MATHS

1. If $2y\cos\theta = x\sin\theta$ and $3x\sec\theta - 5y\,\text{cosec}\,\theta = 1$, then the value of $x^2 + 4y^2$ is

(a) 4 (b) 6 (c) –6 (d) –4

1. (a) $2y\cos\theta = x\sin\theta$

Let $\dfrac{y}{\sin\theta} = \dfrac{x}{2\cos\theta} = k$

$\therefore x = 2k\cos\theta,\ y = k\sin\theta$

Now, $3x\sec\theta - 5y\,\text{cosec}\,\theta = 1$

$3(2k\cos\theta)\sec\theta - 5k\sin\theta.\text{cosec}\,\theta = 1 \Rightarrow 6k - 5k = 1 \Rightarrow k = 1$

$\therefore x = 2\cos\theta,\ y = \sin\theta$

Now $x^2 + 4y^2 = 4\cos^2\theta + 4\sin^2\theta = 4(\cos^2\theta + \sin^2\theta) = 4$

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

2. Find the value of the expression :

$$\frac{\cot A + \text{cosec}A - 1}{\cot A - \text{cosec}A + 1}$$

(a) $\dfrac{\sec A - 1}{\tan A}$ (b) cosecA + cotA (c) $\dfrac{\sin A}{1 - \cos A}$ (d) All of these

2. (d) $\dfrac{\cot A + \text{cosec}A - 1}{\cot A - \text{cosec}A + 1}$ [Using $\text{cosec}^2\theta - \cot^2\theta = 1$]

$$= \frac{\cot A + \text{cosec}A - (\text{cosec}^2 A - \cot^2 A)}{\cot A - \text{cosec}A + 1}$$

$$= \frac{(\cot A + \text{cosec}A)[1 - \text{cosec}A + \cot A]}{[\cot A - \text{cosec}A + 1]} = \cot A + \text{cosec}A$$

$$= \frac{\cos A}{\sin A} + \frac{1}{\sin A} = \frac{1 + \cos A}{\sin A} = \frac{1 + \cos A}{\sin A} \times \frac{\cos A}{\cos A} = \frac{\dfrac{1 + \cos A}{\cos A}}{\dfrac{\sin A}{\cos A}} = \frac{\sec A + 1}{\tan A}$$

Also, $\dfrac{1 + \cos A}{\sin A} \times \dfrac{1 - \cos A}{1 - \cos A} = \dfrac{1 - \cos^2 A}{\sin A(1 - \cos A)} = \dfrac{\sin A}{1 - \cos A}$.

So, $\dfrac{\cot A + \text{cosec}A - 1}{\cot A - \text{cosec}A + 1} = \cot A + \text{cosec}A = \dfrac{1 + \sec A}{\tan A} = \dfrac{\sin A}{1 - \cos A}$

3. Find the value of the following expression :

$\tan 1^\circ.\tan 2^\circ......\tan 88^\circ \tan 89^\circ \tan 90^\circ$

(a) 0 (b) 1 (c) $\dfrac{1}{0}$ (d) $\dfrac{0}{1}$

3. (c) $\tan 1^\circ \tan 2^\circ ...... \tan 88^\circ \tan 89^\circ \tan 90^\circ = \dfrac{1}{0}$

And $\tan 90^\circ = \dfrac{\sin 90^\circ}{\cos 90^\circ} = \dfrac{1}{0} = \infty$

4. x litres of cold water from a right circular cylinder of radius r and height h is transferred into a right circular cone, which has same radius of base. Find the surface area covered by the droplets on cone? (assume the cone is full filled by cold water) Select your answer from the four alternatives given below :

(a) $\pi h\sqrt{9r^2+h^2}$ (b) $\pi r\sqrt{9r^2+h^2}$ (c) $\pi r\sqrt{9h^2+r^2}$ (d) $\pi h\sqrt{9h^2+r^2}$

4. (c) Volume of right circular cylinder = $\pi r^2 h$ ...(1)

Cold water is transferred into cone of some base radius.

Let height of cone = h_1

$\therefore$ Volume of cone = $\frac{\pi}{3}r^2h_1$ ....(2)

But (1) = (2), therefore $h_1 = 3h$.

So, slant height of cone = $\sqrt{h_1^2+r^2} = \sqrt{9h^2+r^2}$

Area of cone covered by water droplets = $\pi r l$ (where l = slant height of cone)

$= \pi r\sqrt{9h^2+r^2}$

5. If $\frac{1}{a^2+b^2}, \frac{1}{b^2+c^2}, \frac{1}{c^2+a^2}$ are in A.P. then which statement from the following is true.

(a) a^2, b^2, c^2 are in A.P. (b) b^2, a^2, c^2 are in A.P.

(c) a^4, b^4, c^4 are in A.P. (d) b^4, a^4, c^4 are in A.P.

5. (d) $\frac{1}{a^2+b^2}, \frac{1}{b^2+c^2}, \frac{1}{c^2+a^2}$ are in A.P.

