 = 0$ have equal roots if $D = p^2 - 4(16)(1) = 0$ 1

$p^2 = 64 \Rightarrow p = \pm 8$ $\frac{1}{2}$

$\therefore$ $x^2 \pm 8x + 16 = 0 \Rightarrow (x \pm 4)^2 = 0$ 1

$x \pm 4 = 0$

$\therefore$ Roots are $x = -4$ and $x = 4$ $\frac{1}{2}$

21. $3x^2 - 5 \overline{)3x^4 - 9x^3 + x^2 + 15x + k} \; (x^2 - 3x + 2$

$3x^4 \quad - 5x^2$

$- \qquad +$

$-9x^3 + 6x^2 + 15x + k$

$-9x^3 \quad + 15x$

$+ \qquad -$

$6x^2 + k$

$6x^2 - 10$

$- \quad +$

$k + 10$

2

$\therefore \quad k + 10 = 0 \Rightarrow k = -10$ 1

OR

$p(y) = 7y^2 - \frac{11}{3}y - \frac{2}{3} = \frac{1}{3}(21y^2 - 11y - 2)$

$= \frac{1}{3}[(7y + 1)(3y - 2)]$ 1

$\therefore$ Zeroes are 2/3, –1/7 $\frac{1}{2}$

Sum of zeroes $= \frac{2}{3} - \frac{1}{7} = \frac{11}{21}$

$\frac{-b}{a} = \frac{11}{21} \quad \therefore$ sum of zeroes $= \frac{-b}{a}$ 1

Product of zeroes $= \left(\frac{2}{3}\right)\left(-\frac{1}{7}\right) = -\frac{2}{21}$

$\frac{c}{a} = -\frac{2}{3}\left(\frac{1}{7}\right) = -\frac{2}{21} \quad \therefore$ Product $= \frac{c}{a}$ $\frac{1}{2}$

22.

x_i :	32.5	37.5	42.5	47.5	52.5	57.5	62.5		$\frac{1}{2}$
f_i :	14	16	28	23	18	8	3	$\Sigma f_i = 110$	$\frac{1}{2}$
u_i :	–3	–2	–1	0	1	2	3		
f_iu_i :	–42	–32	–28	0	18	16	9,	$\Sigma f_iu_i = -59$	1

Mean $= 47.5 - \frac{59 \times 5}{110} = 47.5 - 2.68 = 44.82$ 1

Note: If N is taken as 100, Ans. 44.55 Accept.

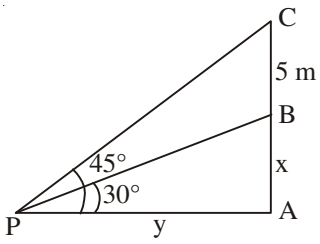
If some one write, data is wrong, give full 3 marks.

SECTION D

23. For correct given, to prove, const. and figure $4\times\frac{1}{2}=2$

For correct proof. 2

24.



In ΔPAC, Correct Figure 1

$\frac{AC}{AP} = \tan 45° = 1$ 1

$\Rightarrow x + 5 = y$ $\frac{1}{2}$

In ΔPAB, $\frac{x}{y} = \tan 30° = \frac{1}{\sqrt{3}}$

$\frac{x}{x+5} = \frac{1}{\sqrt{3}} \Rightarrow x = \frac{5}{\sqrt{3}-1} = \frac{5(\sqrt{3}+1)}{3} = 6.83$ $1\frac{1}{2}$

$\therefore$ Height of tower = 6.83 m

25. Volume of ice-cream in the cylinder = $\pi(6)^2 \cdot 15$ cm^3 1

Volume of ice-cream in one cone = $\frac{1}{3}\pi r^2 \cdot 4r + \frac{2}{3}\pi r^3$ cm^3 1
(Given h = 4r)

