1. If the angles A, B, C of a triangle ABC are in A.P. and $b:c = \sqrt{3} : \sqrt{2}$. Find angle A.

2. The sides of a triangle are three consecutive natural numbers and its largest angle is twice the smallest one. Determine the sides if the triangle. (Ans: 4, 5, 6)

3. In $\triangle ABC$, $\cos A \cos B + \sin B \sin C = 1$, Show that $a:b:c = 1:1:\sqrt{2}$

4. In $\triangle ABC$, $\frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$, Then prove that $\frac{\cos A}{7} = \frac{\cos B}{12} = \frac{\cos C}{25}$

5. a) Define cosine law.

   b) In any triangle, prove that

   $$\frac{\cos A}{a} + \frac{a}{bc} = \frac{\cos B}{b} + \frac{b}{ca} = \frac{\cos C}{c} + \frac{c}{ab}.$$

   c) Prove that:

   $$4\left(bc\cos^2\frac{A}{2} + ca\cos^2\frac{B}{2} + ab\cos^2\frac{C}{2}\right) = (a+b+c)^2.$$

6. a) Prove that the total no of combinations of the set of n objects taken r at a time is given by $C(n, r) = \frac{n!}{r!(n-r)!}$

   b) If $C(18, r) = C(18, r+2)$, find the value of r.

7. a) In an examination paper containing 10 questions, a candidate has to answer 7 questions. If two questions are made compulsory, in how many ways can he choose 7 questions in all.

   b) In how many ways letters of the words PRECARIOUS can be arranged so that all the vowels are always together?

   c) Define combination with suitable example.

8. A student require to answer 6 out of 10 questions which are divided into two groups each containing 5 questions and he is not permitted to attempt more than 4 from any group. In how many different ways can the selection be made?

9. a) A person want to buy a car. There are two brands of car available in the market and each brand has 3 variant models and each model comes in five different colours. In how many ways a person can choose a car to buy?

   b) Evaluate $\frac{n!}{r!\,(n-r)!}$ when for any n with $r = 3$?

   c) If $\frac{1}{7!} + \frac{1}{8!} = \frac{A}{9!}$ then find the value of A.

   d) Prove that $^nP_r = {}^{n-1}P_r + r \times {}^{n-1}P_{r-1}$

10. a) If z be a complex number, prove that $\left|\frac{1}{z}\right| = \frac{1}{|z|}$ and $amp\left(\frac{1}{z}\right) = -amp(z)$.

    b) Express $i - \sqrt{3}$ in the polar form and Euler form.

11. a) Find the product of two complex numbers $z_1 = r_1(\cos\theta_1 + i\sin\theta_1)$ and $z_2 = r_2(\cos\theta_2 + i\sin\theta_2)$.

    b) Express $(\sqrt{3} + i)$ in polar form and Euler form.

    c) State De-moivre's theorem. Using De-moivre's theorem, evaluate $(1 - \sqrt{3}\,i)^6$.

बडा दमैं, शुभ दिपावली तथा छठ पर्व २०८० को हार्दिक मगलमय शुभकामना !!!

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12. (a) Find the sum of the series: $5^2 + 6^2 + 7^2 + \ldots\ldots + 20^2$.

(b) If ω be a complex cube root of unity, show that: $(1 - \omega + \omega^2)^4 (1 + \omega - \omega^2)^4 = 256$

13. a) Define consistent and independent system.

b) Is $2x + y = 3$ & $x + 4y = 5$ is inconsistent and independent. If not why?

c) Use cramer's rule to solve the system:

$3x - 2y = 0$, $x + y - 5 = 0$.

14. A mixture is to be prepared of three foods A, B and C which containts carbohydrates P, Q, R as shown in the table below. The total quantity of 30 units of P 36 units of Q and 30 units of R respectively be required.

Foods	P	Q	R
A	2	2	4
B	3	5	0
C	4	3	5

a) Express the information in equation form.

b) Solve the equation using matrix.

c) If the cost per kg of the foods A, B & C are Rs. 40, Rs. 60 & Rs. 80 respectively. Find total cost of mixture by matrix method.

15. (a) Define Arithmetico-Arithmetic series (AA series)

b) Find the sum of the squares of the first n-natural numbers.

16. a) Ram works in a reputed company. Company assumed him to provided double salary then his previous month salary. If he received Rs. 500 as his first salary.

i) Find the monthly salary that he received at the end of three years.

ii) Find the total salary he received at the end of 3 years.

b) Find the nth term of the series: $1 + 3 + 6 + 10 + \ldots\ldots$

c) Find the nth term of the given series: $1^2 + (1^2 + 2^2) + (1^2 + 2^2 + 3^2) + \ldots\ldots$

17. a) Using vector method prove that, $\cos(A - B) = \cos A \cos B + \sin A \sin B$.

b) Find a unit vector parallel to the sum of the vector $2\vec{i} + 4\vec{j} - 5\vec{k}$ and $\vec{i} + 2\vec{j} - \vec{k}$

c) Solve $z^4 + 1 = 0$, where z be a complex number.

18. a) Evaluate: $\int \dfrac{2x + 2}{\sqrt{3 + 2x - x^2}}\, dx$

c) Evaluate: $\int \dfrac{dx}{(a + b \cos x)}$, $a > b$

b) Evaluate: $\int \dfrac{dx}{(a + b \cos x)}$, $b > a$

d) Evaluate: $\int \dfrac{dx}{\sqrt{(x - \alpha)(x - \beta)}}$; $(\beta > \alpha)$

19. a) Evaluate:

$\int \dfrac{1}{x^2 - a^2}\, dx$

b) Evaluate: $\int \dfrac{1}{1 + x - x^2}\, dx$

c) Evaluate: $\int \dfrac{(2x + 2)}{3 + 2x - x^2}\, dx$