SET-1

Series JMS/3

कोड नं.
Code No. 30/3/1

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. द्विघात समीकरण $(x + 5)^2 = 2(5x - 3)$ का विविक्तकर (discriminant) लिखिए ।

Write the discriminant of the quadratic equation $(x + 5)^2 = 2(5x - 3)$.

2. ज्ञात कीजिए कि संख्या $\frac{27}{2^3 . 5^4 . 3^2}$ के दशमलव रूप का दशमलव के कितने स्थानों के बाद अंत होगा ।

अथवा

संख्या 429 को इसके अभाज्य गुणनखण्डों के गुणनफल के रूप में व्यक्त कीजिए ।

Find after how many places of decimal the decimal form of the number $\frac{27}{2^3 . 5^4 . 3^2}$ will terminate.

OR

Express 429 as a product of its prime factors.

3. 6 के प्रथम 10 गुणजों का योगफल ज्ञात कीजिए ।

Find the sum of first 10 multiples of 6.

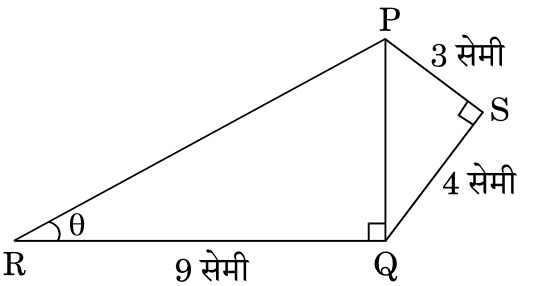
4. यदि बिंदु A(0, 0) तथा बिंदु B(x, – 4) के बीच की दूरी 5 इकाई है, तो x के मान ज्ञात कीजिए ।

Find the value(s) of x, if the distance between the points A(0, 0) and B(x, – 4) is 5 units.

5. त्रिज्याएँ a तथा b (a > b) के दो संकेन्द्री वृत्त दिए गए हैं । बड़े वृत्त की जीवा, जो छोटे वृत्त की स्पर्श-रेखा है, की लम्बाई ज्ञात कीजिए ।

Two concentric circles of radii a and b (a > b) are given. Find the length of the chord of the larger circle which touches the smaller circle.

6. आकृति 1 में, PS = 3 सेमी, QS = 4 सेमी, $\angle$ PRQ = θ, $\angle$ PSQ = 90°, PQ $\perp$ RQ तथा RQ = 9 सेमी है । tan θ का मान ज्ञात कीजिए ।



आकृति 1

अथवा

यदि $\tan \alpha = \frac{5}{12}$ है, तो sec α का मान ज्ञात कीजिए ।

In Figure 1, PS = 3 cm, QS = 4 cm, $\angle$ PRQ = θ, $\angle$ PSQ = 90°, PQ $\perp$ RQ and RQ = 9 cm. Evaluate tan θ.

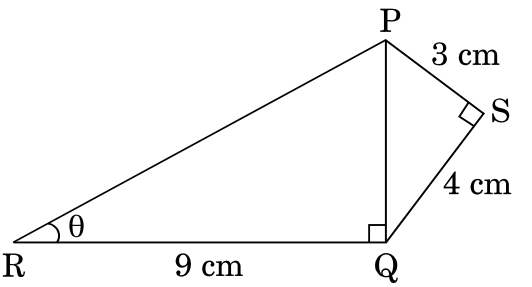


Figure 1

OR

If $\tan \alpha = \frac{5}{12}$, find the value of sec α.

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. बिंदु A(3, 1), B(5, 1), C(a, b) तथा D(4, 3) एक समांतर चतुर्भुज ABCD के शीर्ष बिंदु हैं । a तथा b के मान ज्ञात कीजिए ।

अथवा

बिंदुओं A(– 2, 0) तथा B(0, 8) को जोड़ने वाले रेखाखंड को बिंदु P तथा बिंदु Q समत्रिभाजित करते हैं, जहाँ P बिंदु A के निकट है । बिंदुओं P तथा Q के निर्देशांक ज्ञात कीजिए ।

Points A(3, 1), B(5, 1), C(a, b) and D(4, 3) are vertices of a parallelogram ABCD. Find the values of a and b.

OR

Points P and Q trisect the line segment joining the points A(– 2, 0) and B(0, 8) such that P is near to A. Find the coordinates of points P and Q.

8. निम्न रैखिक समीकरण युग्म को हल कीजिए :

$$3x - 5y = 4$$
$$2y + 7 = 9x$$

Solve the following pair of linear equations :

$$3x - 5y = 4$$
$$2y + 7 = 9x$$

9. यदि 65 तथा 117 के म.स. (HCF) को 65n – 117 के रूप में दर्शाया जा सकता है, तो n का मान ज्ञात कीजिए ।

अथवा

तीन लोग सुबह की सैर के लिए एक साथ बाहर निकले और उनके कदम की लम्बाई क्रमश: 30 cm, 36 cm तथा 40 cm है । प्रत्येक को न्यूनतम कितनी दूरी तय करनी होगी कि सभी अपने पूर्ण कदमों में समान दूरी चलें ?

If HCF of 65 and 117 is expressible in the form 65n – 117, then find the value of n.

OR

On a morning walk, three persons step out together and their steps measure 30 cm, 36 cm and 40 cm respectively. What is the minimum distance each should walk so that each can cover the same distance in complete steps ?

10. एक पासे को एक बार फेंका जाता है । प्रायिकता ज्ञात कीजिए (i) प्राप्त संख्या एक भाज्य संख्या है, (ii) प्राप्त संख्या एक अभाज्य संख्या है ।

A die is thrown once. Find the probability of getting (i) a composite number, (ii) a prime number.

11. पूर्ण वर्ग बनाने की विधि का प्रयोग करते हुए दर्शाइए कि समीकरण $x^2 - 8x + 18 = 0$ का कोई हल नहीं है ।

Using completing the square method, show that the equation $x^2 - 8x + 18 = 0$ has no solution.

12. कार्ड जिन पर 7 से 40 तक की संख्याएँ लिखी हैं, एक पेटी में रखे हुए हैं । पूनम उनमें से एक कार्ड यादृच्छया निकालती है । प्रायिकता ज्ञात कीजिए कि पूनम द्वारा निकाले गए कार्ड पर अंकित संख्या 7 का एक गुणज है ।

Cards numbered 7 to 40 were put in a box. Poonam selects a card at random. What is the probability that Poonam selects a card which is a multiple of 7 ?

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. किसी त्रिभुज ABC के शीर्ष A से भुजा BC पर डाला गया लम्ब BC को बिंदु D पर इस प्रकार मिलता है कि DB = 3CD है । सिद्ध कीजिए कि $2AB^2 = 2AC^2 + BC^2$.

अथवा

AD और PM त्रिभुजों ABC और PQR की क्रमश: माध्यिकाएँ हैं जबकि $\Delta ABC \sim \Delta PQR$ है । सिद्ध कीजिए कि $\frac{AB}{PQ} = \frac{AD}{PM}$ है ।

The perpendicular from A on side BC of a Δ ABC meets BC at D such that DB = 3CD. Prove that $2AB^2 = 2AC^2 + BC^2$.

OR

AD and PM are medians of triangles ABC and PQR respectively where $\Delta ABC \sim \Delta PQR$. Prove that $\frac{AB}{PQ} = \frac{AD}{PM}$.

14. बहुपद p(x) को बहुपद g(x) से भाग करके जाँच कीजिए कि क्या g(x) बहुपद p(x) का एक गुणनखंड है । दिया गया है कि

$$p(x) = x^5 - 4x^3 + x^2 + 3x + 1, \quad g(x) = x^3 - 3x + 1$$

Check whether g(x) is a factor of p(x) by dividing polynomial p(x) by polynomial g(x),

where $p(x) = x^5 - 4x^3 + x^2 + 3x + 1, \quad g(x) = x^3 - 3x + 1$

15. शीर्षों A(0, – 1), B(2, 1) और C(0, 3) वाले त्रिभुज ABC की भुजाओं के मध्य-बिन्दुओं से बनने वाले त्रिभुज का क्षेत्रफल ज्ञात कीजिए ।

Find the area of the triangle formed by joining the mid-points of the sides of the triangle ABC, whose vertices are A(0, – 1), B(2, 1) and C(0, 3).

16. समीकरणों $x - y + 1 = 0$ और $3x + 2y - 12 = 0$ का ग्राफ खींचिए । ग्राफ द्वारा, x और y के दोनों समीकरणों को संतुष्ट करने वाले मान ज्ञात कीजिए ।

Draw the graph of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. Using this graph, find the values of x and y which satisfy both the equations.

17. सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

अथवा

वह बड़ी-से-बड़ी संख्या ज्ञात कीजिए जिससे संख्याओं 1251, 9377 तथा 15628 को भाग करने पर क्रमश: 1, 2 तथा 3 शेषफल आता है ।

Prove that $\sqrt{3}$ is an irrational number.

OR

Find the largest number which on dividing 1251, 9377 and 15628 leaves remainders 1, 2 and 3 respectively.

