2a)

$$\left.\begin{aligned} T_{Ax}\vec{i} + T_{Bx}\vec{i} - R_x\vec{i} = 0 \\ T_{Ay}\vec{j} + R_y\vec{j} - T_{By}\vec{j} = 0 \end{aligned}\right\} \text{as the system is in equilibrium}$$

$$\Rightarrow R_x\vec{i} = T_{Ax}\vec{i} + T_{Bx}\vec{i} \quad (1)$$

$$\Rightarrow R_y\vec{j} = -T_{Ay}\vec{j} + T_{By}\vec{j} \quad (2)$$

$$(1)\ 4000\cos(10^\circ) = T_A\cos(15^\circ) + T_B\cos(20^\circ)$$

$$\Rightarrow 4000\cos(10^\circ) - T_A\cos(15^\circ) = T_B\cos(20^\circ)$$

$$\Rightarrow T_B = \frac{4000\cos(10^\circ) - T_A\cos(15^\circ)}{\cos(20^\circ)} \quad (3)$$

sub (3) into (2)

$$(2)\ 4000\sin(10^\circ) = -T_A\sin(15^\circ) + \left(\frac{4000\cos(10^\circ) - T_A\cos(15^\circ)}{\cos(20^\circ)}\right) \times \sin(20^\circ)$$

$$\Rightarrow 694.593 = -0.2588\,T_A + (4192.05 - 1.0279\,T_A) \times \sin(20^\circ)$$

$$\Rightarrow 694.593 = -0.2588\,T_A + 1433.77 - 0.3516\,T_A$$

$$\Rightarrow -739.177 = -0.6104\,T_A$$

$$\boxed{\Rightarrow T_A = 1210.97 \approx 1211\ \text{N}}$$

sub T_A into (3)

$$\Rightarrow T_B = \frac{4000\cos(10°) - 1211\cos(15°)}{\cos(20°)}$$

$$\Rightarrow T_B = 2947.23 \approx 2947N$$

2b) function [TA, TB] = calcRangeOfTensions

```
theta = 0:0.5:20;
A = [cosd(15) cosd(20); sind(15) -sind(20)];

for i = 1:length(theta)
    C = [4000*cosd(theta(i)); -4000*sind(theta(i))];
    x = inv(A)*C;
    TA(i) = x(1);
    TB(i) = x(2);
end

plot(theta, TA, 'rs', theta, TB, 'go');
grid on
xlabel("theta (degrees)");
ylabel("F (N)");

end
```

Yes, the tensions have an equal magnitude of 2097N with $\boxed{\theta = 2.5°}$