1. (a) If A, B , C are three sets such that A Δ B + A Δ C then prove that B = c
   (b) If $(1+x)^n = \sum_{r=0}^{n} C_r\, x^r$ then prove that

   $$\sum_{r=0}^{n} \frac{C}{(r+1)2^{r+1}} = \frac{3^{n+1} - 2^{n+1}}{(n+1)2^{n+1}}$$

2. (a) By defining $f\left(\frac{\pi}{4}\right)$ suitably, obtain a continuous extension of the function f given by $f(x) = \frac{\sqrt{2}\cos x - 1}{\cos x - 1}$, $x \neq \frac{\pi}{4}$
   (b) a particle moving in a straight line passes vertically above two points A and B on a horizontal plane and 100 metres apart. When above A its angle of elevation as seen from B is 60^0 and when above B, its angle of elevation as seen from A is 30^0. At what distance from the point A will the particle touch the ground?

3. (a) Evaluate $\int \frac{x \tan^{-1} x}{(1+x^2)^{3/2}}\, dt$
   (b) If P is a point inside the triangle ABC such that $\angle PAB = \angle PBC = \angle PCA = \alpha$.
   $Show\ that\ \cot\alpha = \cot A + \cot B + \cot C$

4. (a) Evaluate $\int_0^{\pi/2} \frac{dx}{5+4\cos x}$
   (b) A tangent to the ellipse $\frac{x^2}{a} + \frac{y^2}{b}$=1 cuts the co-ordinate axes in A and B. Show that the equation of the locus of the mid-point of AB is $\frac{a^2}{x^2} + \frac{b^2}{y^2}$=4

5. (a) The following table gives the frequency distribution of marks obtained by a batch of 20 students.

Marks	5	15	25	35	45
No. of students	5	4	6	3	2

   Calculate the Mean and Standard deviation.

   (b) If the normal's at four point Pi(xi + yi) i = 1,2,3,4 on the rectangular hyperbola $xy=c^2$ meet in the point Q(h,k) prove that
   (i) $x_1 + x_2 + x_3 + x_4 = h$
   (ii) $y_1 + y_2 + y_3 + y_4 = K$
   (iii) $x_1 x_2 x_3 x_{4=} y_1 y_2 y_3 y_4 = -c^4$

6. (a) A particle which starts from rest moves at first with a constant acceleration a and then with a constant retardation b. If after moving for a time t from the start the particle comes to rest at a distance from the starting point, prove that $2(a + b)\, s = abt^2$

(b) A heavy uniform rod having a mass of 40 lbs is suspended in a horizontal position by vertical strings from its two ends each of which can sustain a tension of 35 lbs wt. How far from the centre of the rod should a body of mass 20lbs be attached to the rod so that one of the strings may just break?

7. (a) If the sum of the roots of the equation
$ax^2 + bx + c = 0$ *is equal to the sum of the squares of theirreciprocals then* bc^2, ca^2, ab^2 *are in AP. GP or HP?*

(b) The area of the triangle on the Argand diagram formed by the complex numbers z,iz and z+iz is …….

8. (a) In a triangle ABC if a =√3 + 1 cms, b= √3 – 1 and $\angle C = 60^0$ then the smallest angle in the triangle is ……
(b) If A(-1,2,3) , C(1,1,1) and C(2,-1,3) are points on a plane, a unit normal vector to the plane ABC is …..
(c) if the vectors a $\vec{\imath} + \vec{\jmath} + \vec{k}$, a $\vec{\imath} + \overrightarrow{bj} + \vec{k}$ and a $\vec{\imath} + \vec{\jmath} + \overrightarrow{ck}$ (a= b= c≠ 1) are coplanar then the value of
$\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = \cdots$

9. (a) If R is the resultant of two forces P and Q and If $\frac{P}{3} = \frac{Q}{7} = \frac{R}{5}$ then the angle between P and R is …..
(b) If $f(x) = \tan^{-1}\left(\frac{\sin x}{1+\cos x}\right)$ then $f'(\pi/a) = \cdots$

10. (a) The normal at the point P(at_1^2,$2a^3$) then t_3 = …
(b) The angle of projection of a particle when its range on a horizontal plane is 4√3 times the height attained is given by -----
(c) A bag A contains 2 white and 3 red balls and bag B contains 4 white and 5 red balls. One ball is drawn at random from a randomly chosen bag and is found to be red. The probability that it was drawn from bag B was …..