18. A, B और C त्रिभुज ABC के अंत: कोण हैं । दिखाइए कि

(i) $\sin\left(\frac{B+C}{2}\right) = \cos\frac{A}{2}$

(ii) यदि $\angle A = 90°$ है, तो $\tan\left(\frac{B+C}{2}\right)$ का मान ज्ञात कीजिए ।

अथवा

यदि $\tan(A + B) = 1$ तथा $\tan(A - B) = \frac{1}{\sqrt{3}}$ है, जहाँ $0° < A + B < 90°$, $A > B$ है, तो A तथा B के मान ज्ञात कीजिए ।

A, B and C are interior angles of a triangle ABC. Show that

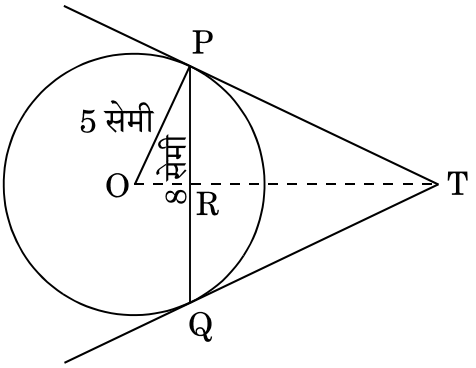
(i) $\sin\left(\frac{B+C}{2}\right) = \cos\frac{A}{2}$

(ii) If $\angle A = 90°$, then find the value of $\tan\left(\frac{B+C}{2}\right)$.

OR

If $\tan(A + B) = 1$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, $0° < A + B < 90°$, $A > B$, then find the values of A and B.

19. आकृति 2 में, 5 सेमी त्रिज्या के एक वृत्त की 8 सेमी लंबी एक जीवा PQ है । P और Q पर स्पर्श-रेखाएँ परस्पर एक बिंदु T पर प्रतिच्छेद करती हैं । TP की लंबाई ज्ञात कीजिए ।



आकृति 2

अथवा

सिद्ध कीजिए कि वृत्त के परिगत बनी चतुर्भुज की आमने-सामने की भुजाएँ, वृत्त के केन्द्र पर संपूरक कोण अंतरित करती हैं ।

In Figure 2, PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q intersect at a point T. Find the length TP.

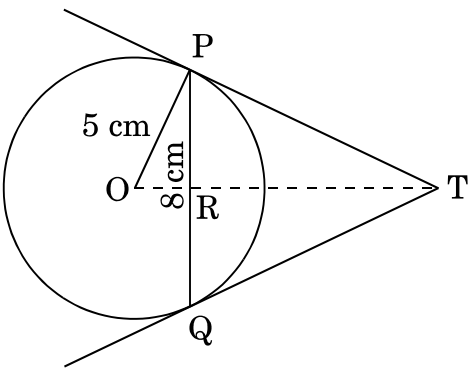


Figure 2

OR

Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

20. 6 मी. चौड़ी और 1·5 मी. गहरी एक नहर में पानी 10 किमी/घं. की चाल से बह रहा है । 30 मिनट में, यह नहर कितने क्षेत्रफल की सिंचाई कर पाएगी जबकि सिंचाई के लिए 8 सेमी गहरे ठहरे हुए पानी की आवश्यकता होती है ?

Water in a canal, 6 m wide and 1·5 m deep, is flowing with a speed of 10 km/h. How much area will it irrigate in 30 minutes if 8 cm of standing water is needed ?

21. किसी कक्षा अध्यापिका ने पूरे सत्र के लिए अपनी कक्षा के 40 विद्यार्थियों की अनुपस्थिति निम्नलिखित रूप में रिकॉर्ड की । एक विद्यार्थी जितने दिन अनुपस्थित रहा उनका माध्य ज्ञात कीजिए ।

दिनों की संख्या :	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30	30 – 36	36 – 42
विद्यार्थियों की संख्या :	10	11	7	4	4	3	1

A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

Number of days :	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30	30 – 36	36 – 42
Number of students :	10	11	7	4	4	3	1

22. किसी कार के दो वाइपर (wipers) हैं, जो परस्पर कभी आच्छादित नहीं होते हैं । प्रत्येक वाइपर की पत्ती की लम्बाई 21 सेमी है और 120° के कोण तक घूमकर सफाई कर सकता है । पत्तियों की प्रत्येक बुहार के साथ जितना क्षेत्रफल साफ हो जाता है, वह ज्ञात कीजिए । ($\pi = \frac{22}{7}$ लीजिए)

A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle 120°. Find the total area cleaned at each sweep of the blades. (Take $\pi = \frac{22}{7}$)

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. 13 मीटर व्यास वाले एक वृत्ताकार पार्क की परिसीमा के एक बिंदु पर एक खंभा इस प्रकार गाड़ना है कि इस पार्क के एक व्यास के दोनों अंत बिंदुओं पर बने फाटकों A और B से खंभे की दूरियों का अंतर 7 मीटर हो । क्या ऐसा करना संभव है ? यदि है, तो दोनों फाटकों से कितनी दूरियों पर खंभा गाड़ना है ?

A pole has to be erected at a point on the boundary of a circular park of diameter 13 m in such a way that the difference of its distances from two diametrically opposite fixed gates A and B on the boundary is 7 m. Is it possible to do so ? If yes, at what distances from the two gates should the pole be erected ?

24. यदि किसी समांतर श्रेढ़ी के mवें पद का m गुणा, इसके nवें पद के n गुणा के बराबर हो $(m \neq n)$, तो दर्शाइए कि समांतर श्रेढ़ी का $(m + n)$वाँ पद शून्य होगा ।

अथवा

किसी समांतर श्रेढ़ी की प्रथम तीन संख्याओं का योगफल 18 है । यदि पहले और तीसरे पद का गुणनफल सार्व अंतर का 5 गुणा हो, तो तीनों संख्याओं को ज्ञात कीजिए ।

If m times the m^{th} term of an Arithmetic Progression is equal to n times its n^{th} term and $m \neq n$, show that the $(m + n)^{th}$ term of the A.P. is zero.

OR

The sum of the first three numbers in an Arithmetic Progression is 18. If the product of the first and the third term is 5 times the common difference, find the three numbers.

25. एक त्रिभुज ABC की रचना कीजिए जिसमें भुजा BC = 6 सेमी, AB = 5 सेमी और $\angle ABC = 60°$ हो । फिर एक अन्य त्रिभुज की रचना कीजिए जिसकी भुजाएँ ΔABC की संगत भुजाओं की $\frac{3}{4}$ गुनी हों ।

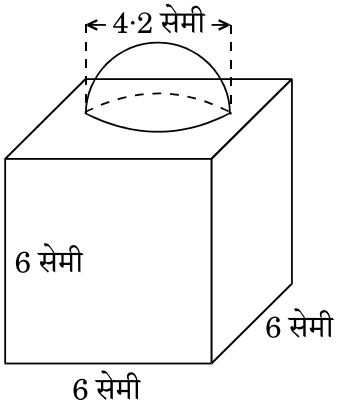
Construct a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60°$. Then construct another triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the triangle ABC.

26. आकृति 3 में, सजावट के लिए बना एक ब्लॉक दर्शाया गया है जो दो ठोसों – एक घन तथा एक अर्धगोले से बना है । ब्लॉक का आधार एक 6 सेमी भुजा का घन है तथा उसके ऊपर एक अर्धगोला है जिसका व्यास 4·2 सेमी है । ज्ञात कीजिए

(a) ब्लॉक का कुल पृष्ठीय क्षेत्रफल ।

(b) बने हुए ब्लॉक का आयतन ।

$(\pi = \frac{22}{7}$ लीजिए)



आकृति 3

अथवा

ऊपर से खुली एक बाल्टी शंकु के छिन्नक के आकार की है जिसकी धारिता 12308·8 सेमी^{3} है । उसके ऊपरी तथा निचले वृत्ताकार सिरों की त्रिज्याएँ क्रमश: 20 सेमी तथा 12 सेमी हैं । बाल्टी की ऊँचाई ज्ञात कीजिए तथा बाल्टी को बनाने में लगी धातु की चादर का क्षेत्रफल ज्ञात कीजिए । ($\pi = 3{\cdot}14$ का प्रयोग कीजिए)

In Figure 3, a decorative block is shown which is made of two solids, a cube and a hemisphere. The base of the block is a cube with edge 6 cm and the hemisphere fixed on the top has a diameter of 4·2 cm. Find

(a) the total surface area of the block.

(b) the volume of the block formed. (Take $\pi = \frac{22}{7}$)

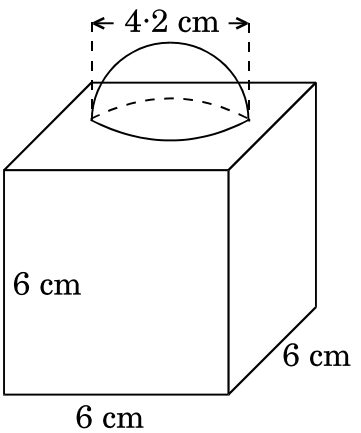


Figure 3

OR

A bucket open at the top is in the form of a frustum of a cone with a capacity of 12308·8 cm^3. The radii of the top and bottom circular ends are 20 cm and 12 cm respectively. Find the height of the bucket and the area of metal sheet used in making the bucket. (Use $\pi = 3{\cdot}14$)

27. यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं 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 ।

अथवा

सिद्ध कीजिए कि एक समकोण त्रिभुज में कर्ण का वर्ग शेष दो भुजाओं के वर्गों के योगफल के बराबर होता है ।

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

OR

Prove that in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

28. यदि $1 + \sin^2 \theta = 3 \sin \theta \cos \theta$ है, तो सिद्ध कीजिए कि $\tan \theta = 1$ अथवा $\tan \theta = \frac{1}{2}$.

