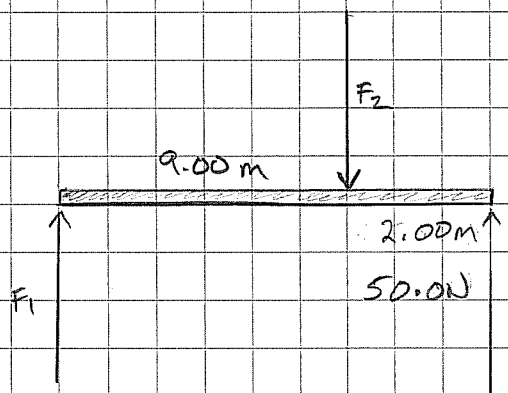
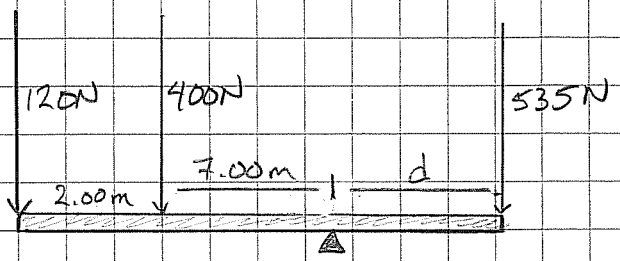
OVERTURNING MOMENT

THE FOLLOWING ARE IN EQUILIBRIUM. FIND THE MISSING FORCES OR DISTANCES.

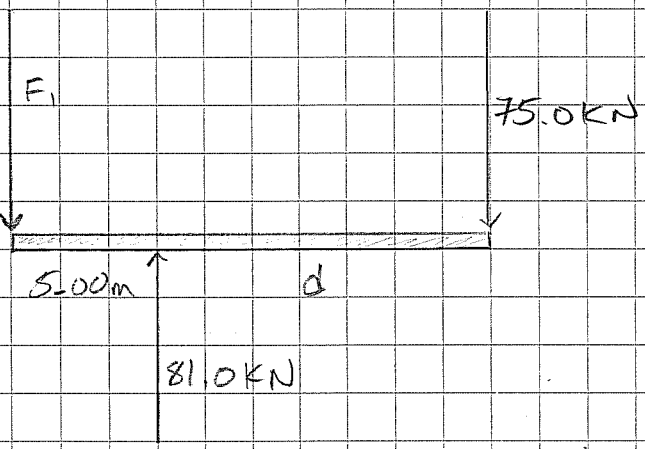
1)



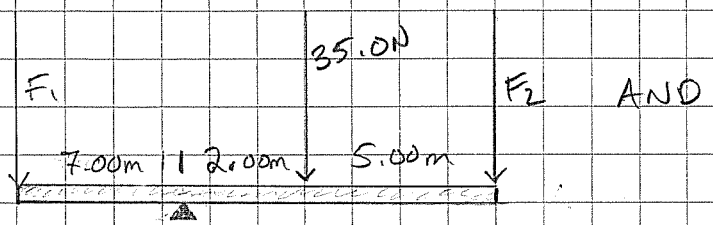
2)



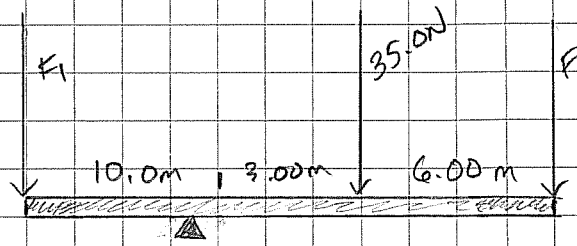
3)



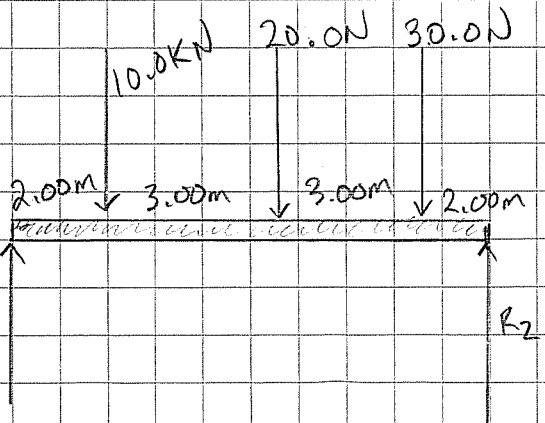
4)



