SEE Model Question Set-2078

C. Mathematics

Maximum marks: 100 **Time: 3 hours**

Attempt all the questions.

Group-A (6 × 1 = 6)

1. (a) एउटा गाउँपालिकाको अहिलेको जनसङ्ख्या P छ र उक्त स्थानको जनसङ्ख्या हरेक वर्ष R% ले बढ्दछ भने T वर्ष पछिको जनसङ्ख्या कति हुन्छ होला?

The present population of a rural municipality is P and the population increases every year by R%. What will be the population of the place after T years?

(b) भुजाहरू a cm, b cm, c cm र अर्धपरिमिती s cm भएको त्रिभुजको क्षेत्रफल कति हुन्छ?

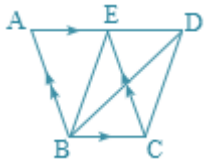
What is the area of triangle having sides a cm, b cm, c cm and the semi-perimeter s cm?

2. (a) $3\sqrt[4]{5}$ मा सर्डको क्रम कति हुन्छ? What is the order of the surd $3\sqrt[4]{5}$?

(b) अविच्छिन्न श्रेणीको मध्यिका निकाल्ने सुत्र लेख्नुहोस्।

Write down the formula to find the median of the continuous data.

3. (a) दिईएको चित्रमा समानान्तर चतुर्भुज ABCE र त्रिभुज BCD का क्षेत्रफलबिचको सम्बन्ध लेख्नुहोस्।



What is the relationship between the area of parallelogram ABCE and triangle BCD in the given figure?

(b) चक्रिय चतुर्भुजको परिभाषा लेख्नुहोस्। Define cyclic quadrilateral.

Group-B (17 × 2 = 34)

4. (a) नेपाल राष्ट्र बैंकको मुद्रा विनिमय दर अनुसार 1 अमेरिकी डलरको खरिददर र बिक्रिदर क्रमशः नेपाली रू. 119.70 र रू. 120.30 छन् भनेः According to the money exchange rate of Nepal Rastra Bank, the purchasing and selling rates of 1 American dollar are NRs 119.70 and NRs 120.30 respectively, then

(i) नेपाली रू. 84,210 सँग कति अमेरिकी डलर साट्न सकिन्छ?

How many American dollars can be exchanged with NRs 84,210?

(ii) तपाईंले $660 सँग कति नेपाली रुपैयाँ साट्न सक्नुहुन्छ?

How many Nepali rupees can you exchange with $660? Find it.

(b) एक जना मानिसले वि.सं. 2077 को सुरुमा रू. 3,00,000 मा एउटा मोटरसाइकल किनेँछ। यदि उक्त मोटरसाइकलको मुल्य हरेक वर्ष 15% ले ह्रास हुन्छ भने वि.सं 2078 को अन्त्यमा यसको मूल्य कति हुनेछ? पत्ता लगाउनुहोस्।

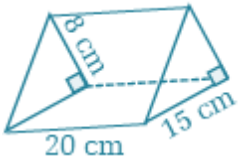
A man bought a motorcycle for Rs 3,00,000 in the beginning of 2077 B.S. If the value of the motorcycle depreciates at the rate is 15% p.a., what will be its value at the end of 2078 B.S.? Find it.

5. (a) एउटा त्रिभुजाकार पार्कको किनाराहरू 51 मि., 52 मि. र 53 मि. भए यसको क्षेत्रफल कति होला? पत्ता लगाउनुहोस्।

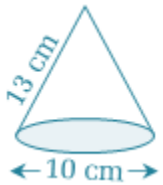
The edges of triangular park are 51 m, 52 m and 53 m long. Calculate its area.

(b) दिईएको त्रिभुजाकार प्रिजमको आयतन निकाल्नुहोस्।

Find the volume of the given triangular prism.



(c) दिईएको सोली आकारको वस्तुको पुरा सतहको क्षेत्रफल कति हुन्छ? पत्ता लगाउनुहोस्।
($\pi = 3.14$ प्रयोग गर्नुहोस्)
What is the total surface area of the given conical object?
Find it. (Use $\pi = 3.14$)



6. (a) म.स. निकाल्नुहोस्। Find the H.C. F. of $m^2 - m$ and $m^3 - m$.

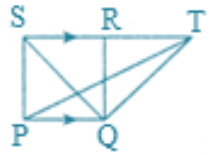
(b) सरल गर्नुहोस्। Simplify: $\frac{6^{n+2} + 7 \times 6^n}{6^{n+1} \times 8 - 5 \times 6^n}$

7. (a) ल.स. निकाल्नुहोस्। Find the L.C.M. of $a^3 - 125$ and $2a^3 + 10a + 50$

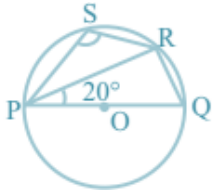
(b) हल गर्नुहोस्। Solve: $\sqrt{x+1} = \sqrt[3]{8}$

(c) यदि एउटा प्राकृतिक सङ्ख्याको वर्गको दोव्वरमा 5 जोड्दा 23 हुन्छ भने उक्त सङ्ख्या पत्ता लगाउनुहोस्।
If 5 is added to twice the square of a natural number, the result is 23, find the number.

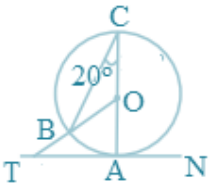
8. (a) दिईएको चित्रमा, एउटा वर्ग PQRS हो जसमा विकर्ण SQ = 6 से.मि. छ भने ΔPQT को क्षेत्रफल निकाल्नुहोस्।
In the given figure, PQRS is a square in which diagonal SQ = 6 cm.
Find the area of ΔPQT.



