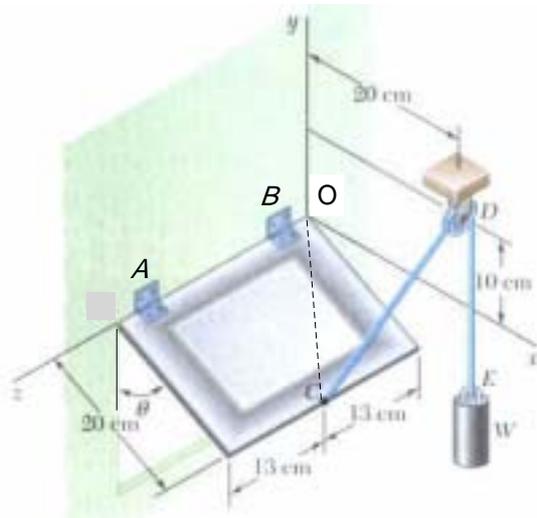
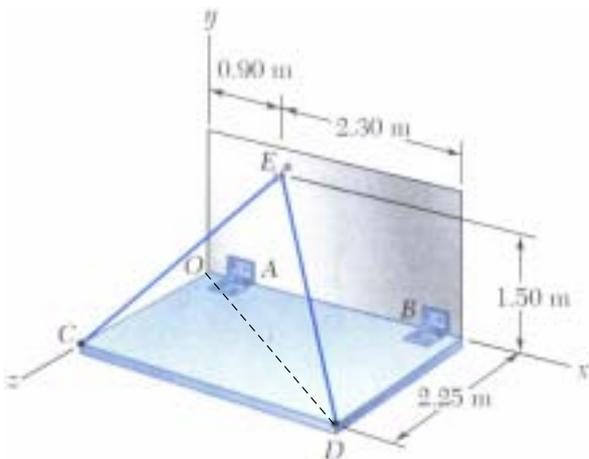


1.[6] 가 26cm×20cm 가 200 N
 A B (hinge)
 C
 D W



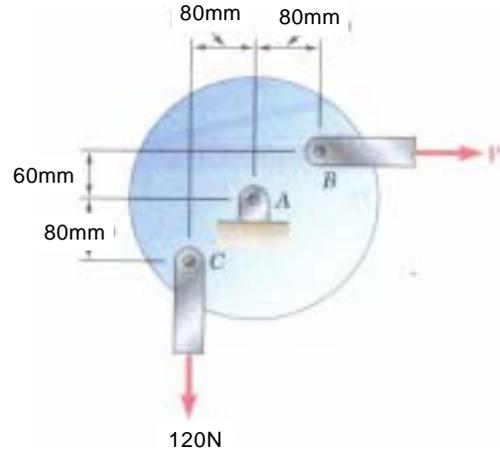
(a)
 (b) θ 가 60° , CD CO가

2.[6] A B E (hinge) CED
 C D 가
 1500 N



(a) CE C 가
 F_{CE}
 (b) O F_{CE} M_O
 (c) DO F_{CE} M_{DO}

(3~4) Horizontal and vertical links are hinged to a wheel, and forces are applied to the links as shown. The bodies are in equilibrium.



3.[5] (rectangular component)

A A P

4.[5] (force triangle)

A A P

5.[3]

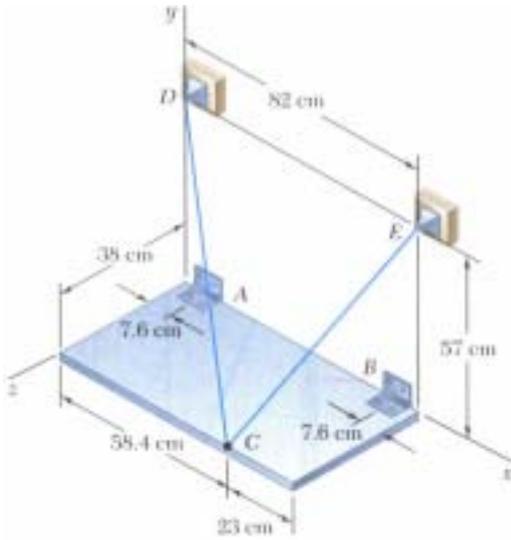
(a) (internal force)

(b) 가 ,

(reaction)

