2. TRANSFORMATION OF AXES

1 x 4 = 4 Marks

IMP FORMULAS, KEY CONCEPTS

I) TRANSLATION OF AXES (shifting of origin):

1.1) To find (i) Transformed (new) equation (ii) Old coordinates of a given point, use the relations $x = X + h,\ y = Y + k$

1.2) To find the (i) original equation (ii) new coordinates, use the relations $X = x - h,\ Y = y - k$

2.1) The point to which the origin should be shifted to eliminate the first degree terms (i.e., x term & y term) in the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ is

$$\left(\frac{hf - bg}{ab - h^2}, \frac{gh - af}{ab - h^2}\right), ab \neq h^2$$

2.2) The point to which the axes be translated to eliminate x,y terms in the equation $ax^2 + by^2 + 2gx + 2fy + c = 0$ is $(-g/a, -f/b)$

2.3) The point to which the axes be translated to eliminate x,y terms in $2hxy + 2gx + 2fy + c = 0$ is $(-f/h, -g/h)$

2.4) The point to which the axes be translated to eliminate x, y terms in $(x - a)^2 + (y - b)^2 = k$ is (a, b)

II. ROTATION OF AXES:

1) The formulae in the rotation of axes are given in the tabular form:

	X	Y
x	$\cos\theta$	$-\sin\theta$
y	$\sin\theta$	$\cos\theta$

1.1) To find (i) Transformed (new) equation (ii) old coordinates of a given point, use the relations $x = X\cos\theta - Y\sin\theta;\ y = Y\cos\theta + X\sin\theta$

1.2) To find (i) the original equation (ii) the new coordinates of a given point, use the relations $X = x\cos\theta + y\sin\theta;\ Y = y\cos\theta - x\sin\theta$

2) In order to eliminate the xy term in $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ the axes should be rotated through an angle $\theta = \frac{1}{2}\mathrm{Tan}^{-1}\left(\frac{2h}{a - b}\right)$