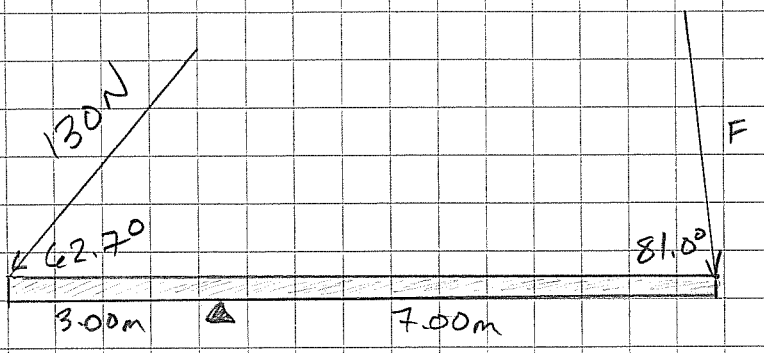
AND



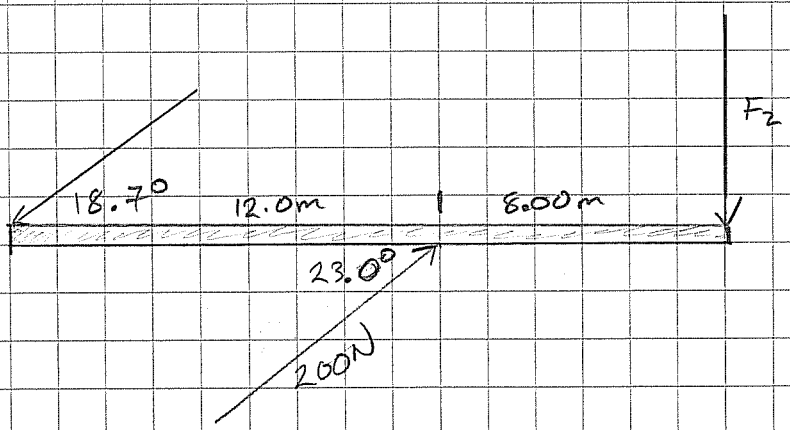
5)



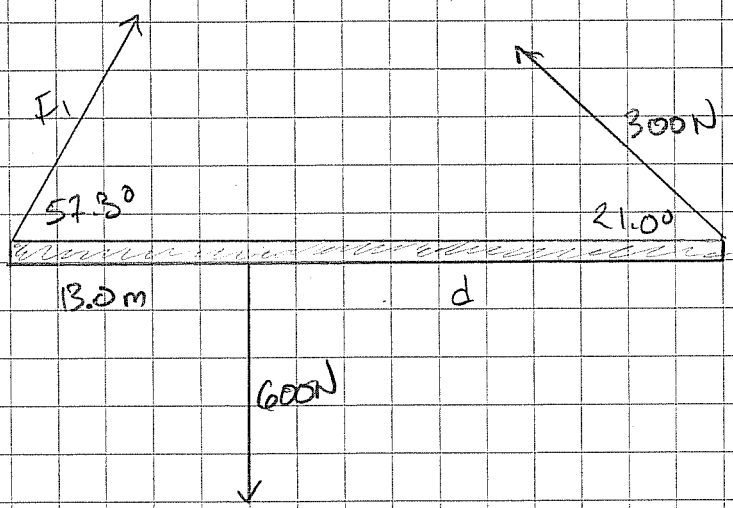
6)


130N
62.7°
F
81.0°
3.00m
7.00m

7)

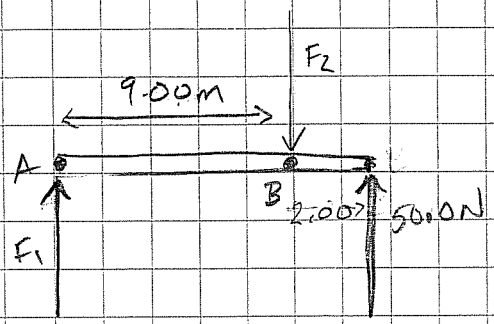

F_2
18.7°
12.0m
8.00m
23.0°
200N

8)


