UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

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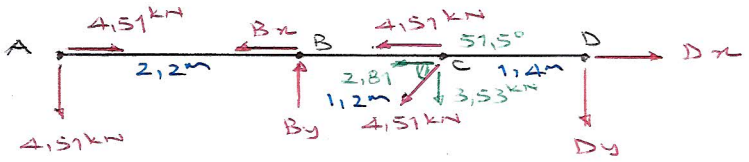
COURSE NO.	COURSE NAME	2
CIV100F	Mechanics	student #

Quiz 2
Solution

1- Part I

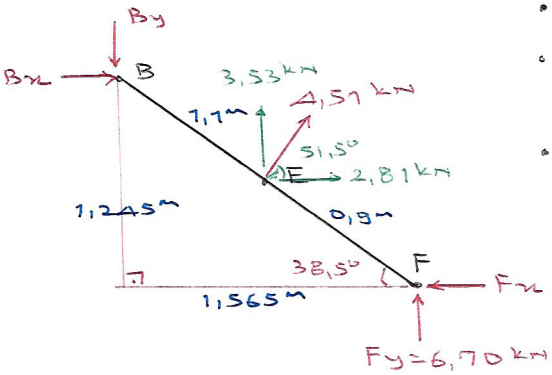


- $\Sigma M_D = 0 \Rightarrow 4{,}51\,kN \cdot 4{,}8\,m + 3{,}53\,kN \cdot 1{,}4\,m - B_y \cdot 2{,}6\,m = 0 \Rightarrow B_y = 10{,}23\,kN$
- $\Sigma F_y = 0 \Rightarrow D_y = 10{,}23 - 4{,}51 - 3{,}53 = 2{,}19\,kN$

Global System (i.e., entire system, no separation)

- $\Sigma F_y = 0 \Rightarrow F_y = 4{,}51 + 2{,}19 = 6{,}70\,kN$

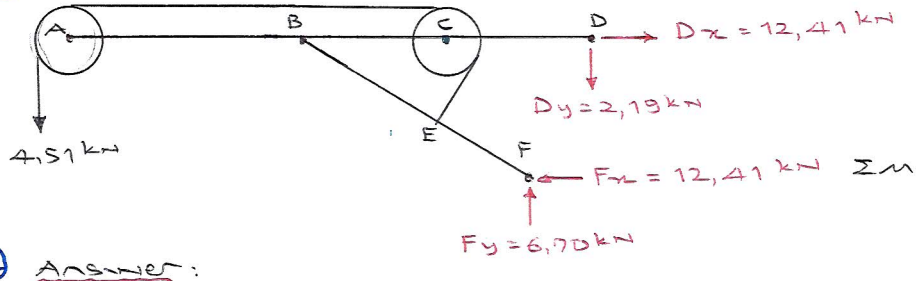
Part II



- $\Sigma F_y = 0 \Rightarrow B_y = 6{,}70 + 3{,}53 = 10{,}23\,kN$
- $\Sigma M_F = 0 \Rightarrow 10{,}23\,kN \cdot 1{,}565\,m - 4{,}51\,kN \cdot 0{,}9\,m - B_x \cdot 1{,}245\,m = 0$
  $\Rightarrow B_x = 9{,}60\,kN$
- $\Sigma F_x = 0 \Rightarrow F_x = 9{,}60 + 2{,}81 = 12{,}41\,kN$

Back to Part I: $\Sigma F_x = 0 \Rightarrow D_x = 9{,}60 + 2{,}81 = 12{,}41\,kN$

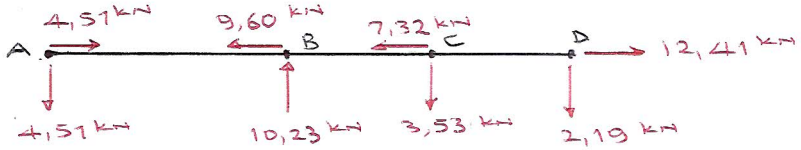
2- Answer:



Check:
$\Sigma F_x \overset{?}{=} 0$ ok ✓
$\Sigma F_y \overset{?}{=} 0$ ok ✓
$\Sigma M_D \overset{?}{=} 0$

$\Sigma M_D = 4{,}51\,kN \cdot 5{,}0\,m - 12{,}41\,kN \cdot 1{,}245\,m - 6{,}70\,kN \cdot 1{,}035\,m = 0{,}16 \cong 0$ ok ✓

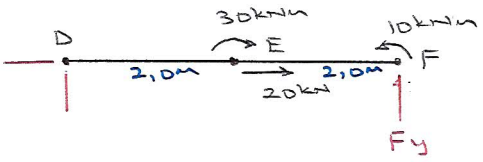
b- Answer:



- Check: $\Sigma F_x \overset{?}{=} 0$ ok ✓
  $\Sigma F_y \overset{?}{=} 0$ ok ✓
  $\Sigma M_A \overset{?}{=} 0 \Rightarrow \Sigma M_A = 10{,}23 \cdot 2{,}2 - 3{,}53 \cdot 3{,}4 - 2{,}19 \cdot 4{,}8 = 0$ ok ✓

2-

(i) 4 support rxns ; 3 equations. Need to separate the system from the pin.

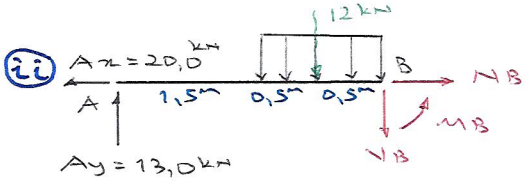


- $\Sigma M_D = 0 \Rightarrow F_y \cdot 4{,}0^m + 10 - 30 = 0$
  $\Rightarrow F_y = \underline{5{,}0\ kN} \uparrow$

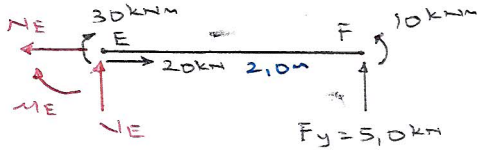
- Back to the global system.
- $\Sigma M_A = 0 \Rightarrow C_y \cdot 5{,}0^m + 5{,}0^{kN} \cdot 10{,}0^m - 24 \cdot 2{,}5^m - 20^{kNm} = 0 \Rightarrow C_y = \underline{6{,}0\ kN} \uparrow$
- $\Sigma F_y = 0 \Rightarrow A_y = 24{,}0 - 6{,}0 - 5{,}0 = \underline{13{,}0\ kN} \uparrow$
- $\Sigma F_x = 0 \Rightarrow A_x = \underline{20{,}0\ kN} \leftarrow$

See FBD below with all support reactions shown.

(ii)



- $N_B = +\underline{20\ kN} \rightarrow$
- $V_B = +\underline{1{,}0\ kN} \downarrow$
- $M_B = 13{,}0^{kN} \cdot 2{,}5^m - 12{,}0^{kN} \cdot 0{,}5^m = \underline{+26{,}5^{kNm}}$ ↻



- $N_E = +\underline{20{,}0\ kN} \leftarrow$
- $V_E = -\underline{5{,}0\ kN} \downarrow$
- $M_E = +10 - 30 + 5{,}0 \cdot 2{,}0 = \underline{-10{,}0\ kNm}$ ↺

(iii)