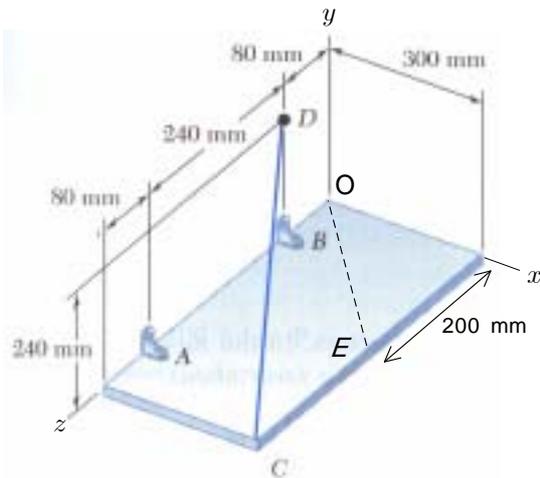
-
- (b) $\theta = 55.7^\circ$
 - (a) $F_{CE} = (474 \text{ N}) i + (789 \text{ N}) j + (-1184 \text{ N}) k$
 (b) $M_O = (-1775 \text{ N}\cdot\text{m}) i + (1067 \text{ N}\cdot\text{m}) j$
 (c) $M_{DO} = 1452 \text{ N}\cdot\text{m}$
 - $P = 160 \text{ N}$, $A_x = 160 \text{ N}$, $A_y = 120 \text{ N}$
 - $A = 200 \text{ N}$ $_36.9^\circ$, $P = 160 \text{ N}$

1.[6] 가 570 N
(hinge) , A B
CD CE가
C 가 .



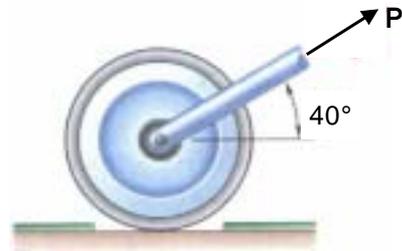
(a) .
(b) CD CE가 .

2.[6] A B
C CD
CD 가 300 N



(a) CD C 가
 F_{CD}
(b) O F_{CD} M_O
(c) EO F_{CD} M_{EO}

(3~4) A 30-kg roller of diameter 240 mm, which is to be used on a tile floor, is resting directly on the subflooring as shown. The thickness of each tile is 10 mm. Force **P** is required to move the roller onto the tiles if the roller is pulled to the right.



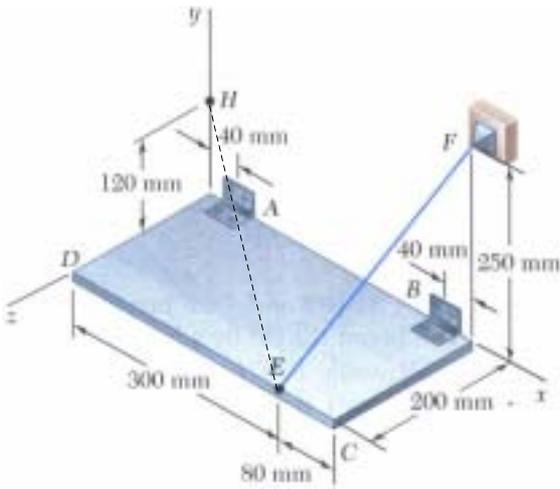
3.[5] (rectangular component)
P
가

4.[5] (force triangle)
가

5.[3]
(a) 가
가
(b) 6 가
(reaction)

