







- (c) Rehema and Seni play a game in which Rehema should win 8 games for every 7 games won by Seni. Prove that if they play three games, the probability that Rehema wins at least two games is approximately to 0.55.
- (d) In a family, the boy tells a lie in 30 percent cases and the girl in 35 percent cases. Find the probability that both contradict each other on the same fact.

(20 marks)

7. (a) (i) Solve the differential equation  $\frac{r \tan \theta}{a^2 - r^2} \frac{dr}{d\theta} = 1$  given that  $r = 0$  when

$$\theta = \frac{\pi}{4}.$$

- (ii) Verify that  $y = 10 \sin 3x + 9 \cos 3x$  is a solution of the differential equation

$$\frac{d^2 y}{dx^2} + 9y = 0 \text{ if } y = 0, \frac{dy}{dx} = 0 \text{ when } x = 0.$$

- (b) The population of a certain country doubles in 15 years. In how many years will it be six times under the assumption that the rate of increase is proportional to the number of inhabitants?
- (c) Find the particular solution of the differential equation  $\frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} + 2y = \cos x$ .
- (d) Form a differential equation whose general solution is  $y = Ae^{mx} + Be^{-mx}$  where A, B and m are constants.

(20 marks)

8. (a) (i) The ellipse has its foci at the points  $(-1, 0)$  and  $(7, 0)$  when its eccentricity is  $\frac{1}{2}$ . Find its Cartesian equation.

- (ii) Convert  $y^2 = 4a(a - x)$  into polar equation.

- (iii) Use the equation  $y = 2x^2 - 6x + 4$  to determine its directrix and the focus.

- (b) A cable used to support a swinging bridge approximates the shape of a parabola. Determine the equation of a parabola if the length of the bridge is 100m and the vertical distance from where the cable is attached to the bridge to the lowest point of the cable is 20m.

- (c) (i) Define the term hyperbola.

- (ii) Show that the latus rectum of the equation  $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$  is  $\frac{2b^2}{a}$ .

- (d) Sketch the graph of  $r = 2 + 4 \cos t$ .

(20 marks)