If $1 + \sin^2 \theta = 3 \sin \theta \cos \theta$, then prove that $\tan \theta = 1$ or $\tan \theta = \frac{1}{2}$.

29. नीचे दिए गए बंटन को 'से अधिक प्रकार' के बंटन में बदलिए और फिर उस बंटन का 'से अधिक प्रकार' का तोरण खींचिए ।

वर्ग अंतराल :	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
बारंबारता :	10	8	12	24	6	25	15

Change the following distribution to a 'more than type' distribution. Hence draw the 'more than type' ogive for this distribution.

Class interval :	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
Frequency :	10	8	12	24	6	25	15

30. एक समतल जमीन पर खड़ी मीनार की छाया उस स्थिति में 40 मी. अधिक लंबी हो जाती है जबकि सूर्य का उन्नतांश (altitude) 60° से घटकर 30° हो जाता है । मीनार की ऊँचाई ज्ञात कीजिए । (दिया गया है $\sqrt{3} = 1{\cdot}732$)

The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it was 60°. Find the height of the tower. (Given $\sqrt{3} = 1{\cdot}732$)

Strictly Confidential: (For Internal and Restricted use only)
Secondary School Examination
March 2019

MARKING SCHEME – MATHEMATICS (SUBJECT CODE -041)

PAPER CODE: 30/3/1, 30/3/2, 30/3/3

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
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. **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 marks be awarded to them.**
3. 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. 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.
4. 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.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 1-80 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. 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 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.
    - 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.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.

12. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

14. 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.

15. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

QUESTION PAPER CODE 30/3/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. $(x + 5)^2 = 2(5x - 3) \Rightarrow x^2 + 31 = 10$ $\frac{1}{2}$

$D = -124$ $\frac{1}{2}$

2. $\frac{27}{2^3 \cdot 5^4 \cdot 3^2} = \frac{3}{2^3 \cdot 5^4}$ $\frac{1}{2}$

It will terminate after 4 decimal places $\frac{1}{2}$

OR

$429 = 3 \times 11 \times 13$ 1

3. $S_{10} = \frac{10}{2}[2 \times 6 + 9 \times 6]$ $\frac{1}{2}$

$= 330$ $\frac{1}{2}$

4. AB = 5

$\Rightarrow \sqrt{(x-0)^2 + (-4-0)^2} = 5$ $\frac{1}{2}$

$x^2 + 16 = 25$

$x = \pm 3$ $\frac{1}{2}$

5. Length of chord = $2\sqrt{a^2 - b^2}$ 1

6. PQ = 5 cm $\frac{1}{2}$

$\tan \theta = \frac{PQ}{PR} = \frac{5}{9}$ $\frac{1}{2}$

OR

$\sec \alpha = \sqrt{1 + \tan^2 \alpha}$ $\frac{1}{2}$

$= \sqrt{1 + \frac{25}{144}} = \frac{13}{12}$ $\frac{1}{2}$

SECTION B

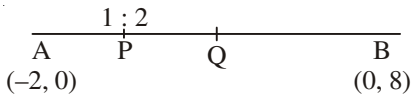
7. Diagonals of parallelogram bisect each other

$\therefore \quad \left(\frac{3+a}{2}, \frac{1+b}{2}\right) = \left(\frac{5+4}{2}, \frac{1+3}{2}\right)$ 1

$3 + a = 9,\ 1 + b = 4$

So $a = 6,\ b = 3$ $\frac{1}{2}+\frac{1}{2}$

OR



P divides AB in the ratio 1 : 2

$\therefore$ Coordinates of P are $\left(\frac{0-4}{3}, \frac{8+0}{2}\right) = \left(\frac{-4}{3}, \frac{8}{3}\right)$ 1

Q divides AB in the ratio 2 : 1

$\therefore$ Coordinates of Q are $\left(\frac{0-2}{3}, \frac{16+0}{3}\right) = \left(\frac{-2}{3}, \frac{16}{3}\right)$ 1

8. $3x - 5y = 4$ ...(1)

$9x - 2y = 7$

$9x - 15y = 12$

$9x - 2y = 7$

$- \quad + \quad -$

$-13y = 5 \Rightarrow y = -5/13$ 1

From (1), $x = 9/13$ $\therefore$ solution is $\left(\frac{9}{13}, \frac{-5}{13}\right)$ 1

9. HCF (65, 117) = 13 1

$13 = 65n - 117$ $\frac{1}{2}$

Solving, we get, $n = 2$ $\frac{1}{2}$

OR

Required minimum distance = LCM (30, 36, 40) 1

$30 = 2 \times 3 \times 5 = 2^3 \times 3^2 \times 5$

$36 = 2^2 \times 3^2 = 360$ cm 1

$40 = 2^3 \times 5$

10. Composite numbers on a die are 4 and 6

$\therefore$ P (composite number) $= \frac{2}{6}$ or $\frac{1}{3}$ 1

Prime numbers are 2, 3 and 5

$\therefore$ P(prime number) $= \frac{3}{6}$ or $\frac{1}{2}$ 1

11. $x^2 - 8x + 18 = 0$

$x^2 - 8x + 16 + 2 = 0$ 1

$(x - 4)^2 = -2$ $\frac{1}{2}$

Square of a number can't be negative

$\therefore$ The equation has no solution. $\frac{1}{2}$

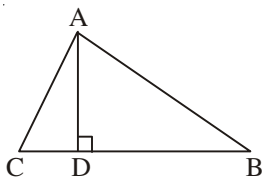
12. Total number of possible outcomes = 34 $\frac{1}{2}$

Favourable number of outcomes is (7, 14, 21, 28 and 35) = 5 1

P(multiple of 7) $= \frac{5}{34}$ $\frac{1}{2}$

SECTION C

13.



$AB^2 = AD^2 + BD^2$ Correct Figure $\frac{1}{2}$

$AC^2 = AD^2 + CD^2$ 1

$AB^2 - AC^2 = BD^2 - CD^2$

$= (3CD)^2 - CD^2$

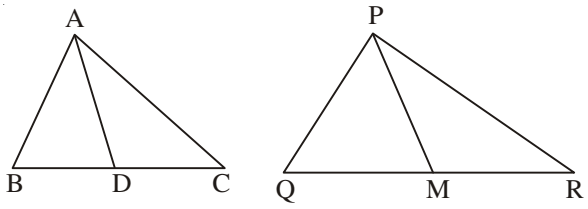
$= 8\ CD^2$ 1

$$= 8 \times \left(\frac{1}{4}BC\right)^2$$

$$\Rightarrow 2AB^2 - 2AC^2 = BC^2$$

$$\text{or } 2AB^2 = 2AC^2 + BC^2 \qquad \frac{1}{2}$$

OR



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

$\Delta ABC \sim \Delta PQR$

$$\therefore \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} \qquad \frac{1}{2}$$

$$\frac{AB}{PQ} = \frac{2BD}{2QM} \text{ or } \frac{BD}{QM} \qquad 1$$

Also $\angle B = \angle Q$

$\therefore \Delta ABD \sim \Delta PQM$ $\frac{1}{2}$

$$\text{So } \frac{AB}{PQ} = \frac{AD}{PM} \qquad \frac{1}{2}$$

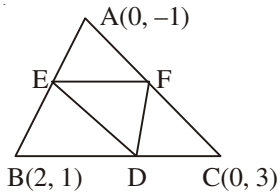
14.

$$\begin{array}{r|l} x^3 - 3x + 1 \;\big)\; x^5 - 4x^3 + x^2 + 3x + 1 & \big(\; x^2 - 1 \\ \underline{x^5 - 3x^3 + x^2} & \\ -x^3 + 3x + 1 & \\ \underline{-x^3 + 3x - 1} & \\ 2 & \end{array}$$

$2\frac{1}{2}$

Since remainder ≠ 0 ∴ g(x) is not a factor of p(x) $\frac{1}{2}$

15.



Coordinates of mid points are

D(1, 2)

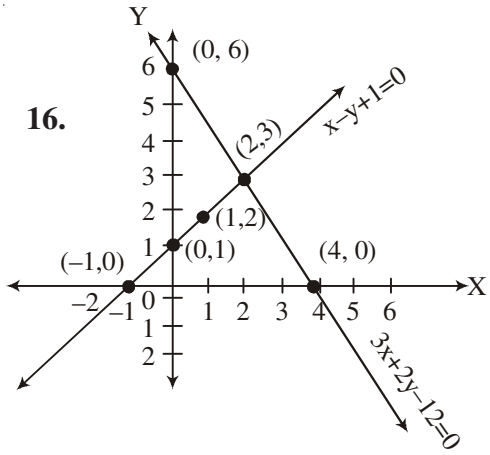
E (1, 0)

F(0 ,1) $1\frac{1}{2}$

Area of ΔDEF = $\frac{1}{2}[1(0-1)+1(1-2)+0]$ 1

$= \frac{1}{2}(-2) = 1$ sq. unit $\frac{1}{2}$

16.