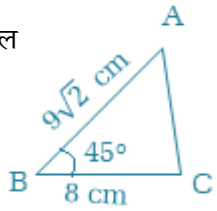
(b) दिईएको चित्रमा, O वृत्तको केन्द्रविन्दु हो। यदि ∠QPR = 20° भए ∠PSR को नाप पत्ता लगाउनुहोस्।
In the figure, O is the centre of the circle. If ∠QPR = 20°, find the measure of ∠PSR.



(c) दिईएको चित्रमा, O वृत्तको केन्द्रविन्दु हो। TAN वृत्तको स्पर्षरेखा हो। यदि ∠OCB = 20° भए ∠OTA को नाप पत्ता लगाउनुहोस्।
In the figure, O is the centre of circle. TAN is the tangent to the circle. If ∠OCB = 20°, find the measure of ∠OTA.



9. (a) ΔABC मा; AB = $9\sqrt{2}$ से.मि. , BC = 8 से.मि. र ∠ABC = 45° भए उक्त त्रिभुजको क्षेत्रफल निकाल्नुहोस्।
In ΔABC; AB = $9\sqrt{2}$ cm, BC = 8 cm and ∠ABC = 45°, find the area of the triangle.



(b) कुनै एउटा तथ्याङ्कमा, यदि मध्येक ($\bar{x}$) = 12, $\Sigma fx = 70 + 10a$ र वारम्वारताको सङ्ख्या (N) = $5 + a$ भए a र N को मान निकाल्नुहोस्।
In a data, if mean ($\bar{x}$) = 12, $\Sigma fx = 70 + 10a$ and the number of frequency (N) = $5 + a$, find the value of a and N.

10. (a) एउटा डाइस र एउटा सिक्कालाई एकैपटक उफार्दा डाइसमा जोर सङ्ख्या र सिक्कामा उग्र भाग आउने सम्भाव्यता पत्ता लगाउनुहोस्।
If a die is rolled and a coin is tossed at a same time, find the probability of getting even number on die and head on the coin.

(b) एउटा झोलामा एउटा रातो, एउटा हरियो र एउटा पहेँलो उत्रै र उस्तै बल छन्। उक्त झोलाबाट दुई वटा बलहरू एकपछि अर्को पुनः नराख्नेगरी निकाल्दा आउने सबै परिणामहरूको सम्भाव्यताहरूलाई वृक्षचित्रमा देखाउनुहोस्।
From a bag containing one red, one green and one yellow ball of same shape and size, two balls are drawn at random without replacement. Show the probabilities of all outcomes in a tree diagram.

Group-C (10 × 4 = 40)

11. एउटा विद्यालयका 32 शिक्षकहरू गोरखापत्र, कान्तिपुर वा दुवै पढ्छन्। ती मध्ये 4 जना गोरखापत्र र कान्तिपुर दुबै पढ्छन्। गोरखापत्र पढ्ने र कान्तिपुर पढ्ने शिक्षकको सङ्ख्याको अनुपात 4:5 छ भनेः

In a school, 32 teachers read either Gorkhapatra or Kantipur or both. 4 teachers read both the newspaper and the ratio of number of teachers who read Gorkhapatra to the number of teachers who read Kantipur is 4:5. Find:

(i) कति जना शिक्षकले यी दुई मध्ये एउटामात्र पत्रिका पढ्छन्?
How many teachers read only one of the newspapers?

(ii) माथिको तथ्यलाई भेन-चित्रमा प्रस्तुत गर्नुहोस्। Show the above information in a Venn-diagram.

12. एक जना पर्यटकले एउटा सिंगिङ् बओललाई 15% छुटपछि 13% भ्याटसहित रू. 11,526 तिरेछ भने उसले कति छुट पाएछन्? साथै नेपाल छोड्ने बेलामा उसले कति रकम फिर्ता पाएछ? पत्ता लगाउनुहोस्।

A tourist paid Rs 11,526 for a head sized singing-bowl made of metal after a discount of 15% and including 13% value added tax (VAT), how much discount did he get? Also, how much amount does he get back while leaving Nepal? Find it.

13. दिईएको चित्रमा आधार वर्ग भएको पिरामिड छ जसको छड्के उचाई 10 से.मि. र आधारको लम्बाई 12 से.मि. छन्। उक्त पिरामिडको पुरा सतहको क्षेत्रफल र आयतन पत्ता लगाउनुहोस्।

Given figure is a square-based pyramid in which the slant height is 10 cm and the length of the base is 12 cm. Find its total surface area and volume.

14. सरल गर्नुहोस्। Simplify: $\frac{x+2}{1+x+x^2} - \frac{x-2}{1-x+x^2} - \frac{2x^2}{1+x^2+x^4}$

15. हल गर्नुहोस्। Solve: $3^x + \frac{1}{3^x} = 9\frac{1}{9}$

16. ΔVXY र समानान्तर चतुर्भुज WXYZ एउटै आधार र उहि समानान्तर रेखाहरू र विचमा छन्। स.च. WXYZ को क्षेत्रफल ΔVXYको क्षेत्रफलको दोब्बर हुन्छ भनी प्रमाणित गर्नुहोस्।

ΔVXY and parallelogram WXYZ stand on the same base XY and between VZ//XY. Prove that area of □WXYZ is double the area of ΔVXY.