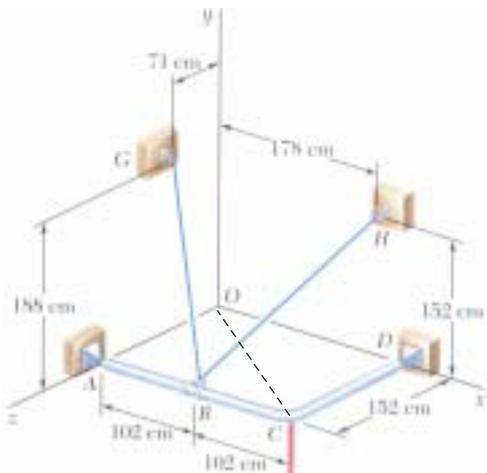
-
- (b) $\theta = 59.0^\circ$
 - (a) $F_{CD} = (-180 \text{ N}) \mathbf{i} + (144 \text{ N}) \mathbf{j} + (-192 \text{ N}) \mathbf{k}$
(b) $M_O = (-57.6 \text{ N}\cdot\text{m}) \mathbf{i} + (-14.4 \text{ N}\cdot\text{m}) \mathbf{j} + (43.2 \text{ N}\cdot\text{m}) \mathbf{k}$
(c) $M_{EO} = 24.0 \text{ N}\cdot\text{m}$
 - $P = 122.7 \text{ N}$, $F_x = 94.0 \text{ N}$, $F_y = 215 \text{ N}$
 - $F = 235 \text{ N}$ 66.4°

1.[6] 가 150 N
(hinge)



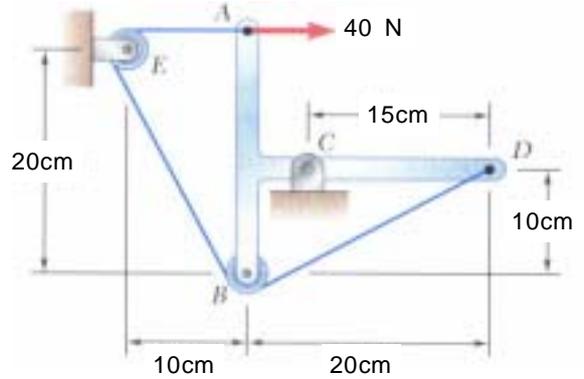
- (a)
- (b) EF EHD

2.[6] A D (hinge)
B GBH
1500 N



- (a) BG B 가 F_{BG}
- (b) O F_{BG} M_O
- (c) CO F_{BG} M_{CO}

(3~4) Member $ABCD$ is supported by a pin and bracket at C and by an inextensible cord attached at A and D and passing over frictionless pulleys at B and E . Neglect the size of the pulleys.



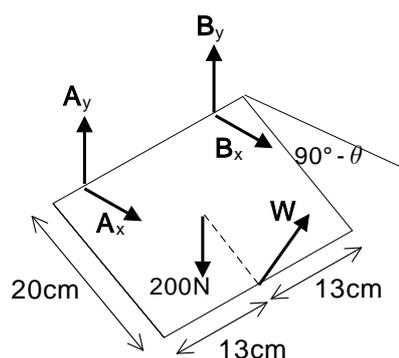
3.[5]
C

4.[5] (force triangle)
C

5.[3]
(a) 가 가
(b) ()
(reaction)

1. (b) $\theta = 68.5^\circ$
2. (a) $F_{BG} = (-669 \text{ N})i + (1233 \text{ N})j + (-531 \text{ N})k$
(b) $M_O = (-1874 \text{ N}\cdot\text{m})i + (-475 \text{ N}\cdot\text{m})j + (1258 \text{ N}\cdot\text{m})k$
(c) $M_{CO} = 751 \text{ N}\cdot\text{m}$
3. $T = 379 \text{ N}$, $C_x = 509 \text{ N}$, $C_y = 339 \text{ N}$
4. $C = 609 \text{ N}$ $\angle 33.7^\circ$

1. (a)



(b) $\theta = 60^\circ$, $90^\circ - \theta = 30^\circ$

C : $x = (20 \text{ cm}) \cos 30^\circ = 17.32 \text{ cm}$, $y = -(20 \text{ cm}) \sin 30^\circ = -10.00 \text{ cm}$, $z = 13 \text{ cm}$

$\mathbf{r}_{O/C} = -17.32 \mathbf{i} + 10.00 \mathbf{j} - 13.00 \mathbf{k} \text{ (cm)}$

$r_{O/C} = \sqrt{(-17.32 \text{ cm})^2 + (10.0 \text{ cm})^2 + (-13.0 \text{ cm})^2} = 23.85 \text{ cm}$

$\mathbf{r}_{D/C} = (20 - 17.32) \mathbf{i} + [10.0 - (-10.0)] \mathbf{j} - 13.0 \mathbf{k} \text{ (cm)} = 2.68 \mathbf{i} + 20.0 \mathbf{j} - 13.0 \mathbf{k} \text{ (cm)}$