Correct graph 2

Solution is

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

17. Let us assume that $\sqrt{3}$ be a rational number

$\sqrt{3} = \frac{p}{q}$ where p and q are co-primes and q ≠ 0 $\frac{1}{2}$

$\Rightarrow \quad p^2 = 3q^2$ ...(1)

$\therefore$ 3 divides p^2

i.e., 3 divides p also ...(2)

Let p = 3m, for some integer m 1

From (1), $9m^2 = 3q^2$

$\Rightarrow \quad q^2 = 3m^2$

$\therefore$ 3 divides q^2 i.e., 3 divides q also ...(3) 1

From (2) and (3), we get that 3 divides p and q both which is a contradiction to the fact that p and q are co-primes. $\frac{1}{2}$

Hence our assumption is wrong

$\therefore \sqrt{3}$ is irrational

OR

$1251 - 1 = 1250,\ 9377 - 2 = 9375,\ 15628 - 3 = 15625$ 1

Required largest number = HCF (1250, 9375, 15625)

$$\left.\begin{aligned} 1250 &= 2 \times 5^4 \\ 9375 &= 3 \times 5^4 \\ 6250 &= 2 \times 5^5 \end{aligned}\right\}$$ $1\frac{1}{2}$

$\therefore$ HCF (1250, 9375, 15625) $= 5^4 = 625$ $\frac{1}{2}$

18. A, B, C are interior angles of ΔABC

$\therefore \quad A + B + C = 180°$ $\frac{1}{2}$

(i) $\sin\left(\frac{B+C}{2}\right) = \sin\left(\frac{180° - A}{2}\right)$

$= \sin\left(90° - \frac{A}{2}\right)$

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

(ii) $\tan\left(\frac{B+C}{2}\right) = \tan\left(\frac{90°}{2}\right)$ $(\because \angle A = 90°)$

$= \tan 45°$ 1

$= 1$

OR

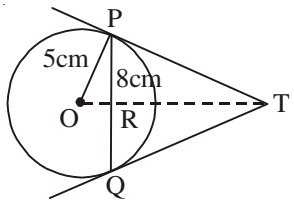
$\tan (A + B) = 1 \ \therefore A + B = 45°$ 1

$\tan (A - B) = \frac{1}{\sqrt{3}} \ \therefore A - B = 30°$ 1

Solving, we get $\angle A = 37\frac{1°}{2}$ or $37.5°$ $\frac{1}{2}$

$\angle B = 7\frac{1°}{2}$ or $7.5°$ $\frac{1}{2}$

19.



Let TR be x cm and TP be y cm

OT is ⊥ bisector of PQ

So PR = 4 cm

In ΔOPR, $OP^2 = PR^2 + OR^2$

$\therefore$ OR = 3 cm 1

In ΔPRT, $y^2 = x^2 + 4^2$ ...(1) $\frac{1}{2}$

In ΔOPT, $(x + 3)^2 = 5^2 + y^2$ $\frac{1}{2}$

$\therefore (x + 3)^2 = 5^2 + x^2 + 16$ [using (1)]

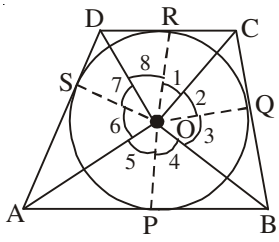
Solving we get $x = \frac{16}{3}$ cm $\frac{1}{2}$

From (1), $y^2 = \frac{256}{9} + 16 = \frac{400}{9}$

So $y = \frac{20}{3}$ cm $\frac{1}{2}$

OR

$\Delta ROC \cong \Delta QOC$ $\frac{1}{2}$



$\therefore \angle 1 = \angle 2$
Similarly $\angle 4 = \angle 3$
$\angle 5 = \angle 6$
$\angle 8 = \angle 7$ 1

$\angle ROQ + \angle QOP + \angle POS + \angle SOR = 360°$ $\frac{1}{2}$

$\therefore 2\angle 1 + 2\angle 4 + 2\angle 5 + 2\angle 8 = 360$

$\Rightarrow \angle 1 + \angle 4 + \angle 5 + \angle 8 = 180°$

So, $\angle DOC + \angle AOB = 180°$

and $\angle AOD + \angle BOC = 180°$. 1

20. Volume of water flowing through canal in 30 minutes

$= 5000 \times 6 \times 1.5 = 45000\ m^3$ $1\frac{1}{2}$

$\text{Area} = 45000 \div \frac{8}{100}$

$= 562500\ m^2$ $1\frac{1}{2}$

21.

Number of days	**Number of students (fi)**	x_i	$f_i x_i$	
0-6	10	3	30	
6-12	11	9	99	
12-18	7	15	105	
18-24	4	21	84	
24-30	4	27	108	Correct Table 2
30-36	3	33	99	
36-42	1	39	39	
Total	40		564	

$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{564}{40}$

$= 14.1$ 1

22. Total area cleaned = 2 × Area of sector

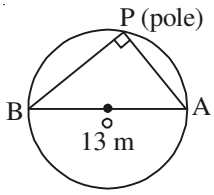
$= 2 \times \frac{\pi r^2 \theta}{260°}$ 1

$= 2 \times \frac{22}{7} \times 21 \times 21 \times \frac{120°}{360°}$ 1

$= 924\ cm^2$ 1

SECTION D

23.



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

PB – PA = 7 m

Let AP be x m $\therefore$ PB = (x + 7) m $\frac{1}{2}$

$AB^2 = PB^2 + AB^2$

$\therefore\ 13^2 = (x + 7)^2 + x^2$

$x^2 + 7x - 60 = 0$ 1

$= (x + 12)\ (x - 5) = 0$ 1

$\therefore$ x = 5, –12 Rejected

$\therefore$ Situation is possible $\frac{1}{2}$

$\therefore$ Distance of pole from gate A = 5 m

and distance of pole from gate B = 12 m. $\frac{1}{2}$

24. $ma_m = na_n$

$\Rightarrow$ $ma + m(m - 1)d = na + n(n - 1)d$ 1

$\Rightarrow$ $(m - n)a + (m^2 - m - n^2 + n)d = 0$ 1

$(m - n)a + [(m - n)\ (m + n) - (m - n)d] = 0$ 1

Dividing by (m – n)

So, $a + (m + n - 1)d = 0$

or $a_{m + n} = 0$ 1

OR

Let first three terms be a –d, a and a + d $\frac{1}{2}$

$a - d + a + a + d = 18$

So $a = 6$ $\frac{1}{2}$

$(a - d)\ (a + d) = 5d$

$\Rightarrow \quad 6^2 - d^2 = 5d$ 1

or $\quad d^2 + 5d - 36 = 0$

$(d + 9)\ (d - 4) = 0$

so $\quad d = -9$ or 4 1

For $d = -9$ three numbers are 15, 6 and –3 $\frac{1}{2}$

For $d = 4$ three numbers are 2, 6 and 10 $\frac{1}{2}$

25. Correct construction of ΔABC 2

Correct construction of triangle similar to ΔABC 2

26. (a) Total surface area of block

= TSA of cube + CSA of hemisphere – Base area of hemisphere 1

$= 6a^2 + 2\pi r^2 - \pi r^2$

$= 6a^2 + \pi r^2$

$= \left(6 \times 6^2 + \frac{22}{7} \times 2.1 \times 2.1\right) cm^2$ $\frac{1}{2}$

$= (216 + 13.86)\ cm^2$

$= 229.86\ cm^2$ $\frac{1}{2}$

(b) Volume of block

$= 6^3 + \frac{2}{3} \times \frac{22}{7} \times (2.1)^3$ 1

$= (216 + 19.40)\ cm^3$

$= 235.40\ cm^3$ 1

OR

Volume of frustum = $12308.8\ cm^3$

$\therefore \quad \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2) = 12308.8$

$\Rightarrow \quad \frac{1}{3} \times 3.14 \times h(20^2 + 12^2 + 20 \times 12) = 12308.8$ 1

$h = \frac{12308.8 \times 3}{784 \times 3.14}$

$h = 15$ cm 1

$l = \sqrt{15^2 + (20-12)^2} = 17$ cm. 1

Area of metal sheet used = $\pi l\ (r_1 + r_2) + \pi r_2^2$

$= 3.14[17 \times 32 + 12^2]$

$= 3.14 \times 688\ cm^2$

$= 2160.32\ cm^2$ 1

27. Correct figure, given, to prove and construction $\frac{1}{2} \times 4 = 2$

Correct proof. 2

OR

Correct figure, given, to prove and construction $\frac{1}{2} \times 4 = 2$

Correct proof. 2

28. $1 + \sin^2 \theta = 3\sin \theta \cos \theta$

Dividing by $\cos^2 \theta$

$\sec^2 \theta + \tan^2 \theta = 3\tan \theta$ 1

$\Rightarrow \quad 1 + \tan^2 \theta + \tan^2 \theta = 3\tan \theta$

$\Rightarrow \quad 2\tan^2 \theta - 3\tan \theta + 1 = 0$ 1

$(\tan \theta - 1)(2\tan \theta - 1) = 0$ 1

So $\tan \theta = 1$ or $\frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$