17. भुजाहरू a = 6.4 से. मि., b = 6 से. मि. र c = 5.6 से. मि. भएको को रचना गर्नुहोस्। साथै, उक्त त्रिभुजको क्षेत्रफलसंग बराबर हुने र एउटा भुजाको नाप हुने अर्को त्रिभुजको रचना गर्नुहोस्।

Construct ΔABC having sides a = 6.4 cm, b = 6 cm and c = 5.6 cm. Also, construct another triangle equal in area to the area of ΔABC and having its one side 7 cm.

18. वृत्तको एउटै चाप PT मा आधारित केन्द्रीय कोण POT र परिधिकोण PUT विचको सम्बन्ध प्रयोगद्वारा खोजी गर्नुहोस्। (कम्तिमा 3 से.मि. अर्धव्यास भएका दुई वटा वृत्तहरू आवश्यक छन्)

Explore experimentally the relation between the centre angle POT and the circumference angle PUT subtended by the arc PT of a circle. (Two circles of radii at least 3 cm are required)

19. एक जना 5 फिट उचाई भएको मानिसले आफू अगाडी भएको 55फिट अग्लो स्तम्भको टुप्पोमा अवलोकन गर्दा 45° को उन्नतांश कोण बन्दछ भने उक्त मानिस र स्तम्भविचको दुरी पत्ता लगाउनुहोस्।

A 5 ft. tall person observes the angle of elevation of the top of a pole 55 ft which is in front of him and finds it to be 45°. Find the distance between the person and the pole.

20. तल दिईएको तथ्याङ्कबाट माथिल्लो चतुर्थांश निकाल्नुहोस्। Calculate the upper quartile from the data given below.

Marks obtained	0-15	15-30	30-45	45-60	60-75
No. of students	8	6	12	15	7

Group-D (4 × 5 = 20)

21. एउटा बैंकले खाता A मा 10% प्रतिवर्ष वार्षिकी चक्रियव्याजदर र खाता B मा 9.5% प्रतिवर्ष अर्धवार्षिकी चक्रियव्याजदर कायम गरेको छ। यदि तपाईं 2 वर्षको लागि सो बैंकमा जम्मा गर्दै हुनुहुन्छ भने कुन खातामा जम्मा गर्नुहुन्छ र किन? हिसाव गरी उल्लेख गर्नुहोस्।

A bank has fixed the rate of interest 10% per annum annually compound interest in account A and 9.5% per annum semi-annually compound interest in account B. If you are going to deposit Rs 80,000 for 2 years in the same bank, in which account will you deposit and why? Give your reason with calculation.

22. एक जना घरमालिकले उसको घरको छतमा टुप्पोमा अर्धगोलाकार भएको वेलनाकार ट्याङ्कीको जडान गरेको छ। सो ट्याङ्कीको आधारको व्यास 2.1 मिटर र जम्मा उचाई 2.35 मिटर छ। यदि सो ट्याङ्की पुरा पानीभरिएको छ र उक्त घरको सदस्यहरूले एक दिनमा 330 लिटर पानी खपत गर्दछ भने उक्त ट्याङ्कीको पानी कति दिनलाई पुग्ला? पत्ता लगाउनुहोस्।

A house owner fixed a cylindrical tank with hemispherical top at the roof of his house. The diameter of the base of the tank is 2.1 m and total height is 2.35 m. If the tank is completely filled with water and the family members consume 330 liters of water in each day, for how many days the water is sufficient? Find it.

23. एक जना कृषकको फर्ममा केहि गाई र केही कुखुरा छन्। सवै गाई तथा कुखुरा सामान्य अवस्थामा छन्। गाई तथा कुखुराका जम्मा टाउको 330 वटा र 720 वटा जम्मा खुट्टा छन्।

In an animal farm of a farmer, there are some cows and hens. All the cows and hens are normal. The total number of heads of animals is 330 and the number of legs is 720.

(i) गाई र कुखुराका सङ्ख्या पत्ता लगाउनुहोस्। Find the number of cows and hens.

(ii) गाईको सङ्ख्या कुखुराको सङ्ख्याभन्दा कति प्रतिशत कम होला?

By how many percent is the number of cow less than the number of hens in the farm?

24. एउटा वृत्ताकार मैदानको केन्द्रविन्दु O छ र व्यास AB छ। यदि उक्त मैदानको परिधिमा भएका दुई विन्दुहरू C र D मा C चाप BD को मध्य-विन्दु हो भने ΔAOC र ΔCOD को क्षेत्रफल बराबर हुन्छन् भनी प्रमाणित गर्नुहोस्।

In a circular ground, O is the centre, AB the diameter, C and D are any two points on the circumference so that C is the mid-point of arc BD. Prove that ΔAOC and ΔCOD are equal in area.

The End

COMPLETE SOLUTION

Group-A (6 × 1 = 6)

1. (a) ***Solution:***

Here, the population of the place after T years (P_T) $= P\left(1 + \frac{R}{100}\right)^T$.

(b) ***Solution:***

Here, the area of triangle (A) $= \sqrt{s(s-a)(s-b)(s-c)}$ sq. cm.

2. (a) ***Solution:***

Here, the order of the surd $3\sqrt[4]{5}$ is 4.

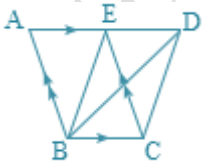
(b) ***Solution:***

Here, median $= L + \left(\frac{N/2 - c.f.}{f}\right) \times i$

3. (a) ***Solution:***

Here, the area of $\square$ABCE is twice the area of ΔBCD

[They are standing on the same base BC and between AD//BC]



(b) ***Solution:***

The quadrilateral formed by joining any four points of the circumference of a circle is known as cyclic quadrilateral.