$r_{D/C} = \sqrt{(2.68 \text{ cm})^2 + (20.0 \text{ cm})^2 + (-13.0 \text{ cm})^2} = 24.00 \text{ cm}$

$\mathbf{r}_{O/C} \cdot \mathbf{r}_{D/C} = [-17.32 \mathbf{i} + 10.00 \mathbf{j} - 13.00 \mathbf{k} \text{ (cm)}] \cdot [2.68 \mathbf{i} + 20.0 \mathbf{j} - 13.0 \mathbf{k} \text{ (cm)}]$

$= (-17.32)(2.68) + (10.0)(20.0) + (-13.0)^2 \text{ (cm}^2) = 322.6 \text{ (cm}^2)$

$\cos \theta = \frac{\mathbf{r}_{O/C} \cdot \mathbf{r}_{D/C}}{r_{O/C} r_{D/C}} = \frac{322.6 \text{ cm}^2}{(23.85 \text{ cm})(24.0 \text{ cm})} = 0.5636$

$\theta = \cos^{-1} 0.5636 = 55.7^\circ$

2. $T_{CE} = 1500 \text{ N}$

(a) $d_{CE} = \sqrt{(0.90 \text{ m})^2 + (1.50 \text{ m})^2 + (-2.25 \text{ m})^2} = 2.850 \text{ m}$

$\lambda_{CE} = \frac{(0.90 \text{ m})\mathbf{i} + (1.50 \text{ m})\mathbf{j} + (-2.25 \text{ m})\mathbf{k}}{2.850 \text{ m}} = 0.3158 \mathbf{i} + 0.5263 \mathbf{j} - 0.7895 \mathbf{k}$

$\mathbf{F}_{CE} = T_{CE} \lambda_{CE} = (1500 \text{ N}) (0.3158 \mathbf{i} + 0.5263 \mathbf{j} - 0.7895 \mathbf{k})$

$= (474 \text{ N}) \mathbf{i} + (789 \text{ N}) \mathbf{j} + (-1184 \text{ N}) \mathbf{k}$

(b) $\mathbf{r}_{C/O} = (2.25 \text{ m}) \mathbf{k}$

$\mathbf{M}_O = \mathbf{r}_{C/O} \times \mathbf{F}_{CE}$

$= [(2.25 \text{ m}) \mathbf{k}] \times [(474 \text{ N}) \mathbf{i} + (789 \text{ N}) \mathbf{j} + (-1184 \text{ N}) \mathbf{k}]$

$= [-(2.25 \text{ m})(789 \text{ N})] \mathbf{i} + [(2.25 \text{ m})(474 \text{ N})] \mathbf{j}$

$= (-1775 \text{ N}\cdot\text{m}) \mathbf{i} + (1067 \text{ N}\cdot\text{m}) \mathbf{j}$

(c) $\mathbf{r}_{O/D} = (-0.90 \text{ m} - 2.30 \text{ m}) \mathbf{i} + (-2.25 \text{ m}) \mathbf{k} = (-3.20 \text{ m}) \mathbf{i} + (-2.25 \text{ m}) \mathbf{k}$

$r_{O/D} = \sqrt{(-3.20 \text{ m})^2 + (-2.25 \text{ m})^2} = 3.912 \text{ m}$

$\lambda_{DO} = \frac{1}{3.912 \text{ m}} [(-3.20 \text{ m}) \mathbf{i} + (-2.25 \text{ m}) \mathbf{k}] = -0.8180 \mathbf{i} - 0.5752 \mathbf{k}$

$M_{DO} = \lambda_{DO} \cdot \mathbf{M}_O = [-0.8180 \mathbf{i} - 0.5752 \mathbf{k}] \cdot [(-1775 \text{ N}\cdot\text{m}) \mathbf{i} + (1067 \text{ N}\cdot\text{m}) \mathbf{j}]$

$= (-0.8180)(-1775 \text{ N}\cdot\text{m})$

$= 1452 \text{ N}\cdot\text{m}$

3. $d_1 = 80 \text{ mm}, \quad d_2 = 60 \text{ mm}, \quad F = 120 \text{ N}$

$+ \uparrow M_A = 0; \quad d_1 F - d_2 P = 0$

$$P = \frac{d_1}{d_2} F = \frac{80 \text{ mm}}{60 \text{ mm}} (120 \text{ N}) = 160 \text{ N}$$