$\therefore \frac{2}{b^2+c^2} = \frac{1}{a^2+b^2} + \frac{1}{c^2+a^2}$

$\Rightarrow \frac{2}{b^2+c^2} = \frac{c^2+2a^2+b^2}{(a^2+b^2)(c^2+a^2)}$

$\Rightarrow 2a^2c^2+2a^4+2b^2c^2+2b^2a^2 = 2b^2c^2+b^4+c^4+2a^2b^2+2a^2c^2$

$\Rightarrow 2a^4 = b^4+c^4$

Therefore b^4, a^4, c^4 are in A.P.

6. Ambika has a monthly income of Rs.15558. She gives Rs.4500 in PF every month and Rs.3160 as LIC Premium (semi annually). If she pays Rs. 200 as income tax every month. How much income tax she have to pay at the end of 12th month?

Calculate the income tax using the given tables

Salary	**Standard Deduction**	**Income Tax**	**Rebate on saving**	**Surcharge**
If the salary exceeds Rs. 1,50,000 but does not exceed Rs. 3,00,000	Rs. 25,000	Rs. 19,000 + 30% of the amount exceeding Rs. 1,50,000	15% of the saving upto a maximum of Rs. 15,000	5%

(a) Rs.6500 (b) Rs.6600 (c) Rs.8900 (d) Rs.6700

6. (d) Ambika's yearly income = 15558 × 12 = Rs.186696.
Standard Deduction = 186696 – 25000 = Rs. 161696.

Income Tax = $19000 + \frac{30}{100} \times (161696 - 150000) = 19000 + (48508.8 - 45000)$

= 19000 + 3508.8 = Rs. 22508.80
Savings, PF = 4500 × 12 = Rs. 54000
LIC Premium = 3160 × 2 = Rs. 6220
Total Savings = Rs. 60220

Rebate on Saving = $60220 \times \frac{15}{100} = \frac{903300}{100} = Rs.9033.00$

Rebate for womens = Rs. 5000.00
Total Rebate = Rs. 14033.00
Income tax to be paid = Rs.22508.80 – 14033.00 = Rs. 8475.80

Surcharge = $8475.80 \times \frac{5}{100} = \frac{42379.00}{100} = Rs.423.79$

$\therefore$ Total I.T. to be paid = $8475.80 + 423.79 = 8899.59 \approx Rs.8900$
She already paid = Rs.2200 in 11 months
So, I.T. to be paid by her at the end of 12th month will be = 8900 – 2200 = Rs.6700.

7. If $\sqrt{x^2 + \sqrt{x^2 + \sqrt{x^2 + \sqrt{x^2 + ...\infty}}}} = 4$, find the value of x? Select your answer from the choices given below.

(a) 12 (b) –12 (c) $\pm\sqrt{12}$ (d) None of these

7. (c) $\Rightarrow \sqrt{x^2 + \sqrt{x^2 + \sqrt{x^2 + \sqrt{x^2 + ...+\infty}}}} = 4$

$\sqrt{x^2 + 4} = 4 \Rightarrow x^2 + 4 = 16 \Rightarrow x^2 = 12 \Rightarrow x = \pm\sqrt{12}$

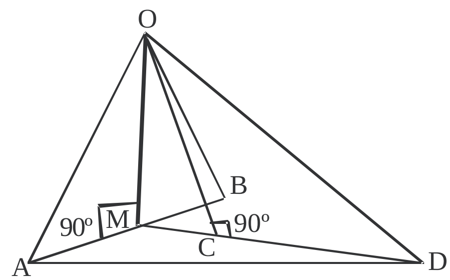
8. What is the volume of regular tetrahedron of side '2m' meters?

(a) $\frac{2\sqrt{2}}{3} m^3$ cubic metres (b) $\frac{4\sqrt{3}}{8\sqrt{2}} m^3$ cubic metres

(c) $\sqrt{\frac{8}{3}} m^3$ cubic metres (d) $\sqrt{2}\, m^3$ cubic metres

8. (a) OABD is regular tetrahedron. OC is the height of tetrahedron.

Here, OA = AB = OB = BD = AD = OD = 2m meter



Now, in right angle triangle OAM,

$AM^2 + OM^2 = OA^2$

$$OM^2 = OA^2 - AM^2 = OA^2 - \left(\frac{AB}{2}\right)^2 = (2m)^2 - \left(\frac{2m}{2}\right)^2 = 4m^2 - m^2 = 3m^2$$

(M is mid point of AB)

$OM = \sqrt{3}$ m meter

Now, In right angle triangle OMC, right angled at C.