Alternate method

$1 + \sin^2 \theta = 3\sin \theta \cos \theta$

$\sin^2 \theta + \cos^2 \theta + \sin^2 \theta - 3\sin \theta \cos \theta = 0$ 1

Dividing by $\cos^2 \theta$

$\Rightarrow \quad 2\tan^2 \theta - 3\tan \theta + 1 = 0$ 1

$\Rightarrow \quad (\tan \theta - 1)(2\tan \theta - 1) = 0$ 1

So $\tan \theta = 1$ or $\frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$

29. **Class interval** **Cumulative Frequency**

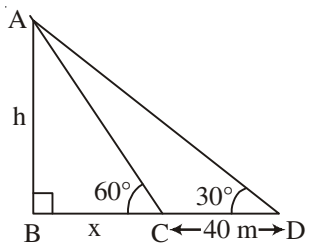
More than or equal to 20	100
More than or equal to 30	90
More than or equal to 40	82
More than or equal to 50	70
More than or equal to 60	46
More than or equal to 70	40
More than or equal to 80	15

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

Plotting of points (20, 100), (30, 90), (40, 82), (50, 70), (60, 46), (70, 40) and (80, 15) $1\frac{1}{2}$

Joining the points to get a curve 1

30. Correct Figure 1



Let AB = h be the height of tower

In ΔABC, $\frac{h}{x} = \tan 60°$

$h = x\sqrt{3}$ 1

In ΔABD, $\frac{h}{x+40} = \tan 30°$

$\Rightarrow h\sqrt{3} = x + 40$ $\frac{1}{2}$

$3x = x + 40$

$\therefore x = 20$ $\frac{1}{2}$

So, height of tower $= h = 20\sqrt{3}$ m $\frac{1}{2}$

$= 20 \times 1.732$ m

$= 34.64$ m $\frac{1}{2}$

QUESTION PAPER CODE 30/3/2

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. Length of chord = $2\sqrt{a^2 - b^2}$ 1

2. PQ = 5 cm $\frac{1}{2}$

$\tan \theta = \frac{PQ}{PR} = \frac{5}{9}$ $\frac{1}{2}$

OR

$\sec \alpha = \sqrt{1 + \tan^2 \alpha}$ $\frac{1}{2}$

$= \sqrt{1 + \frac{25}{144}} = \frac{13}{12}$ $\frac{1}{2}$

3. $(x + 5)^2 = 2(5x - 3) \Rightarrow x^2 + 31 = 10$ $\frac{1}{2}$

$D = -124$ $\frac{1}{2}$

4. $\frac{27}{2^3 \cdot 5^4 \cdot 3^2} = \frac{3}{2^3 \cdot 5^4}$ $\frac{1}{2}$

It will terminate after 4 decimal places $\frac{1}{2}$

OR

$429 = 3 \times 11 \times 13$ 1

5. $S_{10} = \frac{10}{2}[2 \times 6 + 9 \times 6]$ $\frac{1}{2}$

$= 330$ $\frac{1}{2}$

6. AB = 10

$(13 - 5)^2 + (m + 3)^2 = 10$

$(m + 3)^2 = 100 - 64 = 6^2$ $\frac{1}{2}$

$m + 3 = 6$

$m = 3$ $\frac{1}{2}$

SECTION B

7. Composite numbers on a die are 4 and 6

$\therefore$ P (composite number) = $\frac{2}{6}$ or $\frac{1}{3}$ 1

Prime numbers are 2, 3 and 5

$\therefore$ P(prime number) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

8. Total number of possible outcomes = 34 $\frac{1}{2}$

Favourable number of outcomes is (7, 14, 21, 28 and 35) = 5 1

P(multiple of 7) = $\frac{5}{34}$ $\frac{1}{2}$

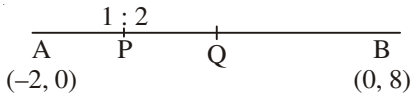
9. Diagonals of parallelogram bisect each other

$\therefore$ $\left(\frac{3+a}{2}, \frac{1+b}{2}\right) = \left(\frac{5+4}{2}, \frac{1+3}{2}\right)$ 1

$3 + a = 9,\ 1 + b = 4$

So $a = 6,\ b = 3$ $\frac{1}{2}+\frac{1}{2}$

OR



P divides AB in the ratio 1 : 2

$\therefore$ Coordinates of P are $\left(\frac{0-4}{3}, \frac{8+0}{2}\right) = \left(\frac{-4}{3}, \frac{8}{3}\right)$ 1

Q divides AB in the ratio 2 : 1

$\therefore$ Coordinates of Q are $\left(\frac{0-2}{3}, \frac{16+0}{3}\right) = \left(\frac{-2}{3}, \frac{16}{3}\right)$ 1

10. $3x - 5y = 4$ ...(1)

$9x - 2y = 7$

$9x - 15y = 12$

$9x - 2y = 7$

$-\quad +\quad -$

$-13y = 5 \Rightarrow y = -5/13$ 1

From (1), x = 9/13 $\therefore$ solution is $\left(\frac{9}{13}, \frac{-5}{13}\right)$ 1

11. HCF (65, 117) = 13 1

$13 = 65n - 117$ $\frac{1}{2}$

Solving, we get, n = 2 $\frac{1}{2}$

OR

Required minimum distance = LCM (30, 36, 40) 1

$30 = 2 \times 3 \times 5 = 2^3 \times 3^2 \times 5$

$36 = 2^2 \times 3^2$ = 360 cm 1

$40 = 2^3 \times 5$

12. $k^2 - 6x - 1 = 0$

Since the roots are not real $\therefore$ D < 0 1

$(-6)^2 - 4 \times k \times (-1) < 0$

$k < -9$ 1

SECTION C

13. A, B, C are interior angles of ΔABC

$\therefore \quad A + B + C = 180°$ $\frac{1}{2}$

(i) $\sin\left(\frac{B+C}{2}\right) = \sin\left(\frac{180° - A}{2}\right)$

$= \sin\left(90° - \frac{A}{2}\right)$

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

(ii) $\tan\left(\frac{B+C}{2}\right) = \tan\left(\frac{90°}{2}\right)$ $(\because \angle A = 90°)$

$= \tan 45°$ 1

$= 1$

OR

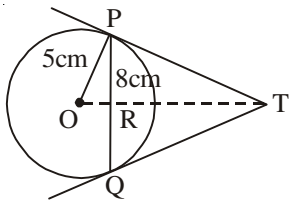
$\tan (A + B) = 1 \therefore A + B = 45°$ 1

$\tan (A - B) = \frac{1}{\sqrt{3}} \therefore A - B = 30°$ 1

Solving, we get $\angle A = 37\frac{1}{2}°$ or $37.5°$ $\frac{1}{2}$

$\angle B = 7\frac{1}{2}°$ or $7.5°$ $\frac{1}{2}$

14.



Let TR be x cm and TP be y cm

OT is $\perp$ bisector of PQ

So PR = 4 cm

In ΔOPR, $OP^2 = PR^2 + OR^2$

$\therefore$ OR = 3 cm 1

In ΔPRT, $y^2 = x^2 + 4^2$ ...(1) $\frac{1}{2}$

In ΔOPT, $(x + 3)^2 = 5^2 + y^2$ $\frac{1}{2}$

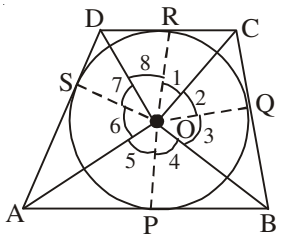
$\therefore (x + 3)^2 = 5^2 + x^2 + 16$ [using (1)]

Solving we get $x = \frac{16}{3}$ cm $\frac{1}{2}$

From (1), $y^2 = \frac{256}{9} + 16 = \frac{400}{9}$

So $y = \frac{20}{3}$ cm $\frac{1}{2}$

OR



$\Delta ROC \cong \Delta QOC$ $\frac{1}{2}$

$\therefore \angle 1 = \angle 2$
Similarly $\angle 4 = \angle 3$
$\angle 5 = \angle 6$
$\angle 8 = \angle 7$ } 1

$\angle ROQ + \angle QOP + \angle POS + \angle SOR = 360°$ $\frac{1}{2}$

$\therefore 2\angle 1 + 2\angle 4 + 2\angle 5 + 2\angle 8 = 360$

$\Rightarrow \angle 1 + \angle 4 + \angle 5 + \angle 8 = 180°$

So, $\angle DOC + \angle AOB = 180°$

and $\angle AOD + \angle BOC = 180°$. 1

15.

