1. (a) Verify: A Δ (B Δ C) = (A Δ B) Δ C for sets
   A = { x| |x|<2 } , B = { x | | x-1 |< 2 } and C = { x | |x+1| <2 }
   (b) Show that for all real values of x , the expression $\frac{x^2 + 7x + 7}{x^2 + x + 1}$ cannot take any value outside the interval [-1,7]
   (c) A candidate is required to answer 7 questions out of 12 questions which are divided into two groups of 6 questions each. He is not permitted to attempt more than 5 questions from either group. In how many different ways can be choose the seven questions ?

2. Evaluate : (i) $\frac{d}{dx}[sin(logx) - log(sinx)]$

(ii) $\int \frac{x \tan^{-1} x}{(1+x^2)^{3/2}} dx$

(b) Determine a and b so that the functions f given by

f(x) = $\frac{1-sin^2 x}{cos^2 x}$ if x <$\frac{\pi}{2}$

= a if x =$\frac{\pi}{2}$

= $\frac{b(1-sinx)}{(\pi-2x)^2}$ if x >$\frac{\pi}{2}$ is continuous at if x =$\frac{\pi}{2}$

3. (a) Prove that the circle circumscribing the triangle formed by any three tangents to a parabola passes through the focus.
   (b) A point P moves such that the tangents PT_1 and PT_2 from it to the hyperbola $4x^2 - 9y^2 = 36$ are mutually of right angels. Find the equation of the locus of P.

4. (a) The probability that A narrates an incident truthfully is ¾ and for B the probability of truthful narration is 4/5. What is the probability that they will contradict each other is narrating the same incident?
   (b) Let the frequency mean and standard deviation be denoted by $n_1\overline{x_1}$ and S_1 for one set of variates and $n_2\overline{x_2}$ and S_2 for the second set. Show that the variance S^2 of the composite set is given by NS^2 = $n_1 {S_1}^2 + n_2 {S_2}^2 + n_1 {d_1}^2 + n_2 {d_2}^2$
   Where N = $n_1 + n_2$ and $d_1 = \overline{x_1} - x$

5. (a) An observer at an Anti Aircraft post. A identifies an enemy aircraft due east of his post at an angle of elevation 60^0. At the same instant detection post D situated 4 km due south of A reports that the aircraft is at an angle of elevation 30^0. Calculate the altitude at which the plane is flying.
   (b) Find the greatest angle in the triangle, the sides of which are $x^2 + x + 1, 2x + 1 \; and \; x^2 - 1$.

6. (a) An aeroplane travelling at the rate pf 60 miles per hour horizontally a height of $2\frac{8}{11}$ miles from the ground has to drop a bomb on a certain target on the ground. At what

horizontal distance from the target must the bomb be dropped so that it may exactly be hits the target?

(b) From a balloon rising vertically with a constant acceleration f a stone is thrown up with a velocity v relative to the balloon overtakes the stone after t seconds, show that $v = \frac{t}{2}(f+g)$.

7. (a) If x= a + b , y = aω + bω^2 and z = aω^2 + bω where ω is the complex cube root of unity, then $x^3 + y^3 + z^3 = \ldots.$

   (b) if $(1+x)^n = \sum_{r=0}^{r=n} C_r x^r$ then $\left(1+\frac{C_1}{C_0}\right)\left(1+\frac{C_2}{C_1}\right)\ldots\ldots+\left(1+\frac{C_n}{C_{n-1}}\right) = \cdots$

8. (a) $\lim_{x\to a}\frac{cosx-cosa}{cotx-cota}$ =

   (b) $\lim_{h\to 0}\frac{2[\sqrt{3}\sin\left(\frac{\pi}{6}+h\right)-\cos\left(\frac{\pi}{6}+h\right)]}{\sqrt{3}h(\sqrt{3}\cosh - sinh)}$

   (c) $\int_0^{x^3}\frac{\sqrt{sinx}}{\sqrt{sinx}-\sqrt{cosx}}$ =

9. (a) The line 3x + 5y = k touches the ellipse $16x^2 + 25y^2 = 400\ if\ k =$

   (b) The equation $16x^2 - 24xy + 9y^2$ + 28x + 14y + 21 = 0 represents

10. (a) $\left(\underset{a}{\rightarrow} + \underset{b}{\rightarrow}\right)x\left(\underset{a}{\rightarrow} - \underset{b}{\rightarrow}\right)$=….

    (b) The planes $\underset{r}{\rightarrow}(7\underset{j}{\rightarrow} - 5\underset{k}{\rightarrow}), \underset{r}{\rightarrow}\left(2\underset{i}{\rightarrow} + 5\underset{j}{\rightarrow} + 3\underset{k}{\rightarrow}\right) = 0, \underset{r}{\rightarrow}(\underset{i}{\rightarrow} - \underset{j}{\rightarrow} - 4\underset{k}{\rightarrow})$=2

    (i) meet in appoint

    (ii) Intersect in a line

    (iii) intersect in mutually parallel lines

    (Iv) are parallel.

    (b) A body of weight 30 lbs in equilibrium on a smooth plane inclined at an angle of 45^0 to the horizontal and is supported by a force P acting at an angle θ with the plane. If R is the reaction of the plane, then R/P = ….