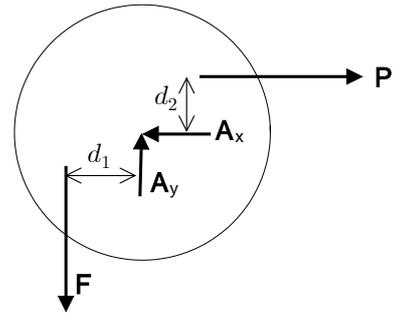
$F_x = 0; \quad -A_x + P = 0$

$A_x = P = 160 \text{ N}$

$F_y = 0; \quad A_y - F = 0$

$A_y = F = 120 \text{ N}$

$A_x = 160 \text{ N}, \quad A_y = 120 \text{ N}$



4. $F = 120 \text{ N},$

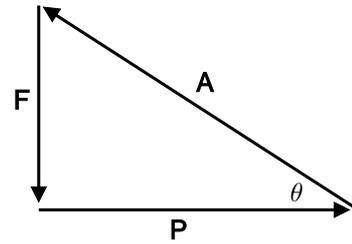
$\tan \theta = \frac{60 \text{ mm}}{80 \text{ mm}} = 0.75 \quad \theta = \tan^{-1} 0.75 = 36.87^\circ$

$A = \frac{F}{\sin \theta} = \frac{120 \text{ N}}{\sin 36.87^\circ} = 200 \text{ N}$

$A = 200 \text{ N} \angle 36.9^\circ$

$P = \frac{F}{\tan \theta} = \frac{120 \text{ N}}{0.75} = 160 \text{ N}$

$P = 160 \text{ N}$



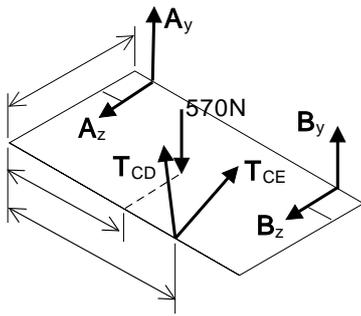
5. (a) (internal force)

, 가 .

(b)

()

1. (a)



(b) $\mathbf{r}_{D/C} = -58.4 \mathbf{i} + 57.0 \mathbf{j} - 38.0 \mathbf{k} \text{ (cm)}$

$$r_{D/C} = \sqrt{(-58.4 \text{ cm})^2 + (57.0 \text{ cm})^2 + (-38.0 \text{ cm})^2} = 90.0 \text{ cm}$$

$$\mathbf{r}_{E/C} = (81.4 - 58.4) \mathbf{i} + 57.0 \mathbf{j} - 38.0 \mathbf{k} \text{ (cm)} = 23.0 \mathbf{i} + 57.0 \mathbf{j} - 38.0 \mathbf{k} \text{ (cm)}$$

$$r_{E/C} = \sqrt{(23.0 \text{ cm})^2 + (57.0 \text{ cm})^2 + (-38.0 \text{ cm})^2} = 72.26 \text{ cm}$$

$$\begin{aligned} \mathbf{r}_{D/C} \cdot \mathbf{r}_{E/C} &= [-58.4 \mathbf{i} + 57.0 \mathbf{j} - 38.0 \mathbf{k} \text{ (cm)}] \cdot [23.0 \mathbf{i} + 57.0 \mathbf{j} - 38.0 \mathbf{k} \text{ (cm)}] \\ &= (-58.4)(23.0) + (57.0)^2 + (-38.0)^2 \text{ (cm}^2\text{)} = 3349.8 \text{ (cm}^2\text{)} \end{aligned}$$

$$\cos \theta = \frac{\mathbf{r}_{D/C} \cdot \mathbf{r}_{E/C}}{r_{D/C} r_{E/C}} = \frac{3349.8 \text{ cm}^2}{(90.0 \text{ cm})(72.26 \text{ cm})} = 0.5151$$

$$\theta = \cos^{-1} 0.5151 = 59.0^\circ$$

2. $T_{CD} = 300 \text{ N}$

(a) $d_{CD} = \sqrt{(-0.30 \text{ m})^2 + (0.24 \text{ m})^2 + (-0.32 \text{ m})^2} = 0.50 \text{ m}$

