



## DEPARTMENT OF MATHEMATICS

### UNIT – III SOLUTIONS OF EQUATIONS

#### GAUSS JACOBI

② Solve the following equations using Jacob's iteration method:

$$30x - 2y + 3z = 75$$

$$x + 17y - 2z = 48$$

$$x + y + 9z = 15$$

Sys:  $x + 17y - 2z = 48$   
 $30x - 2y + 3z = 75$   
 $x + y + 9z = 15$

Iter:  $x_1 = 1.5, y_1 = 1.5, z_1 = 1.5$   
 $x_2 = 1.5, y_2 = 1.5, z_2 = 1.5$

Soln:

$$a_1 \cdot |30| > |-2| + |3|$$

$$b_1 \cdot |17| > |1| + |-2|$$

$$c_1 \cdot |9| > |1| + |1|$$

Since the diagonal elements are dominant, the iteration process is applied here.



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The gn. system can be written as,

$$x = \frac{1}{30} (75 + 2y - 3z)$$

$$y = \frac{1}{17} (48 - x + 2z)$$

$$z = \frac{1}{9} (15 - x - y)$$

1<sup>st</sup> iteration:

$$x_1 = \frac{1}{30} (75 + 2y_0 - 3z_0)$$

$$y_1 = \frac{1}{17} (48 - x_0 + 2z_0)$$

$$z_1 = \frac{1}{9} (15 - x_0 - y_0)$$

Let the initial values be  $x_0 = y_0 = z_0 = 0$

$$x_1 = 2.5$$

$$y_1 = 2.8235$$

$$z_1 = 1.6666$$

2<sup>nd</sup> iteration:

$$x_2 = \frac{1}{30} (75 + 2y_1 - 3z_1)$$

$$y_2 = \frac{1}{17} (48 - x_1 + 2z_1)$$

$$z_2 = \frac{1}{9} (15 - x_1 - y_1)$$



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$$\Rightarrow x_2 = \frac{1}{30} (75 + 2(2.8235) - 3(1.6666)) = 2.5217$$

$$y_2 = \frac{1}{17} (48 - 2.5 + 2(1.6666)) = 3.0086 \approx 2.8725$$

$$z_2 = \frac{1}{9} (15 - 2.5 - 2.8235) = 1.0751$$

iii iteration:

$$x_3 = 2.5839$$

$$y_3 = 2.8016$$

$$z_3 = 1.0673$$

iv iteration:

$$x_4 = 2.5800$$

$$y_4 = 2.7971$$

$$z_4 = 1.0682$$

v iteration:

$$x_5 = 2.5796$$

$$y_5 = 2.7974$$

$$z_5 = 1.0692$$

vi iteration:

$$x_6 = 2.5795$$

$$y_6 = 2.7975$$

$$z_6 = 1.0692$$

vii iteration:

$$x_7 = 2.5795$$

$$y_7 = 2.7975$$

$$z_7 = 1.0692$$



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From  $\sqrt{i}$  &  $\sqrt{ii}$  iterations, approx. we get,

$$x = 2.5795$$

$$y = 2.7975$$

$$z = 1.0692$$

3) HW: Solve: using Jacobi method:

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Ans:  $x \approx 1$

$$y \approx -1$$

$$z \approx 1$$