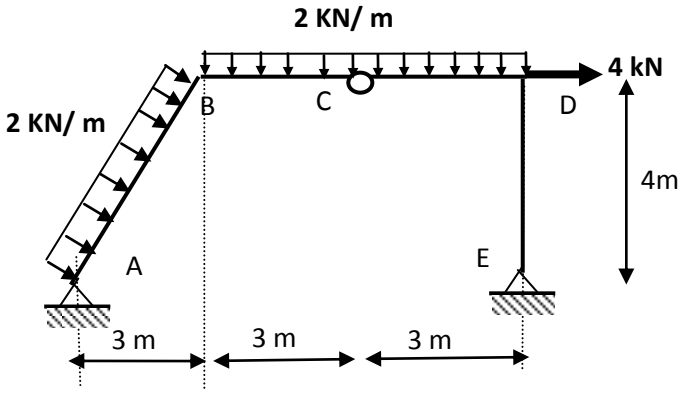
The shown loaded ABCDE Frame is pinned at A, and E, and has a hinge at C. It is required to;



1- Check its stability and determinacy

2- Determine the reactions at A, C

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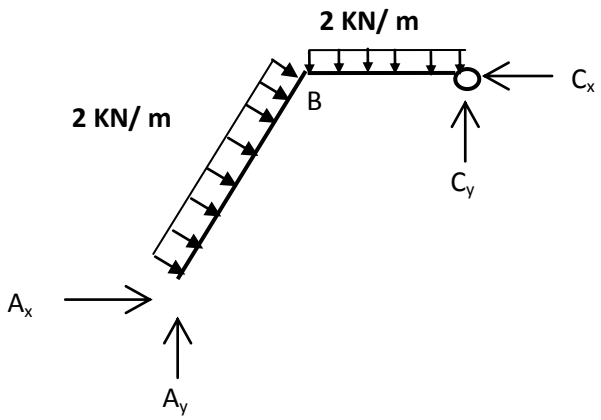
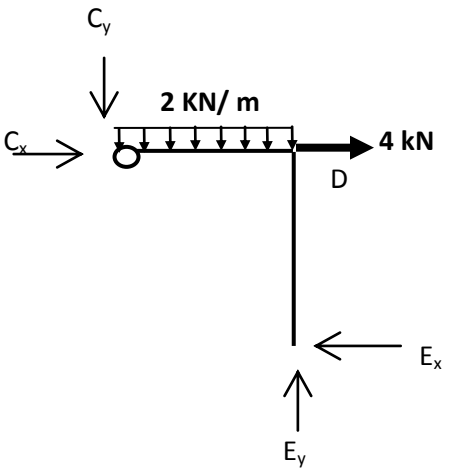
r = 6 n = 2, 3n =6

➔ r= 3n

➔ Statically determinant and stable





$\sum M_A=0$

$-2\times5\times2.5-2\times3\times4.5+C_x\times4+C_y\times6=0$

$4C_x+6C_y=52$ (1)

$\sum M_E=0$

$+2\times3\times1.5-4\times4-C_x\times4+C_y\times3=0$

$3C_y-4C_x=7$ (2)