$$OM^2 = MC^2 + OC^2 = \left(\frac{1}{3}MD\right)^2 + OC^2$$ (where C is centroid of triangle ABC and MD = OM)

$$\Rightarrow 3m^2 = \frac{3m^2}{9} + OC^2 \Rightarrow \frac{8}{3}m^2 = OC^2 \Rightarrow OC = \sqrt{\frac{8}{3}}\ m$$

$$\therefore \text{ Volume of regular tetrahedron } = \frac{1}{3} \times \text{area of base} \times h = \frac{1}{3} \times \frac{\sqrt{3}}{4}(2m)^2 \times \sqrt{\frac{8}{3}}m$$

$$= \frac{2\sqrt{2}\ .\ 4m^3}{(4).(3)} = \frac{2\sqrt{2}}{3}\ m^3 \text{ cubic meters}$$

9. Find the value of the expression :

$999^3 + 1^3 - 1000^3$

(a) –2997000 (b) +29970000 (c) 2996999 (d) Zero

9. (a) $999^3 + 1^3 - 1000^3 = 0$

As $a^3 + b^3 + c^3 = 3abc$

When a + b + c = 0 , here 999 + 1 – 1000 = 0

$\therefore 999^3 + 1^3 - 1000^3 = 3 \times 999 \times 1 \times (-1000) = -2997000$

10. What is the probability of 53rd Sunday in a leap year?

(a) $\frac{2}{7}$ (b) $\frac{1}{7}$ (c) $\frac{2}{9}$ (d) $\frac{1}{9}$

10. (a) Out of 366 days in a leap year, $\frac{366}{7} = 52$ and remainder 2 i.e. there are 52 Sundays and 2 days could be

Sunday, Monday

Monday, Tuesday

Tuesday, Wednesday

Wednesday, Thursday

Thursday, Friday

Friday, Saturday

Saturday, Sunday

$\therefore$ Total possible outcomes = 7

No. of favourable outcomes for 53rd Sunday = 2.

$\therefore$ Probability = $\frac{2}{7}$

11. Two A.P.'s have same common difference. The difference between their 2998th terms 7290917th term is 729717, then find the difference between their 7290917th terms

(a) 729717 (b) 7290717 (c) 17297170 (d) Zero

11. (a) Let a_1 and a_2 be the first terms of two A.P.

$\therefore (t_{2998})_{AP_1} - (t_{2998})_{AP_2} = 729717$

$\Rightarrow a_1 + 2997\,d - a_2 - 2997\,d = 729717$

$\therefore a_1 - a_2 = 729717$

$\Rightarrow a_1 + 7290916\,d - a_2 - 7290916\,d = 729717$ (by adding and subtracting7290916 d)

$\Rightarrow (t_{7290917})_{AP_1} - (t_{7290917})_{AP_2} = 729717$.

12. Ambika and Nitin was standing in the battle field against each other. They have exactly same bullets. Ambika fired $\frac{32}{3}$ times the square root of total bullets to Nitins heart and in return Nitin fired one fourth of total bullets to Ambika's head. Still Ambika and Nitin together had 176 bullets. How many bullets Ambika and Nitin were in the starting?

(a) 784 (b) 576 (c) 841 (d) 961

12. (b) Let total bullets = x.

According to question, $\frac{32}{3}\sqrt{x} + \frac{x}{4} + 176 = x$

$\Rightarrow \frac{32}{3}\sqrt{x} = \frac{3x}{4} - 176 \Rightarrow 128\sqrt{x} = 9x - 2112$ (put $\sqrt{x} = t$)

$\therefore 9t^2 - 128t - 2112 = 0 \Rightarrow 9t^2 + 88t - 216t - 2112 = 0$

$\Rightarrow t(9t+88) - 24(9t+88) = 0$

On solving we get, t = 24, $-\frac{88}{9}$ but $t \neq -\frac{88}{9}$

So, t = 24; x = 576

13. If $p(x) = x^3 - 20x + 33$, $q(x) = x^4 - 31x^2 + 121$. What is the H.C.F. of p(x) and q(x)?

(a) $x - 3$ (b) $x + 3$ (c) $x^2 - 11 - 3x$ (d) None of these

13. (d) $p(x) = x^3 - 20x + 33 = x^3 - 9x - 11x + 33 = x(x^2 - 9) - 11(x - 3)$

$= x(x - 3)(x + 3) - 11(x - 3) = (x - 3)(x^2 + 3x - 11)$

$q(x) = x^4 - 31x^2 + 121 = x^4 - 22x^2 - 9x^2 + 121 = x^4 - 22x^2 + 121 - 9x^2$

$= (x^2 - 11)^2 - (3x)^2 = (x^2 - 11 - 3x)(x^2 - 11 + 3x)$

$\therefore$ H.C.F. of p(x) and q(x) = $x^2 + 3x - 11$

Sides of a right angle triangle are 6 cm, 8 cm and 10 cm. Find radius of its incircle.

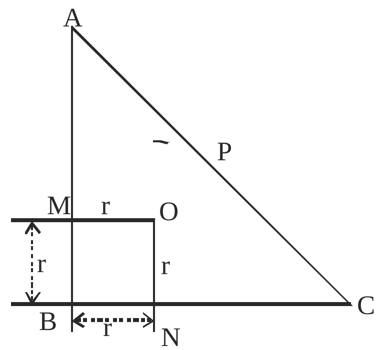
14. A right angled triangle is of sides 6, 8 and 10 cm. The radius of the incircle is

(a) 4 cm (b) 5 cm (c) 2 cm (d) 1 cm

14. (c) Let OM = r

Therefore BM = r, BN = r.