$$\lambda_{CD} = \frac{(-0.30 \text{ m})\mathbf{i} + (0.24 \text{ m})\mathbf{j} + (-0.32 \text{ m})\mathbf{k}}{0.50 \text{ m}} = -0.60 \mathbf{i} + 0.48 \mathbf{j} - 0.64 \mathbf{k}$$

$$\begin{aligned} \mathbf{F}_{CD} &= T_{CD} \lambda_{CD} = (300 \text{ N}) (-0.60 \mathbf{i} + 0.48 \mathbf{j} - 0.64 \mathbf{k}) \\ &= (-180 \text{ N}) \mathbf{i} + (144 \text{ N}) \mathbf{j} + (-192 \text{ N}) \mathbf{k} \end{aligned}$$

(b) $\mathbf{r}_{C/O} = (0.30 \text{ m}) \mathbf{i} + (0.40 \text{ m}) \mathbf{k}$

$$\mathbf{M}_O = \mathbf{r}_{C/O} \times \mathbf{F}_{CD}$$

$$\begin{aligned} &= [(0.30 \text{ m}) \mathbf{i} + (0.40 \text{ m}) \mathbf{k}] \times [(-180 \text{ N}) \mathbf{i} + (144 \text{ N}) \mathbf{j} + (-192 \text{ N}) \mathbf{k}] \\ &= [-(0.40 \text{ m})(144 \text{ N})] \mathbf{i} + [(0.40 \text{ m})(-180 \text{ N}) - (0.30 \text{ m})(-192 \text{ N})] \mathbf{j} + [(0.30 \text{ m})(144 \text{ N})] \mathbf{k} \\ &= (-57.6 \text{ N}\cdot\text{m}) \mathbf{i} + (-14.4 \text{ N}\cdot\text{m}) \mathbf{j} + (43.2 \text{ N}\cdot\text{m}) \mathbf{k} \end{aligned}$$

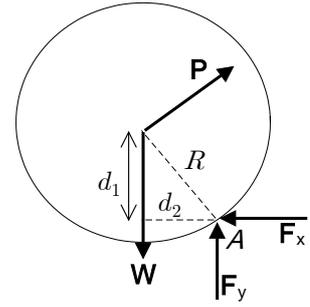
(c) $\mathbf{r}_{O/E} = (-0.30 \text{ m}) \mathbf{i} + (-0.20 \text{ m}) \mathbf{k}$

$$r_{O/E} = \sqrt{(-0.30 \text{ m})^2 + (-0.20 \text{ m})^2} = 0.3606 \text{ m}$$

$$\lambda_{EO} = \frac{1}{0.3606 \text{ m}} [(-0.30 \text{ m}) \mathbf{i} + (-0.20 \text{ m}) \mathbf{k}] = -0.8319 \mathbf{i} - 0.5546 \mathbf{k}$$

$$\begin{aligned} M_{EO} &= \lambda_{EO} \cdot \mathbf{M}_O = [-0.8319 \mathbf{i} - 0.5546 \mathbf{k}] \cdot [(-57.6 \text{ N}\cdot\text{m}) \mathbf{i} + (-14.4 \text{ N}\cdot\text{m}) \mathbf{j} + (43.2 \text{ N}\cdot\text{m}) \mathbf{k}] \\ &= (-0.8319)(-57.6 \text{ N}\cdot\text{m}) + (-0.5546)(43.2 \text{ N}\cdot\text{m}) \\ &= 24.0 \text{ N}\cdot\text{m} \end{aligned}$$

3. $W = (30 \text{ kg})(9.81 \text{ m/s}^2) = 294.3 \text{ N}$
 $R = 0.12 \text{ m}, \quad t = 0.01 \text{ m}$
 $d_1 = R - t = (0.12 \text{ m}) - (0.01 \text{ m}) = 0.11 \text{ m}$
 $d_2 = \sqrt{R^2 - d_1^2} = \sqrt{(0.12 \text{ m})^2 - (0.11 \text{ m})^2} = 0.048 \text{ m}$
 $\uparrow M_A = 0 ;$
 $-d_1 P \cos 40^\circ - d_2 P \sin 40^\circ + d_2 W = 0$



$$P = W \frac{d_2}{d_1 \cos 40^\circ + d_2 \sin 40^\circ}$$

$$= (294.3 \text{ N}) \frac{(0.048 \text{ m})}{(0.11 \text{ m}) \cos 40^\circ + (0.048 \text{ m}) \sin 40^\circ} = 122.7 \text{ N}$$