➔ $C_x\approx3.1667$ kN

➔ $C_y\approx6.5556$ kN

$\sum F_y = 0$

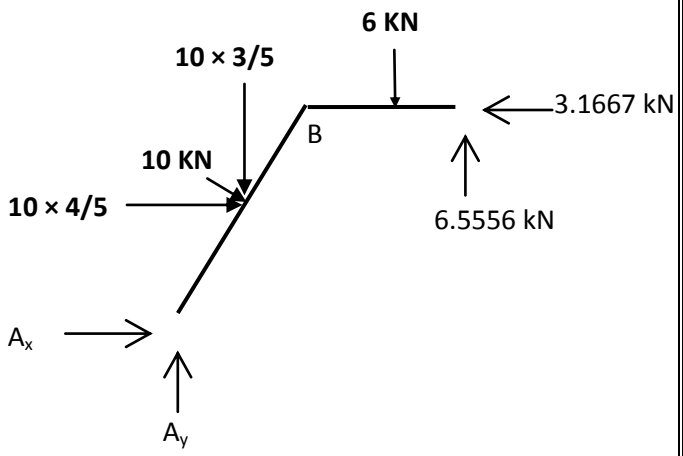
$A_y + 6.5556 - 6 - 10 \times 3/5 = 0$

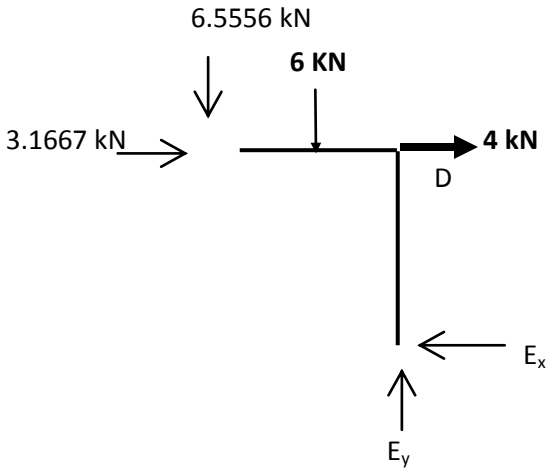
$A_y = 5.4444$ kN

$\sum F_x = 0$

$A_x - 3.1667 + 10 \times 4/5 = 0$

$A_x = -4.8333$ kN ←





$\sum F_y = 0$

$E_y - 6 - 6.5556 = 0$

$E_y = 12.5556$ kN

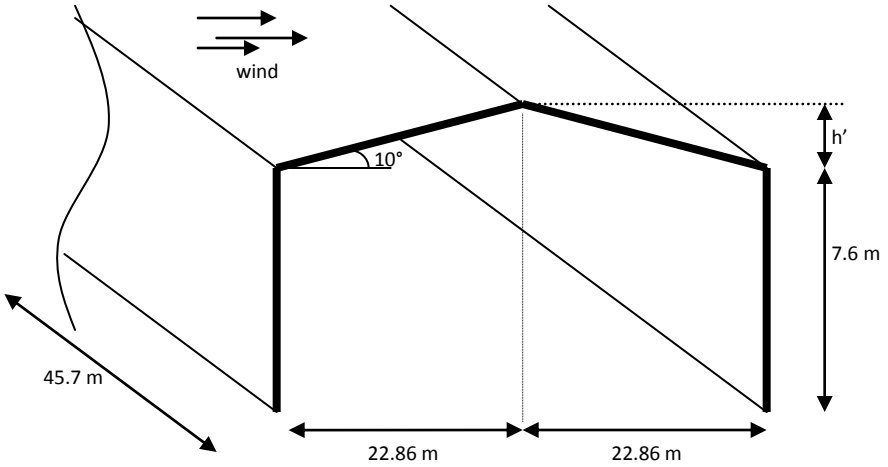
$\sum F_x = 0$

$-E_x + 4 + 3.1667 = 0$

$E_x = 7.1667$ kN

Determine the design wind load.

V= 40m/s, flat terrain, only wind load, I= 0.87.



$q_z = 0.613 K_z K_{zt} K_d V^2 I$

Flat terrain ➔ K_{zt} = 1, only wind load➔ K_d=1

$q_z = 0.613 \times K_z \times 40^2 \times 0.87 = 853.3 K_z$

h' =22.86 tan10 ≈ 4.0 m ➔ h= 7.6 + 4/2 = 9.6 m , mean height of roof

from table 1 -5,

Z, m	K_z	q_z, N/m^2
0 – 4.6	0.85	725
6.1	0.9	768
7.6	0.94	802
h = 9.6	0.99	845 =q_h

$p = qGC_p - q_h(GC_{pi})$

Rigid Structure ➔ G = 0.85, enclosed building ➔ GC_{pi}= ±0.18

$p = 0.85qC_p - 845(\mp 0.18)$

$p = 0.85qC_p \mp 152$

Using fig. 1-13;