Let AB = 6, BC = 8 then AM = 6 – r, BC = 8 – r and AC = 10



CP = CN [tangents on circle from C]

= 8 – r

AP = AM [tangents on circle from B]

= 6 – r

Now, AC = AP + PC

$\Rightarrow 10 = 6 - r + 8 - r \Rightarrow 10 = 14 - 2r \Rightarrow r = 2$

15. Find the sum of the following expression :

3 + 7 + 11 + ... + 2915 =

(a) 1061131 (b) 1036611 (c) 1063611 (d) 1061136

15. (c) 3 + 7 + 11 + ... + 2915. It is an A.P.

Here a = 3, d = 4, t_n = 2915

Using t_n = a + (n – 1) d $\Rightarrow 2915 = 3 + (n-1)4$

$\Rightarrow \frac{2912}{4} = (n-1) \Rightarrow n - 1 = 728 \Rightarrow n = 729$

Now, $S_n = \frac{n}{2}[2a + (n-1)d] = \frac{729}{2}[2\times 3 + 728\times 4] = 2918 \times \frac{729}{2} = 1063611$.

16. π is an irrational number. Which one of the following proved this statement?

(a) August Muni (b) Cyrene

(c) Lambert and Legendre (d) Pythagoras

16. (c) Lambert and Legendre was proved that π is an irrational number.

17. A metal sheet has dimensions 244 cm and 122 cm and a thickness of 0.80 mm. Specific gravity of sheet is 1.41 g/cm^3. If its S.G. decreased by 0.02 g/cm^3 then what will be the decrease in its weight?

(a) 47.6288 g (b) 46.7288 g (c) 42.7688 g (d) 48.7628 g

17. (a) Volume of sheet = 244 × 122 × 0.080 cm = 2381.44 cm^3

Decrease in S.G. = 0.02 g/cm^3

$\therefore$ Decrease in weight = 2381.44 × 0.02 = 47.6288 g

18. If $\sqrt{x} + y = 15$ and $x + \sqrt{y} = 39$. What is the values of (x, y) from the following set of answers.

(a) (36, 9) (b) (±36, ±9)

(c) (–36, –9) (d) $\left(\pm\sqrt{1296}, \pm\sqrt{-81}\right)$

18. (a) $\sqrt{x} + y = 15$ ....(1)

$x + \sqrt{y} = 39$ ....(2)

From (1), $\sqrt{x} = 15 - y$

From (1) & (2), $(15 - y)^2 + \sqrt{y} = 39$

$\Rightarrow 225 + y^2 - 30y + \sqrt{y} = 39 \Rightarrow y^2 - 30y + \sqrt{y} + 186 = 0$

Put $\sqrt{y} = t$, $t^4 - 30t^2 + t + 186 = 0$

By remainder theorem, t = 3.
Therefore y = 9, x = 36.

19. Find the value of the following expression :

$$\frac{\cot 49°58'}{\tan 41°2'} - \operatorname{cosec} 45° + \frac{\tan 15°}{\cot 75°}$$

(a) $\frac{4-\sqrt{2}}{2}$ (b) $-\frac{1}{\sqrt{2}}$ (c) 2 (d) 0

19. (a) $\frac{\cot 49°58'}{\tan 41°2'} - \operatorname{cosec} 45° + \frac{\tan 15°}{\cot 75°} = \frac{\cot(90° - 41°2')}{\tan 41°2'} - \operatorname{cosec} 45° + \frac{\tan(90° - 75°)}{\cot 75°}$

$= \frac{\tan 41°2'}{\tan 41°2'} - \operatorname{cosec} 45° + \frac{\cot 75°}{\cot 75°}$ [Using $\tan(90°-\theta) = \cot\theta$, $\cot(90°-\theta) = \tan\theta$]

$= 1 - \frac{1}{\sqrt{2}} + 1 = 2 - \frac{1}{\sqrt{2}} = \frac{2\sqrt{2}-1}{\sqrt{2}} = \frac{4-\sqrt{2}}{2}$

20. 1111111^2 =

(a) 12345654321 (b) 1234567654321 (c) 1234567821 (d) 12345678431

20. (b) Using Pascal's triangle

$1^2 = 1$

$11^2 = 121$

$111^2 = 12321$

$1111^2 = 1234321$

$11111^2 = 123454321$

$111111^2 = 12345654321$

$1111111^2 = 1234567654321$

21. 5 litres of milk is boiled and was poured into a right cylindrical bowl of base radius 12.6 cm and height 20 cm. If it covered with a lid exactly fitted in the cylinder then find the total surface area where you feel hot to touch? (Assuming no quantity is lost in boiling and you touch the cylinder from outside)

(a) 2581.92 cm^2 (b) 1584 cm^2

(c) 589.96 cm^2 (d) 5 litre milk cannot be poured in that vessel as it flows down

21. (a) Given r = 12.6 cm, V_{milk} = 5 litres, h = 20 cm
But milk is boiled so when it is covered with a lid whole cylinder becomes hot due to steam and hot milk.
So we have to take total surface area. If it may come in bowl.