Group-B (17 × 2 = 34)

4. (a) ***Solution:***

Here, buying rate of 1$ = NRs 119.70 and selling rate of 1 $ = NRs 120.30

(i) Since, the bank sells the US dollar. So, using selling rate: 1 $ = NRs 120.30

$\therefore$ 1 NRs 84,210 can be exchanged with $\frac{84210}{120.30} = \$700$

(ii) Since, the bank buys the US dollar. So, using buying rate: 1 $ = NRs 119.70

$\therefore$ $ 660 = 660 × NRs 119.70 = NRs 79,002

(b) ***Solution:***

Here, the initial price of the motorcycle (P) = Rs 3,00,000;

Time duration (T) = 2 years

Rate of depreciation (R) = 15% p.a.

The value of the motorcycle at the end of B.S. 2078 (P_T) = ?

We have, $P_T = P\left(1 - \frac{R}{100}\right)^T$

$= \text{Rs } 3,00,000\left(1 - \frac{15}{100}\right)^2$

$= \text{Rs } 3,00,000 \times 0.7225$

$= \text{Rs } 2,16,750$

Hence, the value of motorcycle will be Rs 2,16,750.

5. (a) ***Solution:***

Here, the edges of triangular park are; a = 51 m, b = 52 m and c = 53 m

Now, semi-perimeter (s) $= \frac{a+b+c}{2} = \frac{51\text{ m} + 52\text{ m} + 53\text{ m}}{2} = 78$ m

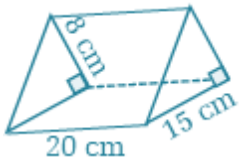
Again, area (A) $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{78\ (78-51)(78-52)(78-53)}$

$= \sqrt{78 \times 27 \times 26 \times 25} = \sqrt{1368900}\ \text{m}^2 = 1170\ \text{m}^2$

Hence, the area of the park is 1,170 m^2.

(b) ***Solution:***



Here, area of triangular base (A) = $\frac{1}{2}$×15 cm × 8 cm = 60 m^2

Again, the volume of the prism (V) = Area × length

= 60 m^2 × 20 m = 1200 m^3

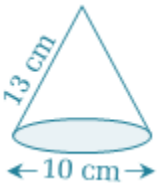
Hence, the volume of the prism is 1,200 m^3.

2

(c) ***Solution:***

Here,

In the given conical object; diameter of the base (d) = 10 cm



$\therefore$Radius (r) = $\frac{d}{2}$= $\frac{10\text{ cm}}{2}$ = 5 cm

Slant height (l) = 13 cm

Total surface area (T.S.A) =?

Now, T.S.A. = $\pi r\ (r + l)$

= 3.14 × 5 cm (5cm + 13 cm)

= 15.7 cm ×18 cm

= 282.6 cm^2

Hence, the total surface area of the cone is 282.6 cm^2.

2

6. (a) ***Solution:***

Here,

The first expression = $m^2 - m$

= m (m – 1)

The second expression = $m^3 - m$

= m (m^2 – 1)

= m (m +1) (m – 1)

Hence, H.C.F. = common factor = m (m – 1)

2

(b) ***Solution:***

Here, $\frac{6^{n+2} + 7 \times 6^n}{6^{n+1} \times 8 - 5 \times 6^n}$ = $\frac{6^n \times 6^2 + 7 \times 6^n}{6^n \times 6^1 \times 8 - 5 \times 6^n}$

= $\frac{6^n (36 + 7)}{6^n (6 \times 8 - 5)}$

= 1

2

7. (a) ***Solution:***

The first expression = $a^3 - 125$

= $a^3 - 5^3$

= $(a - 5)\ (a^2 + 5a + 25)$

The second expression = $2a^3 + 10a^2 + 50a$

= 2a (a^2 + 5a + 25)

Hence, L.C.M. = $2a\ (a - 5)\ (a^2 + 5a + 25) = 2a\ (a^3 - 125)$

2

(b) ***Solution:***

Here, the given equation is $\sqrt{x+1} = \sqrt[3]{8}$

or, $\sqrt{x+1} = 2$

On squaring both sides, we get

$(\sqrt{x+1})^2 = 2^2$

or, x + 1 = 4

or, x = 3

Hence, the required value of x is 3.

2

(c) ***Solution:***

Let, the required natural number be x.

Then, according to the question; $2x^2 + 5 = 23$

or, $2x^2 = 18$

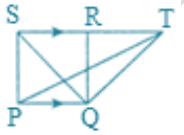
or, $x^2 = 9$

or, $x = \pm 3$

Hence, the required natural number is 3.

8. (a) ***Solution:***

Here, diagonal SQ = 6 cm.



Now, the area of square PQRS $= \frac{1}{2} \times d^2$

$= \frac{1}{2} \times (6\text{ cm})^2$

$= \frac{1}{2} \times 36\text{ cm}^2$

$= 18\text{ cm}^2$

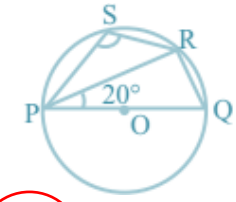
Again, the area of $\Delta PQT = \frac{1}{2} \times$ area of square PQRS [They are standing on PQ and between ST//PQ]

$= \frac{1}{2} \times 18\text{ cm}^2$

$= 9\text{ cm}^2$

Hence, the area of ΔPQT is 9 cm^2.

