Using the equation G 1.1 (c)

$$M_{ulim} = 0.36\frac{x_{umax}}{d}\left(1 - 0.42\frac{x_{umax}}{d}\right)bd^2 f_{ck}$$

$$78.28 \times 10^6 = 0.36 \times 0.48\,(1 - 0.42 \times 0.48)230d^2 \times 20$$

d = 222 mm

$d_{assumed} > d_{required}$

Hence ok.

Step 5: Calculation of steel

Since the section is under reinforced we have,

Using equation G 1.1 (b)

$$M_u = 0.87 f_y\, A_{st}\, d\left(1 - \frac{A_{st} f_y}{bd\, f_{ck}}\right)$$

$$78.28 \times 10^6 = 0.87 \times 415 \times A_{st} \times 450\left(1 - \frac{A_{st} \times 415}{230 \times 450 \times 20}\right)$$

Solving the quadratic equation, A_{st} = 540.33 mm^2 ≈ 540 mm^2

Choosing 16 mm diameter bars,

$$\text{Area of 1 bar} = \frac{\pi}{4} \times 16^2 = 201.06 \text{ mm}^2$$

Therefore number of bars of 8mm required = 2.69= 3 bars

Distance between any two bars

Minimum distance between two bars is greater of the following:

a. Size of the aggregate + 5 mm
   20 mm + 5 mm
b. Size of the bar (whichever is greater)=16mm

Therefore minimum distance = 25 mm

$$\text{Distance between the bars} = \frac{230 - 2\times25 - 2\times16 - 2\times8}{2} = 58\text{mm}$$

Distance provided = 58mm > Minimum distance 25mm

Hence ok.