Now, $V_{bowl} = \pi r^2 h = \frac{22}{7} \times 12.6 \times 12.6 \times 20 = 9979.2 \text{ cm}^3 = 9.9792 \text{ litres}$

So 5 litres can be poured in that bowl.

So total surface area of bowl = $2\pi r(r+h) = 2 \times \frac{22}{7} \times 12.6(12.6+20)$

$$= 44 \times 1.8 \times 32.6 = 2581.92 \text{ cm}^2$$

22. Find the value of the following expression. Select your answer from the choices given after the expression :

$$\sqrt{20+\sqrt{20+\sqrt{20+\sqrt{20+......\infty}}}}$$

(a) –4 (b) 5 (c) –4, 5 (d) None of these

22. (b) Let, $\sqrt{20+\sqrt{20+\sqrt{20+\sqrt{20+......\infty}}}} = y$

$\Rightarrow \sqrt{20+y} = y$

On squaring both sides

$\Rightarrow 20 + y = y^2 \Rightarrow y^2 - 20 - y = 0$

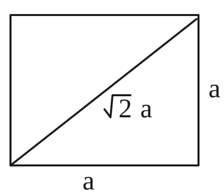
$\Rightarrow y^2 - y - 20 = 0 \Rightarrow (y-5)(y+4) = 0 \Rightarrow y = -4, 5$

But y = –4 is not possible. Therefore y = 5.

23. Diagonal of a square is 75 mm. Find the area of square. Select your answer from the alternatives given below.

(a) 2812.5 mm^2 (b) 28.125 cm^2
(c) both (a) and (b) (d) Neither (a) nor (b)

23. (c) Let the side of the square is a.



$\therefore$ Diagonal is $\sqrt{a^2 + a^2} = \sqrt{2}a$

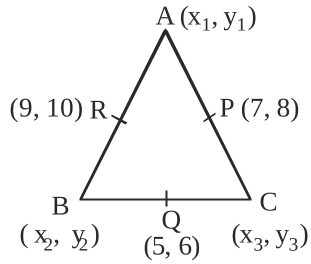
$\therefore \sqrt{2}a = 75 \Rightarrow a = \frac{75}{\sqrt{2}}$ mm

$\therefore \text{area} = \frac{75}{\sqrt{2}} . \frac{75}{\sqrt{2}} = \frac{5625}{2} \text{ mm}^2 = 2812.5 \text{ mm}^2 = 28.125 \text{ cm}^2$

24. The mid points of the sides of a triangle are (5, 6), (7, 8) and (9, 10) respectively. Which one of the following is the coordinates of its median?

(a) $\left(\frac{7}{3}, 20\right)$ (b) $\left(7, \frac{20}{3}\right)$ (c) $\left(-\frac{7}{3}, -20\right)$ (d) $\left(-\frac{7}{3}, 20\right)$

24. (b) Let A = (x_1, y_1), B = (x_2, y_2), C = (x_3, y_3)



P, Q, R be the mid points.
Let Q = (5, 6), P = (7, 8), R = (9, 10)

$$\Rightarrow \frac{x_1 + x_2}{2} = 9, \frac{y_1 + y_2}{2} = 10$$

$\Rightarrow x_1 + x_2 = 18$ ...(1) $y_1 + y_2 = 20$ ...(4)
Similarly, $x_2 + x_3 = 10$ ....(2) $y_2 + y_3 = 12$ ....(5)
$x_3 + x_1 = 14$ ....(3) $y_3 + y_1 = 16$ ....(6)
From equation (1) and (2) put x_1 and x_3 in equation (3), we get

$18 - x_2 + 10 - x_2 = 14 \Rightarrow 2x_2 = 14 \Rightarrow x_2 = 7$

$\therefore x_1 = 11,\ x_3 = 3$

Similarly from (4), (5) and (6), $20 - y_2 + 12 - y_2 = 16 \Rightarrow 2y_2 = 16 \Rightarrow y_2 = 8$

$\therefore y_3 = 4,\ \ y_1 = 12$

$\therefore A = (11, 12),\ B = (7, 8),\ C = (3, 4)$

$$\therefore \text{Median} = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right) = \left(\frac{11 + 7 + 3}{3}, \frac{12 + 8 + 4}{3}\right) = \left(7, \frac{20}{3}\right)$$

25. A T.V. costs Rs. 10000 but it is also available at cash down price of Rs. 2800 and remaining in 10 equal installments of Rs. 800 which will be paid after the interval of every 2.5 months. What is the rate of interest charged?
(a) 11.36363% (b) 10.36363% (c) 13.36363% (d) None of these

25. (a) Total cost = Rs. 10000, Cash down payment = Rs. 2800, Balance = Rs. 7200
Cost of each installment = Rs. 800
No. of installments = 10
Interest paid = 10 × 800 – 7200 = Rs. 800.