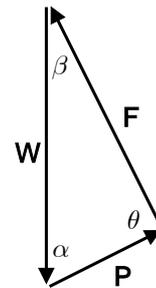
$$F_X = 0 ; -F_x + P \cos 40^\circ = 0 \quad F_x = P \cos 40^\circ = (122.7 \text{ N}) \cos 40^\circ = 94.0 \text{ N}$$

$$F_Y = 0 ; F_y - W + P \sin 40^\circ = 0$$

$$F_y = W - P \sin 40^\circ = (294.3 \text{ N}) - (122.7 \text{ N}) \sin 40^\circ = 215.4 \text{ N}$$

$$F_x = 94.0 \text{ N} \quad , \quad F_y = 215 \text{ N}$$

4. $W = (30 \text{ kg})(9.81 \text{ m/s}^2) = 294.3 \text{ N}$
 $R = 0.12 \text{ m}, \quad t = 0.01 \text{ m}$
 $\alpha = 90^\circ - 40^\circ = 50^\circ$
 $\cos \beta = \frac{R - t}{R} = \frac{(0.12 - 0.01) \text{ m}}{0.12 \text{ m}} = 0.9167$
 $\beta = \cos^{-1} 0.9167 = 23.6^\circ, \quad 90^\circ - 23.6^\circ = 66.4^\circ$
 $\theta = 180^\circ - \alpha - \beta = 180^\circ - 50^\circ - 23.6^\circ = 106.4^\circ$



$$\text{sine} \quad \frac{F}{\sin \alpha} = \frac{W}{\sin \theta}$$

$$F = W \frac{\sin \alpha}{\sin \theta} = (294.3 \text{ N}) \frac{\sin 50^\circ}{\sin 106.4^\circ} = 235.0 \text{ N}$$

$$F = 235 \text{ N} \quad \underline{66.4^\circ}$$

5. (a)

가

0

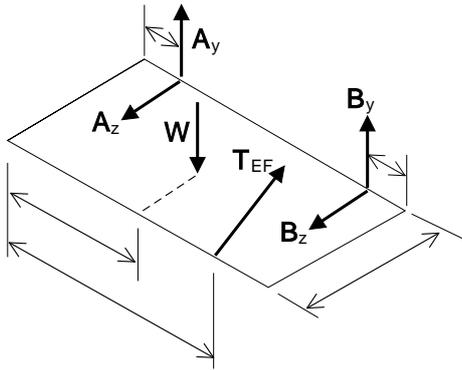
(b)

가

가

()

1. (a)



(b) $\mathbf{r}_{F/E} = 80 \mathbf{i} + 250 \mathbf{j} - 200 \mathbf{k}$ (mm)

$$r_{F/E} = \sqrt{(80 \text{ mm})^2 + (250 \text{ mm})^2 + (-200 \text{ mm})^2} = 330 \text{ mm}$$

$\mathbf{r}_{H/E} = -300 \mathbf{i} + 120 \mathbf{j} - 200 \mathbf{k}$ (mm)

$$r_{H/E} = \sqrt{(-300 \text{ mm})^2 + (120 \text{ mm})^2 + (-200 \text{ mm})^2} = 380 \text{ mm}$$

$\mathbf{r}_{F/E} \cdot \mathbf{r}_{H/E} = [80 \mathbf{i} + 250 \mathbf{j} - 200 \mathbf{k} \text{ (mm)}] \cdot [-300 \mathbf{i} + 120 \mathbf{j} - 200 \mathbf{k} \text{ (mm)}]$

$$= (80)(-300) + (250)(120) + (-200)^2 \text{ (mm}^2\text{)} = 46000 \text{ (mm}^2\text{)}$$

$$\cos \theta = \frac{\mathbf{r}_{F/E} \cdot \mathbf{r}_{H/E}}{r_{F/E} r_{H/E}} = \frac{46000 \text{ mm}^2}{(330 \text{ mm})(380 \text{ mm})} = 0.3668$$