F_1
57.3°
300N
21.0°
13.0m
d
600N

SOLUTIONS

1)



@A $\overrightarrow{OM} = \overleftarrow{OM}$

$F_2(9) = (50.0)(11.0)$

$F_2 = \frac{550}{9.00} = 61.1\,N$

@B $\overrightarrow{OM} = \overleftarrow{OM}$

$F_1(9.00) = (50.0)(2.00)$

$F_1 = \frac{100}{9} = 11.11$

2) @A $\overrightarrow{OM} = \overleftarrow{OM}$

$535d = (9.00)(120) + (7.00)(400)$

$= 3880$

$d = 7.25\,m$

@B $\overrightarrow{OM} = \overleftarrow{OM}$

$(7.25)(81.0) = (10.25)F_1$

$F_1 = 57.3N$

4) FROM SYSTEM 1

$\overrightarrow{OM} = \overleftarrow{OM}$

$(2)(35) + (7)F_2 = 7F_1$

$70 + 7F_2 = 7F_1$

$\therefore \quad F_2 = -10 + F_1$

$\therefore \quad 105 + 9(-F_1 - 10) = 10F_1$

$105 - 9F_1 - 90 = 10F_1$

$15 = F_1$

$F_2 = -10 + 15$

$= 5$

$\therefore \quad F_2 = 5.00N \quad F_1 = 15.0N$

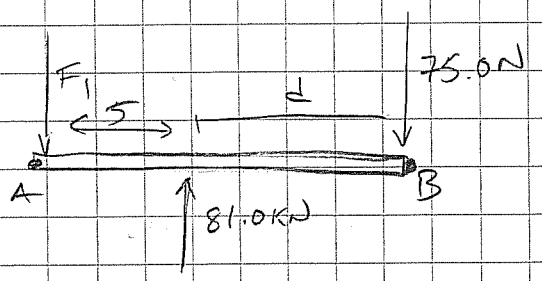
FROM SYSTEM 2

$\overrightarrow{OM} = \overleftarrow{OM}$

$3(35) + 9F_2 = 10F_1$

$105 + 9F_2 = 10F_1$

3)



@A $\overrightarrow{\sum M} = \overleftarrow{\sum M}$

$(5+d)75.0 = 5(81.0)$

$375 + 75d = 405$

$75d = 30$

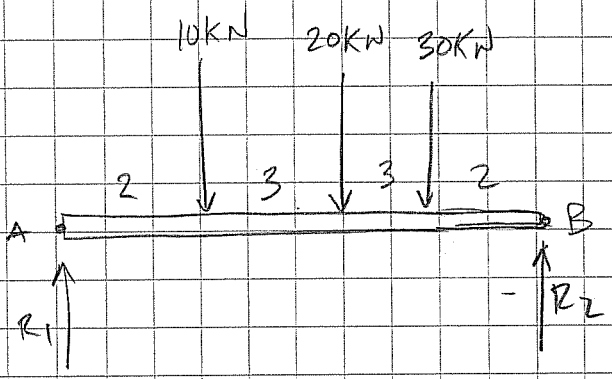
$d = 0.400m$

@B $\overrightarrow{\sum M} = \overleftarrow{\sum M}$

$(6.400)(81.0) = (5.40)F_1$

$\therefore F_1 = 6.00N$

5)



@A $\overrightarrow{\sum M} = \overleftarrow{\sum M}$

$2(10) + 5(20) + 8(30) = 10R_2$

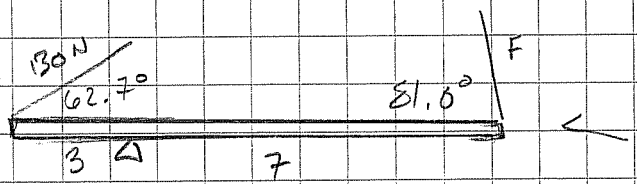
$R_2 = 36N$

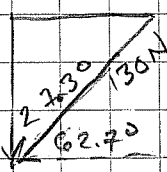
@B $\overrightarrow{\sum M} = \overleftarrow{\sum M}$