Windward wall: $C_p = 0.8$

$P_{4.6}$ =341 N/m^2 or 645 N/m^2

$P_{6.1}$ =370 N/m^2 or 674 N/m^2

$P_{7.6}$ =393 N/m^2 or 697 N/m^2

Leeward wall: L/B = 2×22.86/45.72 = 1➔ $C_p = -0.5$

P =−511 N/m^2 or −207 N/m^2

Side wall: $C_p = -0.7$

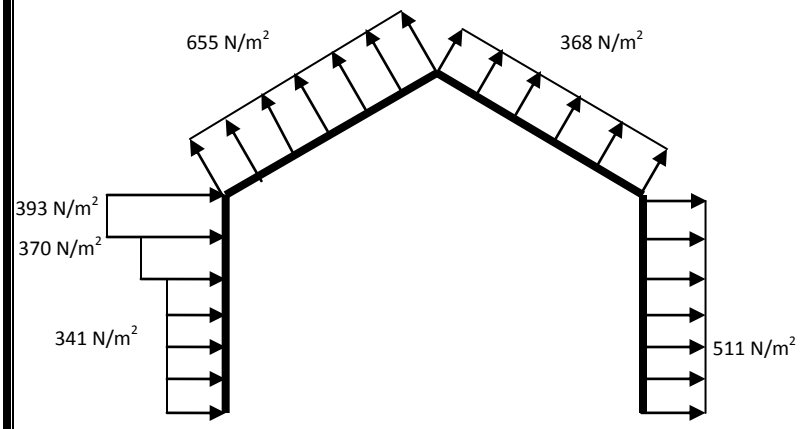
P =−655 N/m^2 or −351 N/m^2

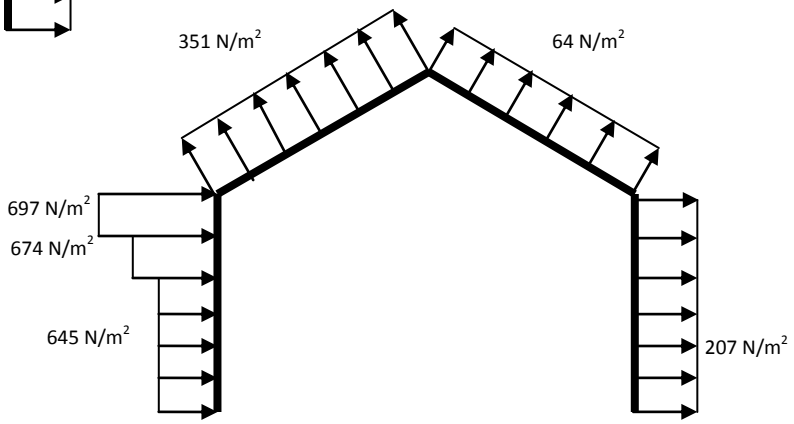
Windward roof: h/L = 9.6/ 2×22.86 = 0.21 < 0.25 ➔$C_p = -0.7$