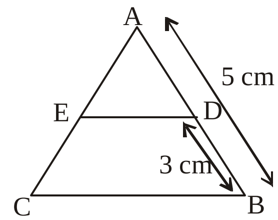
$$\therefore T = \frac{2.5}{12}$$

Principal of Ist installment = Rs. 7200
Principal of IInd Installment = 7200 – 1 (800)
Principal of IIIrd Installment = 7200 – 2 (800)
Principal of IVth Installment = 7200 – 3 (800)
Principal of Vth Installment = 7200 – 4 (800)
Principal of VIth Installment = 7200 – 5 (800)
Principal of VIIth Installment = 7200 – 6 (800)
Principal of VIIIth Installment = 7200 – 7 (800)
Principal of IXth Installment = 7200 – 8 (800)
Principal of Xth Installment = 7200 – 9 (800)
Total Principal = 7200 × 10 – 46 × 800 = 72000 – 36800 = 35200

$$I = \frac{PRt}{100} \Rightarrow 800 = \frac{35200 \times R \times 2.5}{100 \times 12} \Rightarrow \frac{500}{44} = R \Rightarrow R = \frac{250}{22}$$

$$\therefore R = \frac{125}{11} = 11.36363\ \%$$

26. In figure, ΔABC is shown in which AB = 5 cm, DB = 3 cm and DE || BC and area of $\Delta AED = 1764$ cm^2, then the area of BCED would be



If somehow, ▭ BDEC will be converted into a circular cone of slant height 147/22 cm then it base radius will be

(a) 6248 (b) 4000 (c) 4261 (d) 9261

26. (d) As DE ∥ BC

$$\frac{ar(ABC)}{ar(\Delta ADE)} = \frac{AB^2}{AD^2} \Rightarrow \frac{ar(ADE) + ar(BCDE)}{ar\,\Delta ADE} = \frac{25}{4}$$

$$\Rightarrow 1 + \frac{ar.\ BCED}{ar.\ \Delta AED} = \frac{25}{4} \Rightarrow ar.\ BCED = \frac{21}{4} \times 1764 = 21 \times 21 \times 21 = 21^3.$$

27. If b = 4, a = 9 then find the value of following expression and select your answer from the choices given below the expression :

$$(a+b)^3 - (a-b)^3 - 6b(a^2 - b^2) =$$

(a) 512 (b) 5832 (c) –512 (d) –5832

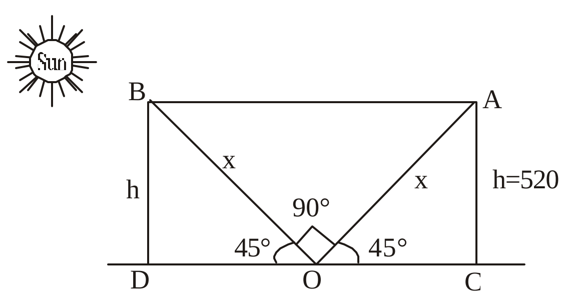
27. (a) $(a+b)^3 - (a-b)^3 - 6b(a^2 - b^2) = (a+b)^3 - (a-b)^3 - 3[(a+b) - (a-b)].(a+b)(a-b)$

$$= [(a+b) - (a-b)]^3 = (2b)^3 = 8b^3 = 8 \times 4^3 = 512 .$$

28. A person is watching a bird flying in the sky at an angle of 45°. Man is facing opposite to Sun. After 5 hrs. he see the same bird in opposite direction at a same angle. If bird is flying at a height of 520 m from the ground what is the speed of bird? Assume the bird is flying at a constant speed on same height throughout its flying.

(a) 0.416 Km/h (b) 0.104 Km/h (c) 0.208 Km/h (d) 0.052 Km/h

28. (c) O is point where men stands.
A is Ist position of bird and B is position of bird after 5 hrs.



Now in ΔAOC, $\frac{AC}{AO} = \sin 45°$

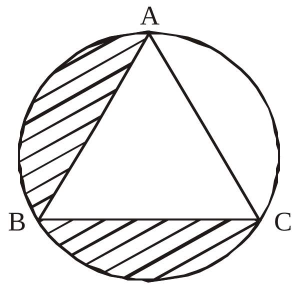
$AO = 520\sqrt{2}$ m

Similarly, $B = 520\sqrt{2}$ m

Now in right angle ΔAOB, $AB = \sqrt{AO^2 + OB^2} = 520(2) = 1040\ m = 1.04\ km$

$Speed = \frac{1.04}{5} = 0.208\ KPh$

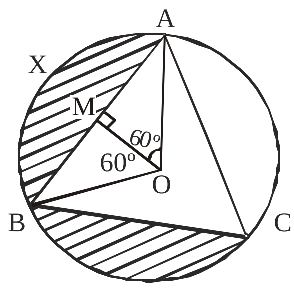
29. In fig. ΔABC is an equilateral triangle. A circumcircle is drawn of radius 6 cm. Find the area of shaded region?