Number of days	**Number of students (fi)**	x_i	$f_i x_i$	
0-6	10	3	30	
6-12	11	9	99	
12-18	7	15	105	
18-24	4	21	84	
24-30	4	27	108	Correct Table 2
30-36	3	33	99	
36-42	1	39	39	
Total	40		564	

$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{564}{40}$

$= 14.1$ 1

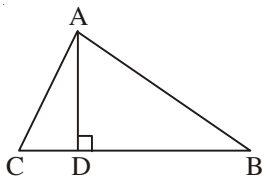
16. Total area cleaned = 2 × Area of sector

$= 2 \times \frac{\pi r^2 \theta}{260°}$ 1

$= 2 \times \frac{22}{7} \times 21 \times 21 \times \frac{120°}{360°}$ 1

$= 924 \text{ cm}^2$ 1

17.



$AB^2 = AD^2 + BD^2$ — Correct Figure $\frac{1}{2}$

$AC^2 = AD^2 + CD^2$ — 1

$AB^2 - AC^2 = BD^2 - CD^2$

$= (3CD)^2 - CD^2$

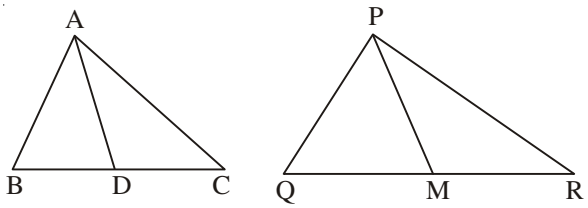
$= 8\ CD^2$ — 1

$= 8 \times \left(\frac{1}{4}BC\right)^2$

$\Rightarrow 2AB^2 - 2AC^2 = BC^2$

or $2AB^2 = 2AC^2 + BC^2$ — $\frac{1}{2}$

OR



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

$\Delta ABC \sim \Delta PQR$

$\therefore \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$ — $\frac{1}{2}$

$\frac{AB}{PQ} = \frac{2BD}{2QM}$ or $\frac{BD}{QM}$ — 1

Also $\angle B = \angle Q$

$\therefore \Delta ABD \sim \Delta PQM$ — $\frac{1}{2}$

So $\frac{AB}{PQ} = \frac{AD}{PM}$ — $\frac{1}{2}$

18.

$$x^3 - 3x + 1 \overline{)\, x^5 - 4x^3 + x^2 + 3x + 1 \,(\, x^2 - 1}$$

$$\begin{array}{r} x^5 - 3x^3 + x^2 \\ - \quad + \quad - \\ \hline -x^3 + 3x + 1 \\ -x^3 + 3x - 1 \\ + \quad - \quad + \\ \hline 2 \end{array}$$

$2\frac{1}{2}$

Since remainder $\neq 0$ $\therefore$ g(x) is not a factor of p(x) $\frac{1}{2}$

19. Let us assume that $\sqrt{3}$ be a rational number

$\sqrt{3} = \frac{p}{q}$ where p and q are co-primes and $q \neq 0$ $\frac{1}{2}$

$\Rightarrow \quad p^2 = 3q^2$ ...(1)

$\therefore$ 3 divides p^2

i.e., 3 divides p also ...(2)

Let p = 3m, for some integer m 1

From (1), $9m^2 = 3q^2$

$\Rightarrow \quad q^2 = 3m^2$

$\therefore$ 3 divides q^2 i.e., 3 divides q also ...(3) 1

From (2) and (3), we get that 3 divides p and q both which is a contradiction to the fact that p and q are co-primes. $\frac{1}{2}$

Hence our assumption is wrong $\therefore$ $\sqrt{3}$ is irrational

OR

1251 – 1 = 1250, 9377 – 2 = 9375, 15628 – 3 = 15625 1

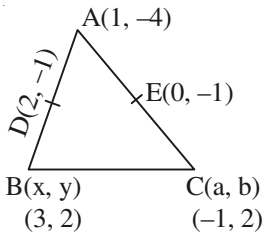
Required largest number = HCF (1250, 9375, 15625)

$$\left.\begin{array}{l} 1250 = 2 \times 5^4 \\ 9375 = 3 \times 5^4 \\ 6250 = 2 \times 5^5 \end{array}\right\}$$

$1\frac{1}{2}$

$\therefore$ HCF (1250, 9375, 15625) = 5^4 = 625 $\frac{1}{2}$

20.



$\left(\frac{x+1}{2}, \frac{y-4}{2}\right) = (2, -1)$

$\therefore$ x = 3, y = 2 1

$\left(\frac{1+a}{2}, \frac{-4+b}{2}\right) = (0, -1)$

a = –1, b = 2 1

Area of $\Delta ABC = \frac{1}{2}[1(2-2)+3(2+4)-1(-4-2)]$

$= \frac{1}{2} \times 24 = 12$ sq. units 1

21. Let the numbers be 5x and 6x $\frac{1}{2}$

$\frac{5x-7}{6x-7} = \frac{4}{5}$ 1

Solving, we get x = 7 $\frac{1}{2}$

$\therefore$ Numbers are 35 and 42 $\frac{1}{2}+\frac{1}{2}$

22. Volume of water flowing through pipe in half an hour

$= \pi r^2 \times 1260\ m^3$ ...(1) $\frac{1}{2}$

Volume of water raised in cylinder

$= \pi \times \frac{40}{100} \times \frac{40}{100} \times \frac{315}{100} m^3$ ...(2) 1

(1) = (2) $\Rightarrow r^2 = \frac{4}{10} \times \frac{4}{10} \times \frac{315}{100 \times 2160}$

$= \frac{4}{100 \times 100} m^2 = 4\ cm^2$ 1

$\Rightarrow$ r = 2 cm, $\therefore$ diameter = 4 cm $\frac{1}{2}$

SECTION D

23. (a) Total surface area of block

= TSA of cube + CSA of hemisphere – Base area of hemisphere 1

$= 6a^2 + 2\pi r^2 - \pi r^2$

$= 6a^2 + \pi r^2$

$= \left(6 \times 6^2 + \frac{22}{7} \times 2.1 \times 2.1\right) cm^2$ $\frac{1}{2}$

$= (216 + 13.86)\ cm^2$

$= 229.86\ cm^2$ $\frac{1}{2}$

(b) Volume of block

$= 6^3 + \frac{2}{3} \times \frac{22}{7} \times (2.1)^3$ 1

$= (216 + 19.40)\ cm^3$

$= 235.40\ cm^3$ 1

OR

Volume of frustum = 12308.8 cm^3

$\therefore \quad \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2) = 12308.8$

$\Rightarrow \quad \frac{1}{3} \times 3.14 \times h(20^2 + 12^2 + 20 \times 12) = 12308.8$ 1

$h = \frac{12308.8 \times 3}{784 \times 3.14}$

h = 15 cm 1

$l = \sqrt{15^2 + (20 - 12)^2} = 17$ cm. 1

Area of metal sheet used = $\pi l\ (r_1 + r_2) + \pi r_2^2$

$= 3.14[17 \times 32 + 12^2]$

$= 3.14 \times 688\ cm^2$

$= 2160.32\ cm^2$ 1

24. Correct figure, given, to prove and construction $\frac{1}{2}\times4=2$

Correct proof. 2

OR

Correct figure, given, to prove and construction $\frac{1}{2}\times4=2$

Correct proof. 2

25.

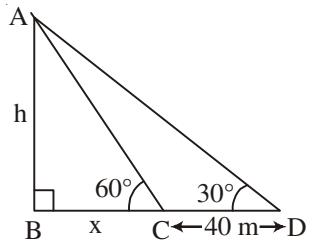
Class interval	**Cumulative Frequency**
More than or equal to 20	100
More than or equal to 30	90
More than or equal to 40	82
More than or equal to 50	70
More than or equal to 60	46
More than or equal to 70	40
More than or equal to 80	15

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

Plotting of points (20, 100), (30, 90), (40, 82), (50, 70), (60, 46), (70, 40) and (80, 15) $1\frac{1}{2}$

Joining the points to get a curve 1

26. Correct Figure 1



Let AB = h be the height of tower

In ΔABC, $\frac{h}{x} = \tan 60°$

$h = x\sqrt{3}$ 1

In ΔABD, $\frac{h}{x+40} = \tan 30°$

$\Rightarrow h\sqrt{3} = x + 40$ $\frac{1}{2}$

$3x = x + 40$

$\therefore x = 20$ $\frac{1}{2}$

So, height of tower $= h = 20\sqrt{3}$ m $\frac{1}{2}$

$= 20 \times 1.732$ m

$= 34.64$ m $\frac{1}{2}$

27. $ma_m = na_n$

$\Rightarrow$ $ma + m(m-1)d = na + n(n-1)d$ 1

$\Rightarrow$ $(m-n)a + (m^2 - m - n^2 + n)d = 0$ 1

$(m-n)a + [(m-n)(m+n) - (m-n)d] = 0$ 1

Dividing by $(m-n)$

So, $a + (m + n - 1)d = 0$

or $a_{m+n} = 0$ 1

OR

Let first three terms be $a - d$, a and $a + d$ $\frac{1}{2}$

$a - d + a + a + d = 18$

So $a = 6$ $\frac{1}{2}$

$(a - d)(a + d) = 5d$

$\Rightarrow$ $6^2 - d^2 = 5d$ 1

or $d^2 + 5d - 36 = 0$

$(d + 9)(d - 4) = 0$

so $d = -9$ or 4 1

For $d = -9$ three numbers are 15, 6 and -3 $\frac{1}{2}$

For $d = 4$ three numbers are 2, 6 and 10 $\frac{1}{2}$

28. Let the number of books be x

$\frac{80}{x} - \frac{80}{x+4} = 1$ 2

$x^2 + 4x - 320 = 0$ 1

$(x + 20)(x - 16) = 0$

$x = -20, 16$
(rejected)