(b) ***Solution:***



Here, O is the centre of the circle and $\angle QPR = 20^\circ$, $\angle PSR = ?$

Now, $\angle PRQ = 90^\circ$ [The angle in semi-circle is always a right angle]

Also, In ΔPQR, $\angle QPR + \angle PRQ + \angle PQR = 180^\circ$

or, $20^\circ + 90^\circ + \angle PQR = 180^\circ$

or, $\angle PQR = 70^\circ$

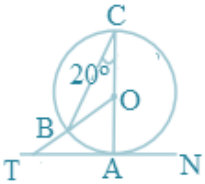
Again, $\angle PQR + \angle PSR = 180^\circ$ [The opposite angles of cyclic quadrilateral are supplementary]

or, $70^\circ + \angle PSR = 180^\circ$

or, $\angle PSR = 110^\circ$

Hence, the measurement of $\angle PSR$ is 110°.

(c) ***Solution:***



Here, O is the centre of circle. TAN is the tangent to the circle and $\angle OCB = 20^\circ$, $\angle OTA = ?$

Now, $\angle AOB = 2 \times \angle ACB$ [The central angle is twice the inscribed angle on the same arc AB]

$= 2 \times 20^\circ = 40^\circ$

Again, $\angle OAT = 90^\circ$ [The radius is perpendicular to the tangent at the point of contact.]

In ΔOAT, $\angle OAT + \angle AOT + \angle OTA = 180^\circ$

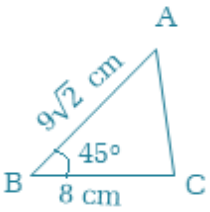
or, $90^\circ + 40^\circ + \angle OTA = 180^\circ$

or, $\angle OTA = 50^\circ$

Hence, the measurement of $\angle OTA$ is 50°.

9. (a) ***Solution:***

Here, in ΔABC; AB = $9\sqrt{2}$ cm, BC = 8 cm and ∠ABC = 45°



Area (A) =?

Now, area of ΔABC = $\frac{1}{2}\times AB\times BC\times \sin B$

$= \frac{1}{2}\times 9\sqrt{2}\text{ cm}\times 8\text{ cm}\times \sin 45^\circ$

$= \frac{1}{2}\times 9\sqrt{2}\text{ cm}\times 8\text{ cm}\times \frac{1}{\sqrt{2}}$

$= 36\text{ cm}^2$

Hence, the area of ΔABC is 36 cm^2.

2

(b) ***Solution:***

Here, mean ($\bar{x}$) = 12, $\Sigma fx = 70 + 10a$ and the number of frequency (N) = $5 + a$

Now, mean ($\bar{x}$) $= \frac{\Sigma fx}{N}$

or, $12 = \frac{70+10a}{5+a}$

or, $60 + 12a = 70 + 10a$

or, $2a = 10$

or, $a = 5$

Hence, $a = 5$ and $N = 5 + a = 5 + 5 = 10$.

2

10. (a) ***Solution:***

Let, H and E denote the events of getting head in coin and an even number on a die respectively.

For a coin; n (S) = 2 and n (H) = 1 ∴The probability of getting head, $P(H) = \frac{n(H)}{n(S)} = \frac{1}{2}$

For a die, n (S) = 6 and E = {2, 4, 6} ∴n (E) = 3

∴The probability of getting an even number, $P(E) = \frac{n(E)}{n(S)} = \frac{\cancel{3}^{1}}{\cancel{6}_{2}} = \frac{1}{2}$

Now, P (H and E) = P (H)×P (E) $= \frac{1}{2}\times\frac{1}{2} = \frac{1}{4}$

Hence, the probability of getting even number on die and head on the coin is $\frac{1}{4}$.

2

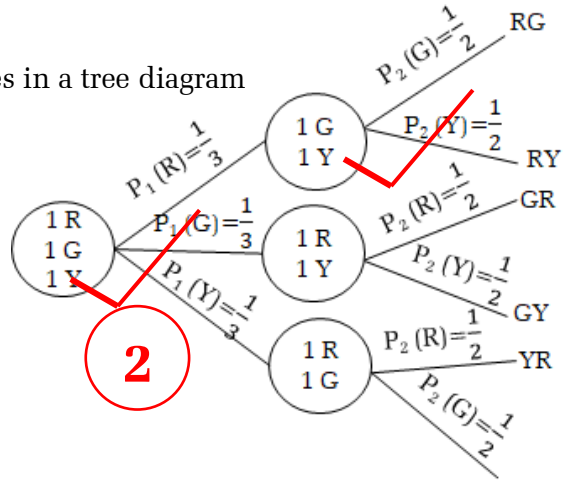
(b) ***Solution:***

Let R, G and Y denote the events of getting red, green and yellow ball respectively.

Then, n (S) = 1 + 1 + 1 = 3

Case: without replacement.

Showing the probabilities of all outcomes in a tree diagram



2

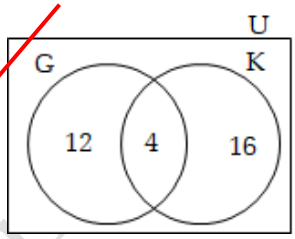
Group-C (10 × 4 = 40)

11. ***Solution:***

Let, G and K denote the sets of teachers who read Gorkhapatra and Kantipur respectively.
Then, n (U) = 32 = n (G∪K) and n (G∩K) = 4. Suppose, n (G) = 4x and n (K) = 5x
Now, n (G∪K) = n (G) + n(K) - n (G∩K)
or, 32 = 4x + 5x – 4
or, 36 = 9x
or, x = 4
∴ n (G) = 4x = 4×4 = 16, n (K) = 5x = 5×4 = 20

(i) n_o (G) = n (G) - n (G∩K) = 16 – 4 = 12 and
n_o (K) = n (K) - n (G∩K) = 20 – 4 = 16
Thus, the number of teachers who read only one of these newspaper = n_o (G) + n_o (K)
= 12 + 16 = 28.