$10R_1 = 2(30) + 5(20) + 8(10)$

$R_1 = 24N$

6)



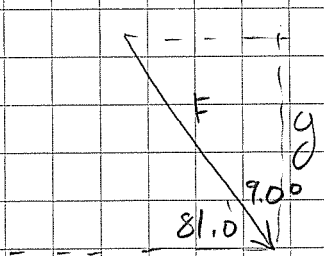


$x = 130\cos 27.3°$

$= 115.5N$

$\therefore \overleftarrow{\sum M} = 3(115.5)$

$= 346.0$



$\therefore \cos 9.0° = \frac{y}{F}$

$\Rightarrow y = F\cos 9.0°$

$= 0.988F$

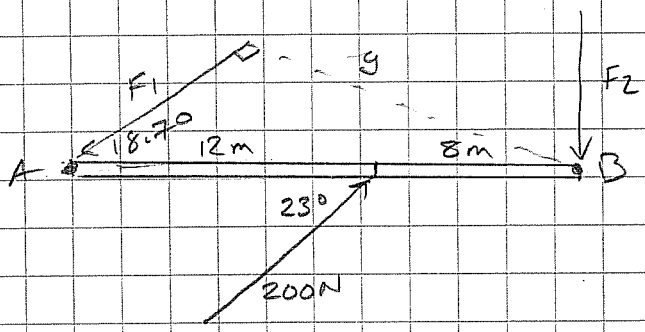
$\therefore \overrightarrow{\sum M} = 7(0.988F)$

$= 6.91F$

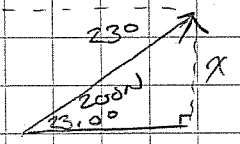
$\therefore 346 = 6.91F$

$F = 50.0N$

7)



@ A



$x = 200 \sin 23.0°$
$= 78.1\ N$

$\therefore \overset{\curvearrowleft}{OM} = (78.1)(12)$
$= 937.2\ Nm$

@B $\overset{\curvearrowright}{OM} = (78.1)(8)$
$= 624.8\ Nm$

$\overset{\curvearrowleft}{OM} = 20F_2$

$\therefore 937.2 = 20F_2$
$F_2 = 46.9\ N$

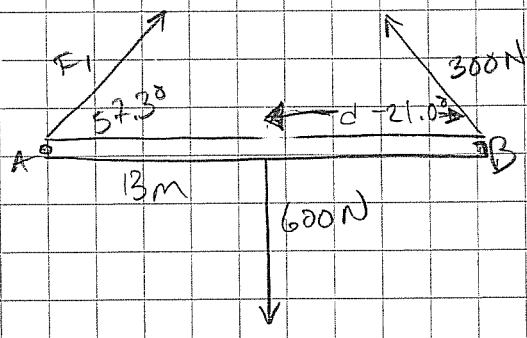
$\sin 18.7° = \frac{y}{20}$

$\Rightarrow y = 20 \sin 18.7°$
$= 6.41\ m$

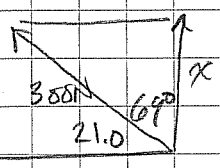
$\therefore \overset{\curvearrowleft}{OM} = 6.41F_1$

$\therefore 6.41F_1 = 624.8\ Nm$
$F_1 = 97.5\ N$

8



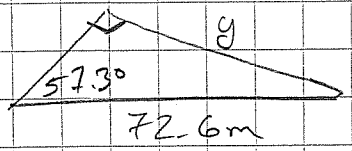
@ A



$x = 300 \cos 69°$
$= 107.5\ N$

$\therefore \overset{\curvearrowright}{OM} = \overset{\curvearrowleft}{OM}$
$(600)(13) = (107.5)(13+d)$
$\therefore d = 59.6\ m$

@ B



$\therefore y = 72.6 \sin 57.3$

$= 61.1\,m$

$\therefore \overrightarrow{OM} = \overrightarrow{OA}$

$(600)(59.6) = 61.1 F_1$

$\therefore F_1 = 585.3\,N$