$\therefore$ Number of books = 16 1

29. Correct construction of circle. 1

Correct construction of tangents. 3

30. $LHS = \frac{1}{1+\sin^2\theta} + \frac{1}{1+\cos^2\theta} + \frac{1}{1+\sec^2\theta} + \frac{1}{1+\text{cosec}^2\theta}$

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

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

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

$= 1 + 1 = 2$

= R.H.S. 1

QUESTION PAPER CODE 30/3/3

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. PQ = 5 cm $\frac{1}{2}$

$\tan\theta = \frac{PQ}{PR} = \frac{5}{9}$ $\frac{1}{2}$

OR

$\sec\alpha = \sqrt{1+\tan^2\alpha}$ $\frac{1}{2}$

$= \sqrt{1+\frac{25}{144}} = \frac{13}{12}$ $\frac{1}{2}$

2. Length of chord = $2\sqrt{a^2-b^2}$ 1

3. AB = 5

$\Rightarrow \quad \sqrt{(x-0)^2+(-4-0)^2} = 5$ $\frac{1}{2}$

$x^2 + 16 = 25$

$x = \pm 3$ $\frac{1}{2}$

4. $\frac{27}{2^3\cdot 5^4\cdot 3^2} = \frac{3}{2^3\cdot 5^4}$ $\frac{1}{2}$

It will terminate after 4 decimal places $\frac{1}{2}$

OR

$429 = 3 \times 11 \times 13$ 1

5. $(x+5)^2 = 2(5x-3) \Rightarrow x^2 + 31 = 10$ $\frac{1}{2}$

$D = -124$ $\frac{1}{2}$

6. $S_{10} = \frac{10}{2}[2\times 3 + 9\times 3]$ $\frac{1}{2}$

$= 5 \times 33 = 165$ $\frac{1}{2}$

SECTION B

7. HCF (65, 117) = 13 — 1

13 = 65n – 117 — $\frac{1}{2}$

Solving, we get, n = 2 — $\frac{1}{2}$

OR

Required minimum distance = LCM (30, 36, 40) — 1

$30 = 2 \times 3 \times 5 = 2^3 \times 3^2 \times 5$

$36 = 2^2 \times 3^2 = 360$ cm — 1

$40 = 2^3 \times 5$

8. Composite numbers on a die are 4 and 6

$\therefore$ P (composite number) = $\frac{2}{6}$ or $\frac{1}{3}$ — 1

Prime numbers are 2, 3 and 5

$\therefore$ P(prime number) = $\frac{3}{6}$ or $\frac{1}{2}$ — 1

9. $x^2 - 8x + 18 = 0$

$x^2 - 8x + 16 + 2 = 0$ — 1

$(x - 4)^2 = -2$ — $\frac{1}{2}$

Square of a number can't be negative

$\therefore$ The equation has no solution. — $\frac{1}{2}$

10. Total number of possible outcomes = 34 — $\frac{1}{2}$

Favourable number of outcomes is (7, 14, 21, 28 and 35) = 5 — 1

P(multiple of 7) = $\frac{5}{34}$ — $\frac{1}{2}$

11. $3x + 4y = 10 \Rightarrow 3x + 4y = 10$

$2x - 2y = 2 \Rightarrow 4x - 4y = 10$

On solving, $7x = 14 \quad \therefore x = 2$ 1

So, $y = 1$ 1

Solution is (2, 1)

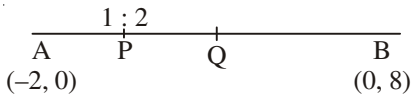
12. Diagonals of parallelogram bisect each other

$$\therefore \quad \left(\frac{3+a}{2}, \frac{1+b}{2}\right) = \left(\frac{5+4}{2}, \frac{1+3}{2}\right)$$ 1

$3 + a = 9, \; 1 + b = 4$

So $a = 6, \; b = 3$ $\frac{1}{2}+\frac{1}{2}$

OR



P divides AB in the ratio 1 : 2

$$\therefore \text{ Coordinates of P are } \left(\frac{0-4}{3}, \frac{8+0}{2}\right) = \left(\frac{-4}{3}, \frac{8}{3}\right)$$ 1

Q divides AB in the ratio 2 : 1

$$\therefore \text{ Coordinates of Q are } \left(\frac{0-2}{3}, \frac{16+0}{3}\right) = \left(\frac{-2}{3}, \frac{16}{3}\right)$$ 1

SECTION C

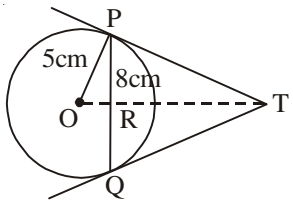
13.

Number of days	**Number of students (fi)**	x_i	f_ix_i	
0-6	10	3	30	
6-12	11	9	99	
12-18	7	15	105	
18-24	4	21	84	
24-30	4	27	108	Correct Table 2
30-36	3	33	99	
36-42	1	39	39	
Total	40		564	

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{564}{40}$$

$= 14.1$ 1

14.



Let TR be x cm and TP be y cm

OT is ⊥ bisector of PQ

So PR = 4 cm

In ΔOPR, $OP^2 = PR^2 + OR^2$

$\therefore$ OR = 3 cm 1

In ΔPRT, $y^2 = x^2 + 4^2$ ...(1) $\frac{1}{2}$

In ΔOPT, $(x + 3)^2 = 5^2 + y^2$ $\frac{1}{2}$

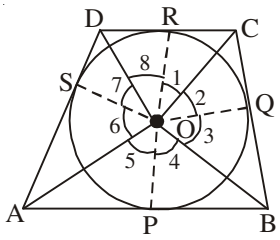
$\therefore (x + 3)^2 = 5^2 + x^2 + 16$ [using (1)]

Solving we get $x = \frac{16}{3}$ cm $\frac{1}{2}$

From (1), $y^2 = \frac{256}{9} + 16 = \frac{400}{9}$

So $y = \frac{20}{3}$ cm $\frac{1}{2}$

OR



$\Delta ROC \cong \Delta QOC$ $\frac{1}{2}$

$\therefore \angle 1 = \angle 2$
Similarly $\angle 4 = \angle 3$
$\angle 5 = \angle 6$
$\angle 8 = \angle 7$ 1

$\angle ROQ + \angle QOP + \angle POS + \angle SOR = 360°$ $\frac{1}{2}$

$\therefore 2\angle 1 + 2\angle 4 + 2\angle 5 + 2\angle 8 = 360$

$\Rightarrow \angle 1 + \angle 4 + \angle 5 + \angle 8 = 180°$

So, $\angle DOC + \angle AOB = 180°$

and $\angle AOD + \angle BOC = 180°$. 1

15. A, B, C are interior angles of ΔABC

$\therefore \quad A + B + C = 180°$ $\frac{1}{2}$

(i) $\sin\left(\frac{B+C}{2}\right) = \sin\left(\frac{180° - A}{2}\right)$

$= \sin\left(90° - \frac{A}{2}\right)$

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

(ii) $\tan\left(\frac{B+C}{2}\right) = \tan\left(\frac{90°}{2}\right)$ $(\because \angle A = 90°)$

$= \tan 45°$ 1

$= 1$

OR

$\tan (A + B) = 1 \ \therefore A + B = 45°$ 1

$\tan (A - B) = \frac{1}{\sqrt{3}} \ \therefore A - B = 30°$ 1

Solving, we get $\angle A = 37\frac{1°}{2}$ or $37.5°$ $\frac{1}{2}$

$\angle B = 7\frac{1°}{2}$ or $7.5°$ $\frac{1}{2}$

16. Let us assume that $\sqrt{3}$ be a rational number

$\sqrt{3} = \frac{p}{q}$ where p and q are co-primes and $q \neq 0$ $\frac{1}{2}$

$\Rightarrow \quad p^2 = 3q^2$ ...(1)

$\therefore$ 3 divides p^2

i.e., 3 divides p also ...(2)

Let $p = 3m$, for some integer m 1

From (1), $9m^2 = 3q^2$

$\Rightarrow \quad q^2 = 3m^2$

$\therefore$ 3 divides q^2 i.e., 3 divides q also ...(3) 1

From (2) and (3), we get that 3 divides p and q both which is a contradiction to the fact that p and q are co-primes. $\frac{1}{2}$

Hence our assumption is wrong $\therefore \sqrt{3}$ is irrational

OR

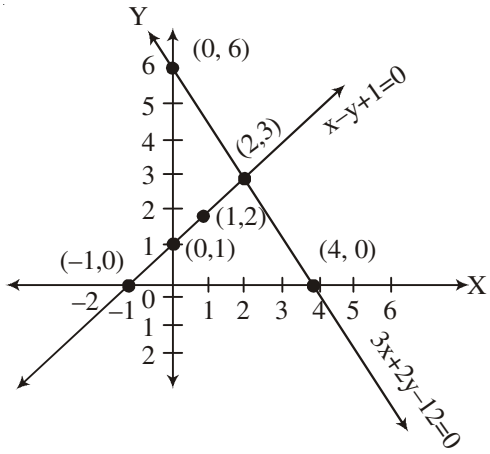
$1251 - 1 = 1250,\ 9377 - 2 = 9375,\ 15628 - 3 = 15625$ 1

Required largest number = HCF (1250, 9375, 15625)

$$\left.\begin{aligned} 1250 &= 2 \times 5^4 \\ 9375 &= 3 \times 5^4 \\ 6250 &= 2 \times 5^5 \end{aligned}\right\}$$ $1\frac{1}{2}$

$\therefore$ HCF (1250, 9375, 15625) $= 5^4 = 625$ $\frac{1}{2}$

17. Correct graph 2



Solution is

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

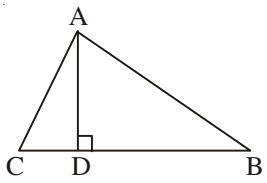
18. Volume of water flowing through canal in 30 minutes

$= 5000 \times 6 \times 1.5 = 45000\ m^3$ $1\frac{1}{2}$

$\text{Area} = 45000 \div \frac{8}{100}$

$= 562500\ m^2$ $1\frac{1}{2}$

19.