(ii) Showing the above information in a Venn-diagram.



4

12. ***Solution:***

Here, S.P. with VAT = Rs11,526
Rate of discount = 15%
Rate of VAT = 13%
Let, marked price (M.P.) of the singing-bowl be Rs x.
Now,
S.P. = M.P. – Discount% of M.P.
= Rs x – 15% of Rs x
= Rs 0.85x
Also, S.P. with VAT = S.P. + VAT% of S.P.
or, Rs 11,526 = 0.85x + 13% of 0.85x
or, Rs 11,526 = 0.9605x
or, $x = \frac{11526}{0.9605}$
or, x = Rs 12,000
Hence, M.P. of the singing –bowl is Rs 12,000.
Again, discount amount = 15% of M.P. = 15% of Rs 12000 = Rs 1,800
S.P. = M.P. – discount = Rs 12,000 – Rs 1,800 = Rs 10,200
We have, VAT amount = 13% of S.P. = 13% of Rs 10,200 = Rs 1,326
Hence, he got back Rs 1,326 while leaving Nepal.

4

13. ***Solution:***

Here,
In the given square-based pyramid; length of base (a) = 12 cm
Slant height (l) = 10 cm
Total surface area =?
We have, T.S.A. = $a^2 + 2al = (12\text{ cm})^2 + 2\times12\text{ cm}\times10\text{ cm} = 384\text{ cm}^2$
Also, vertical height (h) = $\sqrt{l^2 - \left(\frac{a}{2}\right)^2} = \sqrt{10^2 - \left(\frac{12}{2}\right)^2} = \sqrt{100 - 36} = 8$ cm

Again, volume (V) $= \frac{1}{3}a^2h = \frac{1}{3}\times (12\text{ cm})^2 \times 8\text{ cm} = 384\text{ cm}^3$

Hence, the total surface area of the pyramid is 384 cm^2 and its volume is 384 cm^3.

14. ***Solution:***

Here, $\frac{x+2}{1+x+x^2} - \frac{x-2}{1-x+x^2} - \frac{2x^2}{1+x^2+x^4}$

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

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

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

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

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

$= \frac{4}{1+x^2+x^4}$

15. ***Solution:***

Here, the given equation is $3^x + \frac{1}{3^x} = 9\frac{1}{9}$ …(i)

Let, $3^x = a$ then equation (i) becomes $a + \frac{1}{a} = \frac{82}{9}$

or, $\frac{a^2+1}{a} = \frac{82}{9}$

or, $9a^2 + 9 = 82a$

or, $9a^2 - 82a + 9 = 0$

or, $9a^2 - 81a - a + 9 = 0$

or, $9a(a-9) - 1(a-9) = 0$

or, $(9a-1)(a-9) = 0$

Either, $9a - 1 = 0$ … (ii)

Or, $a - 9 = 0$ … (iii)

From (ii), $9a - 1 = 0$

or, $9a = 1$

or, $a = \frac{1}{9}$

or, $3^x = \frac{1}{3^2}$

or, $3^x = 3^{-2}$

$\therefore x = -2$

From (iii), $a - 9 = 0$

or, $a = 9$

or, $3^x = 3^2$

$\therefore x = 2$

Hence, $x = \pm 2$

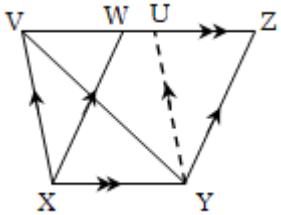
16. ***Solution:***

Here,

Given: ΔVXY and parallelogram WXYZ stand on the same base XY and between VZ//XY.

To prove: area of □WXYZ = 2×area ofΔVXY

Construction: UY//VX is drawn where U is on VZ.



Proof:

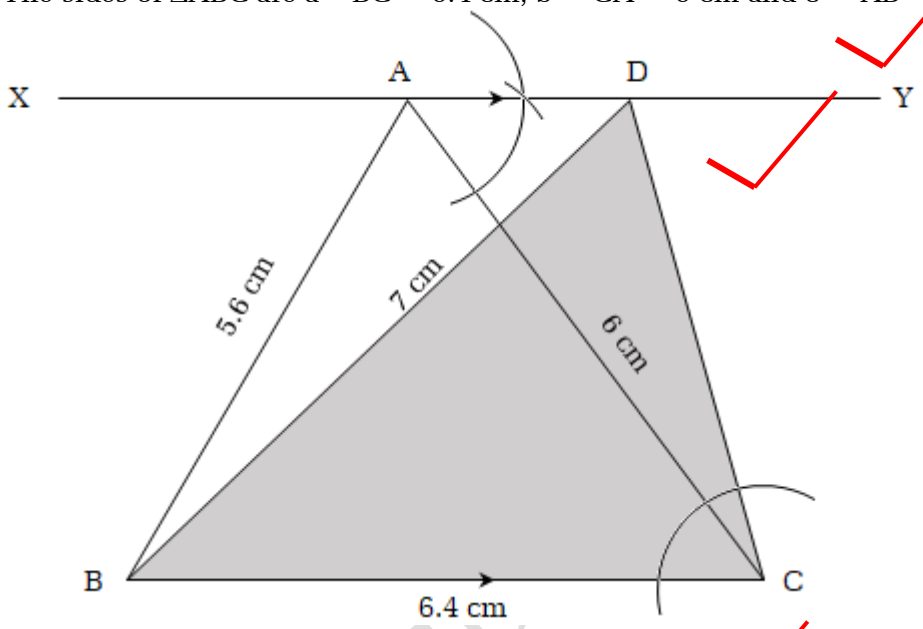
S.N.	Statements	S.N.	Reasons
1.	UVXY is a parallelogram.	1.	VU//XY and XV//YU.
2.	□UVXY = □WXYZ	2.	Both are standing on XY and between VZ//XY.
3.	□UVXY = 2ΔVXY	3.	Median VY bisects the □UVXY
4.	□WXYZ = 2ΔVXY	4.	From statements (2) and (3)
Hence			Proved