(a) $25-24\sqrt{3}$ sq.cm. (b) $24\pi-18\sqrt{3}$ sq.cm.

(c) $12\pi-9\sqrt{3}$ sq.cm. (d) $24\pi-25\sqrt{3}$ sq.cm.

29. (b) If ABC is an equilateral triangle, then $\angle ACB = 60^o$, $\angle AOB = 120^o$ (angle made on arc is half of angle at the centre of circle) radius = 6 cm.



$\therefore$ Area of sector AXBO is $= \frac{\angle AOB}{360}\pi r^2 = \frac{120}{360}\times\pi\times 6^2 = 12\pi$ sq.cm.

Area of $\Delta AOB = \frac{1}{2} OM \times AB$

Now, $\angle AOM = \angle MOB$ (OM is $\perp$ r bisector of AB, and also angle bisector $\angle AOB$)
So, in right angled ΔOMB right angled at M,

$$\frac{OM}{OB} = \sin 30^o$$

$$OM = \frac{1}{2}\times 6 = 3\text{cm} \text{ and } \frac{OM}{MB} = \tan 30^o$$

$$\Rightarrow MB = \frac{OM}{\tan 30^o} = 3\sqrt{3} \text{ cm} \Rightarrow AB = 2\times 3\sqrt{3} = 6\sqrt{3}$$

So, ar $\Delta AOB = \frac{1}{2}\times OM \times AB = \frac{1}{2}\times 6\sqrt{3}\times 3 = \frac{18\sqrt{3}}{2} = 9\sqrt{3}$ sq.cm.

Area of segment AXBM is $= 12\pi - 9\sqrt{3}$ sq.cm.

So area of shaded region $= 2\left(ar.\widehat{AXBM}\right) = 2\left(12\pi - 9\sqrt{3}\right) = 24\pi - 18\sqrt{3}$

30. Diameter of circle is 480 cm. A series of concentric circles is made inside the circle in which diameter of circles decreases by 4 cm. What is the total number of concentric circles that can

be drawn in this way?

(a) 120 (b) 121 (c) 119 (d) 123

30. (a) Decrease in diameter forms an A.P.

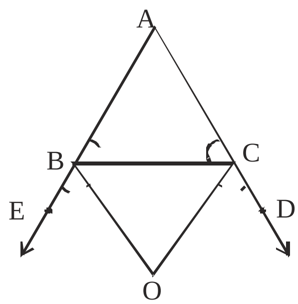
Here a = 480, d = –4, t_n = 4

$\Rightarrow$ a + (n – 1)d = 4

$\Rightarrow$ 480 + (n – 1) (–4) = 4

$\Rightarrow$ 480 – 4n + 4 = 4 $\Rightarrow$ n = 120

31. The sides AB and AC of ΔABC are produced to points E and D respectively. If bisectors BO and CO of $\angle CBE$ and $\angle BCD$ respectively meets at point O and $\angle BAC = 63°18'$, then $\angle BOC$ is



(a) 63°18' (b) 26°42' (c) 58°21' (d) None of these

31. (c) $\angle BOC = 90° - \frac{1}{2}\angle BAC = 90° - \frac{1}{2}(63°18') = 90° - 31°39' = 58°21'$

32. If one of the interior angles of a regular polygon is found to be equal to $\frac{9}{8}$ times of one of the interior angles of a regular hexagon, then find the number of sides of the polygon? Select your answer from the following alternatives.

(a) 5 (b) 8 (c) 7 (d) 4

32. (b) Let the number of sides of a regular polygon are n and one of the interior angles is α_P.

Given, $\alpha_P = \frac{9}{8} \times \alpha_{hexagon}$

$$\Rightarrow \frac{(2n-4)}{n} \times 90^o = \frac{9}{8} \times \frac{(2 \times 6 - 4)}{6} \times 90^o$$

or $$\frac{2n-4}{n} \times 90^o = \frac{3}{2} \times 90^o$$

$\Rightarrow$ 4n – 8 = 3n $\Rightarrow$ n = 8

33. Nitin takes the underground train to work and uses an escalator at the railway station. If Nitin runs up 8 steps of escalator, then it takes him 35 seconds to reach the top of escalator. If he runs up 13 steps of the escalator, then it takes him only 22.5 seconds to reach the top. How many seconds would it take Nitin to reach the top if he did not run up any steps of the escalator at all?

(a) 35 seconds (b) 49 seconds (c) 55 seconds (d) 29 seconds

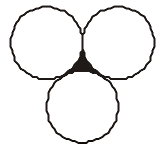
33. (c) If he runs up 8 steps then he needs 35 seconds to reach the top. If he runs up 13 steps then he needs 22.5 seconds to reach the top. The 5 additional steps take 12.5 seconds. Therefore, each step takes 2.5 seconds.