$AB^2 = AD^2 + BD^2$ — Correct Figure $\frac{1}{2}$

$AC^2 = AD^2 + CD^2$ — 1

$AB^2 - AC^2 = BD^2 - CD^2$

$= (3CD)^2 - CD^2$

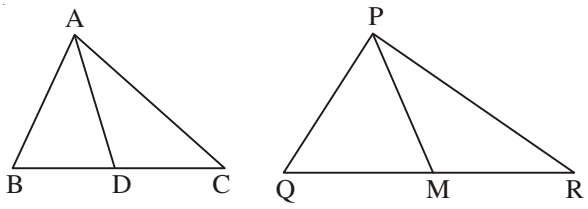
$= 8\ CD^2$ — 1

$= 8 \times \left(\frac{1}{4}BC\right)^2$

$\Rightarrow 2AB^2 - 2AC^2 = BC^2$

or $2AB^2 = 2AC^2 + BC^2$ — $\frac{1}{2}$

OR



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

$\Delta ABC \sim \Delta PQR$

$\therefore \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$ — $\frac{1}{2}$

$\frac{AB}{PQ} = \frac{2BD}{2QM}$ or $\frac{BD}{QM}$ — 1

Also $\angle B = \angle Q$

$\therefore \Delta ABD \sim \Delta PQM$ — $\frac{1}{2}$

So $\frac{AB}{PQ} = \frac{AD}{PM}$ — $\frac{1}{2}$

20. Area of minor segment $= \frac{\pi r^2\theta}{360°} - \frac{\sqrt{3}}{4}r^2$ 1

$= 14\times14\left[\frac{22}{7}\times\frac{60°}{360°} - \frac{1.73}{4}\right]cm^2$ 1

$= \frac{14\times14}{84}(44 - 36.33)\,cm^2$

$= 17.90\ cm^2$ (approx.) 1

21. $\frac{1}{2}[(k+1)(-3+k) + 4(-k-1) + 7(1+3)] = 6$ 1

$\frac{1}{2}(k^2 - 6k + 21) = 6$ 1

$\Rightarrow \quad k^2 - 6k + 9 = 0$

$(k - 3)^2 = 0$

$\therefore \quad k = 3$ 1

22. $ax^2 + 7x + b$

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

$\therefore \quad a = 3$

Product of zeroes $= \frac{b}{a} = -2$

$\therefore \quad b = -6.$ $1\frac{1}{2}$

SECTION D

23.

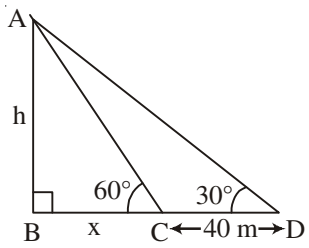
Class interval	**Cumulative Frequency**
More than or equal to 20	100
More than or equal to 30	90
More than or equal to 40	82
More than or equal to 50	70
More than or equal to 60	46
More than or equal to 70	40
More than or equal to 80	15

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

Plotting of points (20, 100), (30, 90), (40, 82), (50, 70), (60, 46), (70, 40) and (80, 15) $1\frac{1}{2}$

Joining the points to get a curve 1

24. Correct Figure 1



Let AB = h be the height of tower

In ΔABC, $\frac{h}{x} = \tan 60°$

$h = x\sqrt{3}$ 1

In ΔABD, $\frac{h}{x+40} = \tan 30°$

$\Rightarrow h\sqrt{3} = x + 40$ $\frac{1}{2}$

$3x = x + 40$

$\therefore x = 20$ $\frac{1}{2}$

So, height of tower $= h = 20\sqrt{3}$ m $\frac{1}{2}$

$= 20 \times 1.732$ m

$= 34.64$ m $\frac{1}{2}$

25. Correct figure, given, to prove and construction $\frac{1}{2} \times 4 = 2$

Correct proof. 2

OR

Correct figure, given, to prove and construction $\frac{1}{2} \times 4 = 2$

Correct proof. 2

26. $ma_m = na_n$

$\Rightarrow$ $ma + m(m-1)d = na + n(n-1)d$ 1

$\Rightarrow$ $(m-n)a + (m^2 - m - n^2 + n)d = 0$ 1

$(m-n)a + [(m-n)(m+n) - (m-n)d] = 0$ 1

Dividing by $(m-n)$

So, $a + (m + n - 1)d = 0$

or $a_{m+n} = 0$ 1

OR

Let first three terms be $a - d$, a and $a + d$ $\frac{1}{2}$

$a - d + a + a + d = 18$

So $a = 6$ $\frac{1}{2}$

$(a - d)(a + d) = 5d$

$\Rightarrow$ $6^2 - d^2 = 5d$ 1

or $d^2 + 5d - 36 = 0$

$(d + 9)(d - 4) = 0$

so $d = -9$ or 4 1

For $d = -9$ three numbers are 15, 6 and –3 $\frac{1}{2}$

For $d = 4$ three numbers are 2, 6 and 10 $\frac{1}{2}$

27. (a) Total surface area of block

= TSA of cube + CSA of hemisphere – Base area of hemisphere 1

$= 6a^2 + 2\pi r^2 - \pi r^2$

$= 6a^2 + \pi r^2$

$= \left(6 \times 6^2 + \frac{22}{7} \times 2.1 \times 2.1\right) cm^2$ $\frac{1}{2}$

$= (216 + 13.86)\ cm^2$

$= 229.86\ cm^2$ $\frac{1}{2}$

(b) Volume of block

$= 6^3 + \frac{2}{3} \times \frac{22}{7} \times (2.1)^3$ 1

$= (216 + 19.40)\ cm^3$

$= 235.40\ cm^3$ 1

OR

Volume of frustum = $12308.8\ cm^3$

$\therefore \quad \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2) = 12308.8$

$\Rightarrow \quad \frac{1}{3} \times 3.14 \times h(20^2 + 12^2 + 20 \times 12) = 12308.8$ 1

$h = \frac{12308.8 \times 3}{784 \times 3.14}$

$h = 15\ cm$ 1

$l = \sqrt{15^2 + (20-12)^2} = 17\ cm.$ 1

Area of metal sheet used = $\pi l\ (r_1 + r_2) + \pi r_2^2$

$= 3.14[17 \times 32 + 12^2]$

$= 3.14 \times 688\ cm^2$

$= 2160.32\ cm^2$ 1

28. Correct construction of given triangle 2

Correct construction of triangle similar to given triangle 2

29. LHS $= \frac{\tan^3\theta}{1+\tan^2\theta} + \frac{\cot^3\theta}{1+\cot^2\theta}$

$= \frac{\frac{\sin^3\theta}{\cos^3\theta}}{1+\frac{\sin^2\theta}{\cos^2\theta}} + \frac{\frac{\cos^3\theta}{\sin^3\theta}}{1+\frac{\cos^2\theta}{\sin^2\theta}}$ 1

$= \frac{\sin^3\theta}{\cos\theta} + \frac{\cos^3\theta}{\sin\theta}$

$= \frac{\sin^4\theta + \cos^4\theta}{\cos\theta \sin\theta}$ 1

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

$= \dfrac{1 - 2\sin^2\theta\cos^2\theta}{\cos\theta\sin\theta} = \sec\theta\,\text{cosec}\,\theta - 2\sin\theta\cos\theta$ 1

= R.H.S.

30. Let speed of stream be x km/hr.

Speed in downstream = (9 + x) km/hr. $\frac{1}{2}$

Speed in upstream = (9 – x) km/hr. $\frac{1}{2}$

$\dfrac{15}{9+x} + \dfrac{15}{9-x} = 3\dfrac{45}{60} = 3\dfrac{3}{4}$ 1

$\dfrac{15(9 - x + 9 + x)}{(9+x)(9-x)} = \dfrac{15}{4}$

$\Rightarrow$ $72 = 81 - x^2$ 1

$x^2 = 9$

$x = 3$ or -3 Rejected

$\therefore$ Speed of stream = 3 km/hr 1