4

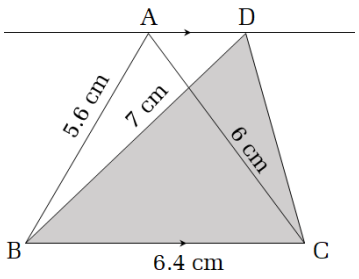
17. ***Solution:***

Here,

The sides of ΔABC are a =BC = 6.4 cm, b = CA = 6 cm and c = AB = 5.6 cm.



Rough sketch



4

Hence, ΔDBC is the required triangle whose area is equal to the area of ΔABC as they stand on the same base BC and between XY//BC.

18. ***Solution:***

Here,

Step 1: Two circles with centre O and different length of radii are drawn.

Step 2: The centre angle POT and the circumference angle PUT subtended by the arc PT are drawn in each circle.

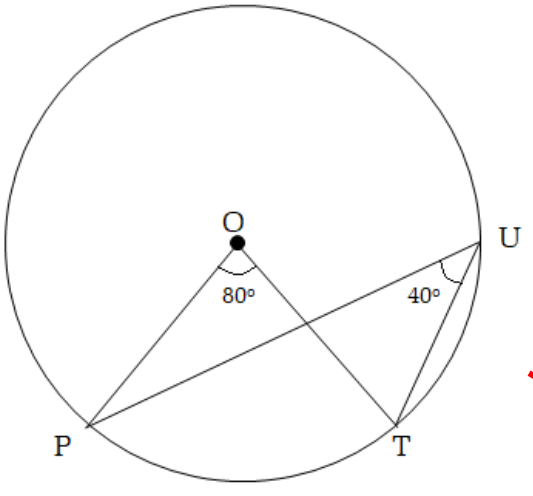


Fig. (i)

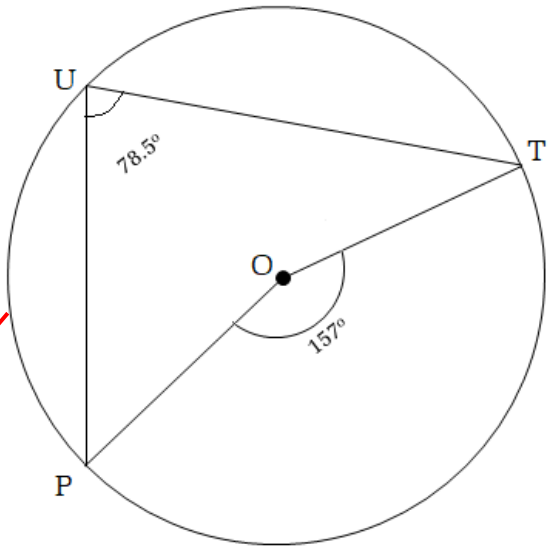


Fig. (ii)

Step 3: ∠POT and ∠PUT are measured in each circle and the result is tabulated below.

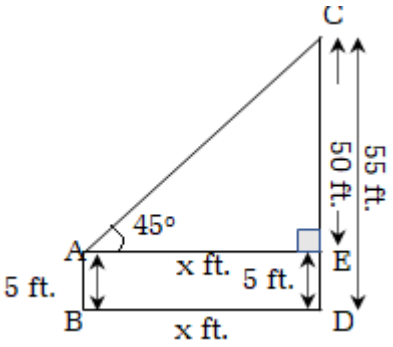
Figure no.	∠POT	∠PUT	Result
(i)	80^o	40^o	∠POT = 2∠PUT
(ii)	157^o	78.5^o	∠POT = 2∠PUT

4

Conclusion: From the above experiment, we came to know that the angle at the centre of a circle is twice the angle at the circumference standing on the same arc.

19. ***Solution:***

Let, AB be the height of a person, CD the height of the pole, BD the distance between the person and the pole and ∠EAC be the angle of elevation of the top of the pole.



Then, AB = ED = 5 ft., CD = 55 ft.

∴CE = CD – ED = 55 ft. – 5 ft. = 50 ft.

∠EAC = 45^o

BD = AE = x ft. (say)

Now, from the right angled triangle AEC;

$$\tan 45^o = \frac{CE(p)}{AE\ (b)}$$

$$\text{or, } 1 = \frac{50 \text{ ft.}}{x}$$

$$\text{or, } x = 50 \text{ ft.}$$

Hence, the distance between the person and the pole is 50 ft.