$= 2\pi r^3$ cm^3 $\frac{1}{2}$

$\Rightarrow \quad 10(2\pi r^3) = \pi(6)^2 \times 15$ 1

$\Rightarrow \quad r^3 = (3)^3 \Rightarrow r = 3$ cm. $\frac{1}{2}$

26. Let marks in Hindi be x

Then marks in Eng = 30 – x $\frac{1}{2}$

$\therefore \quad (x + 2)\ (30 - x - 3) = 210$ 1

$\Rightarrow \quad x^2 - 25x + 156 = 0$ or $(x - 13)\ (x - 12) = 0$ 1

$\Rightarrow \quad x = 13$ or $x = 12$

$\therefore$ $30 - 13 = 17$ or $30 - 12 = 18$ 1

$\therefore$ Marks in Hindi & English are

(13, 17) or (12, 18) $\frac{1}{2}$

27. Let $-82 = a_n$ $\therefore$ $-82 = -7 + (n - 1)(-5)$ 1

$\Rightarrow$ $15 = n - 1$ or $n = 16$ 1

Again $-100 = a_m = -7 + (m - 1)(-5)$ 1

$\Rightarrow$ $(m - 1)(-5) = -93$

$m - 1 = \frac{93}{5}$ or $m = \frac{93}{5} + 1 \notin N$ 1

$\therefore$ -100 is not a term of the AP.

OR

$S_n = 180 = \frac{n}{2} \cdot [90 + (n-1)(-6)]$ 1

$360 = 90n - 6n^2 + 6n \Rightarrow 6n^2 - 96n + 360 = 0$ 1

$\Rightarrow$ $6[(n - 6)(n - 10)] = 0 \Rightarrow n = 6, n = 10$ 1

Sum of $a_7, a_8, a_9, a_{10} = 0$ $\therefore$ $n = 6$ or $n = 10$ 1

28. $\text{LHS} = \frac{\tan\theta}{1 - \frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1 - \tan\theta} = \frac{\tan^2\theta}{\tan\theta - 1} - \frac{1}{\tan\theta(\tan\theta - 1)}$ 1

$= \frac{\tan^3\theta - 1}{\tan\theta(\tan\theta - 1)} = \frac{(\tan\theta - 1)(\tan^2\theta + \tan\theta + 1)}{\tan\theta(\tan\theta - 1)}$ 1

$= \tan\theta + 1 + \cot\theta = 1 + \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = 1 + \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$ 1

$= 1 + \frac{1}{\sin\theta\cos\theta} = 1 + \text{cosec}\,\theta\,\sec\theta = \text{RHS}$ 1

OR

Consider

$$\frac{\sin\theta}{\text{cosec}\,\theta+\cot\theta}-\frac{\sin\theta}{\cot\theta-\text{cosec}\,\theta}=\frac{\sin\theta}{\text{cosec}\,\theta+\cot\theta}+\frac{\sin\theta}{\text{cosec}\,\theta-\cot\theta} \qquad 1+1$$

$$=\frac{\sin\theta[\text{cosec}\,\theta-\cot\theta+\text{cosec}\,\theta+\cot\theta]}{\text{cosec}^2\theta-\cot^2\theta}=\frac{\sin\theta(2\,\text{cosec}\,\theta)}{1}=2 \qquad 1\frac{1}{2}$$

Hence $\frac{\sin\theta}{\text{cosec}\,\theta+\cot\theta}=2+\frac{\sin\theta}{\cot\theta-\text{cosec}\,\theta}$ $\frac{1}{2}$

29.

Less than	40	less than 50	less than 60	less than 70	less than 80	less than 90	less than 100	$\frac{1}{2}$
cf.	7	12	20	30	36	42	50	1

Plotting of points (40, 7), (50, 12), (60, 20), (70, 30), (80, 36), (90, 42) and (100, 50) $1\frac{1}{2}$

Joining the points to get the curve 1

30. Constructing an equilateral triangle of side 5 cm 1

Constructing another similar Δ with scale factor $\frac{2}{3}$ 3

OR

Constructing two concentric circle of radii 2 cm and 5 cm 1

Drawing two tangents PA and PB 2

PA = 4.5 cm (approx) 1