1. (a) If Z1 , Z2, Z3 are the vertices of an equilateral triangle, in the Argand plane, then show that
   $Z_1^2 + Z_2^2 + Z_3^2 = Z_1 Z_2 + Z_2 Z_3 + Z_3 Z_1$
   (b) Find the real x, satisfying $|x2 - x - 6| + x + 2 = 0$

2. (a) If in a triangle ABC, tanA/2, tanB/2, tanC/2 are in H.P then show that sides a,b,c are in AP.
   (b) The angles of elevation of the top of a tower at the top and the foot of a pole of height 10m are 300 and 600 respectively. Find the height of the tower.

3. (a) f is a real valued function defined on the real's and (x + y) = f(x) + f(y) for all reals x,y. If f is continuous at 'O' then show that f is everywhere continuous on reals.
   (b) Evaluate the following :
   $\int \frac{cos^3 x + cos^5 x}{sin^2 x + sin^4 x} dx$

4. (a) If the normal at t_1 on the parabola $y^2=4x$ meets it again at t_2 find the relation between t_1 and t_2
   (b) Prove that the locus of the middle point of the portion of a tangent to
   $\frac{x^2}{a^2} + \frac{y^2}{b^2}=1$ included between the axes is $\frac{a^2}{x^2} + \frac{b^2}{y^2}=4$

5. (a) The length of an inclined plane is 5 feet and the height is 3 feet a force of 3 lb. weight acting parallel to the plane will just prevent a weight 10 lb. from sliding down. Show that the co-efficient of friction is 3/8
   (b) A man can throw a ball 60 ft. vertically upwards. Find the greatest horizontal distance he can throw it.

6. (a) If $\vec{a}$, $\vec{b}$ are vectors such that $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then show that a, b are perpendicular.
   (b) A bag contains 'a' white and 'b' black balls. Two players A and B alternately draw a ball from the bag, replacing the ball each time after the draw till one of them draws a white ball and wins the game. A begins the game. If the probability of A winning the game is three times that of B, then show that a:b = 2:1

7. (a) If $Z_r = \cos\frac{\pi}{2r} + i\sin\frac{\pi}{2r}$, $r = 1,2, \ldots . then$ $Z_1, Z_2 \ldots$ to ∞ is …
   (b) If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals then $b^2/ac + bc/a^2$ = …

8. (a) Derivative of $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ $w.r.t$ $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ is …

   (b) $\int_{-2}^{1}|1-x^2|dx =$

   (c) If $\vec{a}$, $\vec{b}$,$\vec{c}$ are three non-coplanar vectors and $\vec{p},\vec{q},\vec{r}$ are the vectors where $\vec{p}=\frac{\vec{b}\times\vec{c}}{[\ \vec{a}\ \vec{b}\ \vec{c}\ ]}$, $\vec{q}=\frac{\vec{c}\times\vec{a}}{[\ \vec{a}\ \vec{b}\ \vec{c}\ ]}$, $\vec{r}=\frac{\vec{a}\times\vec{b}}{[\ \vec{a}\ \vec{b}\ \vec{c}\ ]}$ then ($\vec{a}+\vec{b}$). $\vec{p}$ + ($\vec{b}+\ \vec{c}$).$\vec{q}$ + ($\vec{c}+\vec{a}$).$\vec{r}$ = …

9. (a) The point of contact o line y = x-1 with $3x^2 - 4y^2 = 12$ is …

   (b) The foci of $16x^2 + 25y^2 = 400$ are …

10. (a) The range of random variable x is { 1, 2, 3 … }. The probability that x takes the value k is $\frac{\lambda^k}{\lfloor k}$ (k=1,2,…). Then $\lambda =$ ..

    (b) The standard deviation of a, a+d , a+2d, …. a+ 2nd is …