4

20. ***Solution:***

Here, computation of upper quartile

Marks obtained	No. of students (f)	Cumulative frequency (c.f.)
0-15	8	8
15-30	6	14
30-45	12	26
45-60	15	41
60-75	7	48
	N = 48	

Now, the position of Q_3 $= \left(\frac{3N}{4}\right)^{th}$ class

$= \left(\frac{3\times48}{4}\right)^{th}$ class

$= 36^{th}$ term

From the above c.f. column, the c.f. just greater than 36 is 41 and its corresponding class is (45-60) ∴Q_3 class = (45-60) where L = 45, c.f. = 26, f = 15 and i = 15

Again, $Q_3 = L + \left(\frac{3N/4 - c.f.}{f}\right) \times i$

$= 45 + \left(\frac{36 - 26}{15}\right) \times 15$

$= 45 + 10$

$= 55$

Hence, the upper quartile of the data is 55.

4

Group-D (4 × 5 = 20)

21. ***Solution:***

Here, principal (P) = Rs 80,000 and time (T) = 2 years

For account A; rate (R) = 10% p.a. annually compound interest

We have, annually C.I. $= P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= \text{Rs } 80{,}000\left[\left(1+\frac{10}{100}\right)^{2}-1\right]$

$= \text{Rs } 80{,}000 \times 0.21$

$= \text{Rs } 16{,}800$

For account B; rate (R) = 9.5 % p.a. semi-annually compound interest

We have, semi-annually C.I. $= P\left[\left(1+\frac{R}{200}\right)^{2T}-1\right]$

$= \text{Rs } 80{,}000\left[\left(1+\frac{9.5}{200}\right)^{2\times2}-1\right]$

$= \text{Rs } 80{,}000\left[(1.0475)^{4}-1\right]$

$= \text{Rs } 80{,}000 \times 0.2039712781$

$= \text{Rs } 16{,}317.70$

5

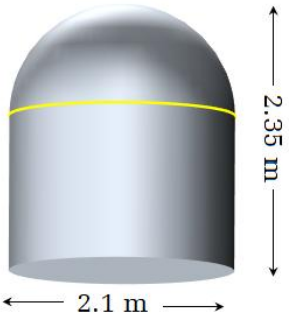
Annually C.I. – semi-annually C.I. = Rs16,800 – Rs 16,317.70 = Rs 482.30

I would deposit in account A because it gives Rs 482.30 more interest than account B.

22. ***Solution:***

Here, diameter of base (d) = 2.1 m

$\therefore$ Radius (r) $= \frac{d}{2}=\frac{2.1\text{ m}}{2}=1.05\text{ m}$



Height of cylindrical part (h) = 2.35 m – 1.05 m = 1.3 m

Now,

Volume of tank = volume of (cylindrical part + hemispherical part)

$= \pi r^2 h + \frac{2}{3}\pi r^3$

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

$= \frac{22}{7}\times(1.05\text{ m})^2\left(1.3\text{ m} + \frac{2}{3}\times1.05\text{ m}\right)$

$= \frac{22}{7}\times(1.05\text{ m})^2\left(1.3\text{ m} + \frac{2}{3}\times1.05\text{ m}\right)$

$= 3.465\text{ m}^2\times2\text{ m}$

$= 6.93\text{m}^3$

5

We know, 1 m^3 = 1000 liters

$\therefore$ Volume of water in the tank (V) = 6.93× 1000 liters = 6930 liters

Again, 330 liters of water can be consumed in 1 day.

1 liter of water can be consumed in $\frac{1}{330}$ days.

$\therefore$ 6930 liters of water can be consumed in $\frac{1}{330}\times 6930$ days = 21 days

Hence, the full tank of tank is sufficient for 21 days.

25. ***Solution:***

Let, the number of cows be x and the number of hens be y.

Then,

From the given first condition; $x + y = 330$ … (i)

Since, each cow has 4 legs and that of each hen has 2 legs

From the given second condition; $4x + 2y = 720$

or, $2x + y = 360$ … (ii)

Now, subtracting equation (i) from equation (ii), we get

$$\begin{array}{r} 2x + y = 360 \\ x + y = 330 \\ (-)\quad (-)\quad (-) \\ \hline x = 30 \end{array}$$

Also, putting the value of x in equation (i), we get

$30 + y = 330$

or, $y = 300$

Hence, there are 30 cows and 300 hens.

Again, difference $= 300 - 30 = 270$

Less percentage $= \frac{\text{diffrence}}{300} \times 100\% = \frac{270}{300} \times 100\% = 90\%$

Hence, the number of cows is less than the number of hens by 90%.

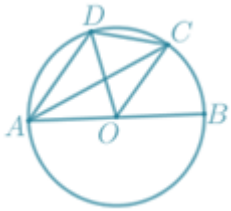
5

26. ***Solution:***

Given: O is the centre of circle, AB is the diameter and arc BC = arc CD.

To prove: Area of ΔAOC = Area of ΔCOD.

Proof:



S.N.	Statements	S.N.	Reasons
1.	arc BD = 2 × arc BC	1.	Given
2.	$\angle BAD = \frac{1}{2}$ arc BD°	2.	Relation between the inscribed angle and its opposite arc.
3.	$\angle BAD = \frac{1}{2} \times 2 \times$ arc BC°	3.	From statements (1) and (2)
4.	$\angle BOC =$ arc BC°	4.	Relation between the centre angle and its opposite arc.
5.	$\angle BAD = \angle BOC$	5.	From statements (3) and (4)
6.	AD//OC	6.	The corresponding angles are equal.
7.	$\Delta AOC = \Delta COD$	7.	Botha are standing on the same base OC and between AD//OC.
			Proved

The End

5