P =−655 N/m^2 or −351 N/m^2

Leeward roof: h/L = 9.6/ 2×22.86 = 0.21 < 0.25 ➔$C_p = -0.3$

P =−368 N/m^2 or −64 N/m^2

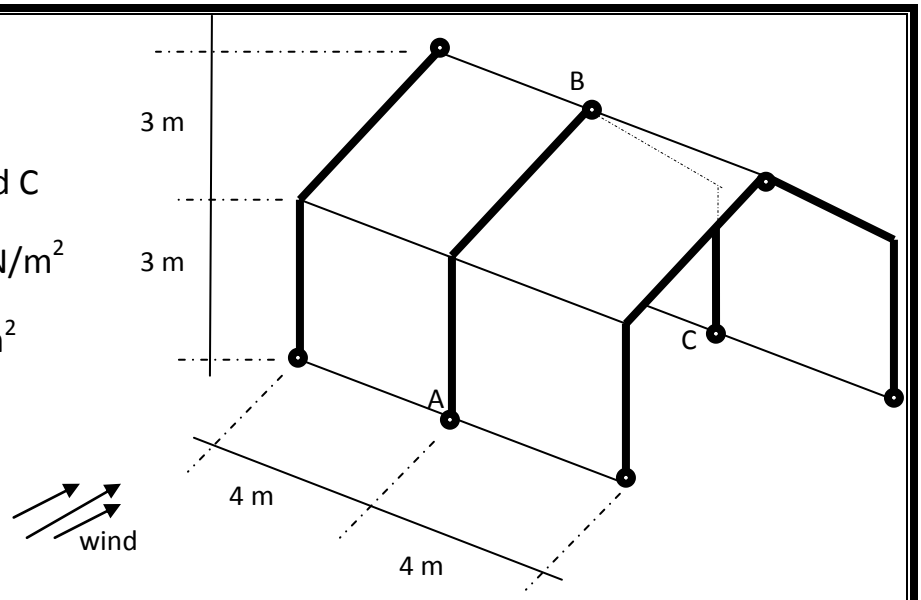




Determine the reactions at A,B and C

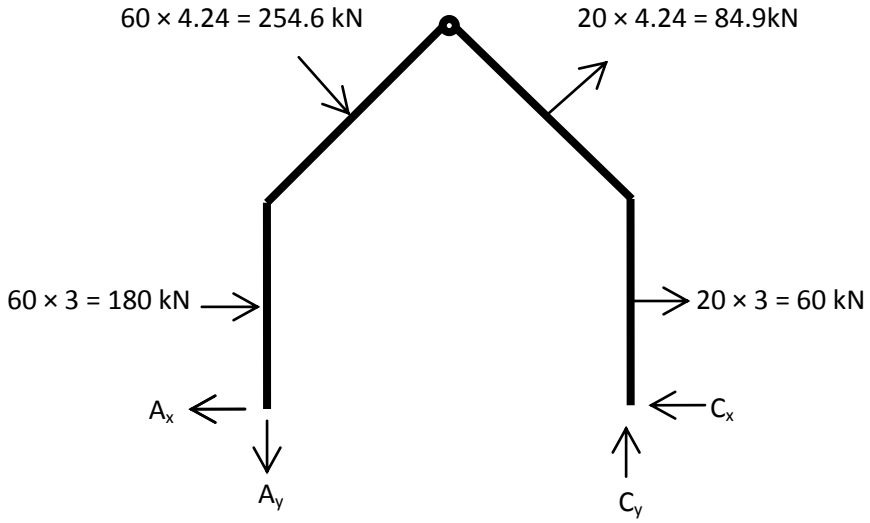
Pressure on windward side = 15 kN/m^2

Pressure on leeward side = 5 kN/m^2



Linear windward load = 15 kN/m^2 × 4 m = 60 kN/m

Linear leeward load = 5 kN/m^2 × 4 m = 20 kN/m



$\sum M_A = 0$

$-180\times1.5-254.6\cos45\times4.5-245.6\sin45\times1.5-84.8\cos45\times4.5+84.9\sin45\times4.5-60\times1.5+6C_y=0$

$C_y = 240$ kN

$\sum F_y = 0$

$-A_y - 254.6\sin45 + 84.9\sin45 + 240 = 0$

$A_y = 120$ kN

$\sum M_B = 0$

$-A_x \times 6 + 120 \times 3 + 180 \times 4.5 + 254.6 \times 2.12 = 0$

$A_x = 285$ kN

$\sum F_y = 0$

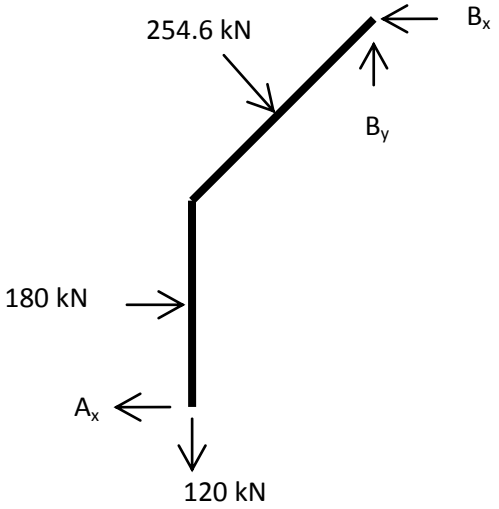
$-120 - 254.6\sin 45 + B_y = 0$

$B_y = 300$ kN

$\sum F_x = 0$

$-285 + 180 + 254.6\cos 45 - B_x = 0$

$B_x = 75$ kN



$\sum F_x = 0$

$-C_x + 60 + 84.9\cos 45 + 75 = 0$

$C_x = 195$ kN