Total steps in escalator $= 8 + \frac{35}{2.5} = 8 + 14 = 22$

$$13 + \frac{22.5}{2.5} = 13 + 9 = 22$$

If Nitin did not run up any step at all, he would reach the top of the escalator in 55 seconds.

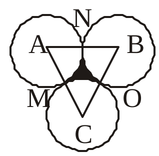
35. What is the area of the shaded region in the adjoining figure if every circle is of unit radius?



(a) $\left(\sqrt{3}-\frac{\pi}{2}\right)$ sq. units (b) $(\sqrt{3}+\pi)$ sq. units

(c) $\left(2\sqrt{3}-\frac{\pi}{2}\right)$ sq. units (d) $\left(\sqrt{3}-\frac{\pi}{4}\right)$ sq. units

35. (a) Each circle is of unit radius so AC = 2, BC = 2, AB = 2



Area of $\Delta ABC = \frac{\sqrt{3}}{4}a^2$ (area of an equilateral triangle)

$= \frac{\sqrt{3}}{4} \times 4 = \sqrt{3}$ sq. units.

Now area of sector AMN = $\frac{\theta}{360} \times \pi r^2 = \frac{60}{360} \times \pi \times 1 \times 1 = \frac{\pi}{6}$ sq. units

Area of sector BOM = area of sector CMO = $\frac{\pi}{6}$ sq. units

So, area of shaded region = area of ΔABC – 3 (area of sector BNO)

$= \sqrt{3} - 3 \times \frac{\pi}{6} = \sqrt{3} - \frac{\pi}{2}$ sq. units .

36.

Class Interval	**Frequency**
32.6-46.3	768
46.3-60.0	667
60.0-73.7	577
73.7-87.4	669
87.4-101.1	771
101.1-114.8	887
114.8-128.5	901
128.5-142.2	988
142.2-155.9	502

Find the mean of above data. Select your answer from the options given below.

(a) < 94.25 (b) > 94.25 (c) = 94.25 (d) None of these

36. (b)

Class	x_i	$d_i = \frac{x_i - a}{h}$ (h = 13.7)	f_i	$f_i d_i$
32.6-46.3	39.45	–4	768	–3072
46.3-60.0	53.15	–3	667	–2001
60.0-73.7	66.85	–2	577	–1154
73.7-87.4	80.55	–1	669	–669
87.4-101.1	94.25	0	771	0
101.1-114.8	107.95	1	887	887
114.8-128.5	121.65	2	901	1802
128.5-142.2	135.35	3	988	2964
142.2-155.9	149.05	4	502	2008

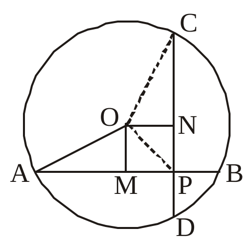
Mean $\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i} \times h = 94.25 + \left(\frac{-6896 + 7661}{6730}\right) \times 13.7$

$= 94.25 + \frac{765}{6730} \times 13.7 > 94.25$

37. Two chords of lengths 16 cm and 17 cm are drawn perpendicular to each other in a circle of radius 10 cm. Find the approximate distance of their point of intersection from the centre.

(a) 6.5 cm (b) 7.2 cm (c) 7.6 cm (d) 8 cm

37. (d) Let the two chords AB and CD of lengths 16 cm and 17 cm are drawn perpendicular to each other in a circle of radius 10 cm. Their point of intersection is P.



Since OM and ON are the perpendicular bisector of chord AB and CD.

$\therefore$ AM = MB and CN = ND

$\therefore OM^2 = OA^2 - AM^2 = 10^2 - 8^2 = 36$

$ON^2 = OC^2 - CN^2 = 10^2 - (8.5)^2$

$ON = \sqrt{100 - 72.25} = \sqrt{27.75}$

$\therefore$ Required distance = OP = $\sqrt{OM^2 + ON^2} = \sqrt{36 + 27.75} = \sqrt{63.75} = 8$ cms (approx.)

38. A water tap fills a tank in p hours and the tap of the bottom of the tank empties it in q hours. If p is less than q and when both the taps are open, the tank is filled in r hours. Then

(a) $\frac{1}{r} = \frac{1}{p} + \frac{1}{q}$ (b) $\frac{1}{r} = \frac{1}{p} - \frac{1}{q}$ (c) r = p + q (d) r = p – q

38. (b) Let water tank has volume = V cm^3

Speed of tap fills the water = $\frac{V}{p}$ cm^3/hr.

Speed of tap empties the tank = $\frac{V}{q}$ cm^3/hr.

p < q given, therefore $\frac{V}{p} > \frac{V}{q}$

Water fill in 'r' hour when both taps are open, so $\frac{V}{p} - \frac{V}{q} = \frac{V}{r} \Rightarrow \frac{1}{p} - \frac{1}{q} = \frac{1}{r}$.