$$\theta = \cos^{-1} 0.3668 = 68.5^\circ$$

2. $T_{BG} = 1500 \text{ N}$

(a) $d_{BG} = \sqrt{(-1.02 \text{ m})^2 + (1.88 \text{ m})^2 + (-0.81 \text{ m})^2} = 2.287 \text{ m}$

$$\lambda_{BG} = \frac{(-1.02 \text{ m})\mathbf{i} + (1.88 \text{ m})\mathbf{j} + (-0.81 \text{ m})\mathbf{k}}{2.287 \text{ m}} = -0.4460 \mathbf{i} + 0.8220 \mathbf{j} - 0.3542 \mathbf{k}$$

$$\begin{aligned} \mathbf{F}_{BG} &= T_{BG} \lambda_{BG} = (1500 \text{ N}) (-0.4460 \mathbf{i} + 0.8220 \mathbf{j} - 0.3542 \mathbf{k}) \\ &= (-669 \text{ N}) \mathbf{i} + (1233 \text{ N}) \mathbf{j} + (-531 \text{ N}) \mathbf{k} \end{aligned}$$

(b) $\mathbf{r}_{B/O} = (1.02 \text{ m}) \mathbf{i} + (1.52 \text{ m}) \mathbf{k}$

$$\mathbf{M}_O = \mathbf{r}_{B/O} \times \mathbf{F}_{BG}$$

$$= [(1.02 \text{ m}) \mathbf{i} + (1.52 \text{ m}) \mathbf{k}] \times [(-669 \text{ N}) \mathbf{i} + (1233 \text{ N}) \mathbf{j} + (-531 \text{ N}) \mathbf{k}]$$

$$= [-(1.52 \text{ m})(1233 \text{ N})] \mathbf{i} + [(1.52 \text{ m})(-669 \text{ N}) - (1.02 \text{ m})(-531 \text{ N})] \mathbf{j} + [(1.02 \text{ m})(1233 \text{ N})] \mathbf{k}$$

$$= (-1874 \text{ N}\cdot\text{m}) \mathbf{i} + (-475 \text{ N}\cdot\text{m}) \mathbf{j} + (1258 \text{ N}\cdot\text{m}) \mathbf{k}$$

(c) $\mathbf{r}_{O/C} = (-2.04 \text{ m}) \mathbf{i} + (-1.52 \text{ m}) \mathbf{k}$

$$r_{O/C} = \sqrt{(-2.04 \text{ m})^2 + (-1.52 \text{ m})^2} = 2.544 \text{ m}$$

$$\lambda_{CO} = \frac{1}{2.544 \text{ m}} [(-2.04 \text{ m}) \mathbf{i} + (-1.52 \text{ m}) \mathbf{k}] = -0.8019 \mathbf{i} - 0.5974 \mathbf{k}$$

$$\begin{aligned} M_{CO} &= \lambda_{CO} \cdot \mathbf{M}_O = [-0.8019 \mathbf{i} - 0.5974 \mathbf{k}] \cdot [(-1874 \text{ N}\cdot\text{m}) \mathbf{i} + (-475 \text{ N}\cdot\text{m}) \mathbf{j} + (1258 \text{ N}\cdot\text{m}) \mathbf{k}] \\ &= (-0.8019)(-1874 \text{ N}\cdot\text{m}) + (-0.5974)(1258 \text{ N}\cdot\text{m}) \\ &= 751 \text{ N}\cdot\text{m} \end{aligned}$$

3. $F = 40 \text{ N}$

$d_{AB} = 20 \text{ cm}$,

$d_1 = 10 \text{ cm}$, $d_3 = 10 \text{ cm}$

$$\tan \alpha = \frac{d_{AB}}{d_1} = \frac{20 \text{ cm}}{10 \text{ cm}} = 2.0$$

$$\alpha = \tan^{-1} 2.0 = 63.43^\circ$$

$+ \uparrow M_C = 0$;

$$- (10 \text{ cm}) T \cos \alpha - (5 \text{ cm}) T \sin \alpha + (10 \text{ cm}) (T - F) = 0$$

$$T = F \frac{(10 \text{ cm})}{(10 \text{ cm}) - (10 \text{ cm}) \cos 63.43^\circ - (5 \text{ cm}) \sin 63.43^\circ} = 379 \text{ N}$$

$F_x = 0$; $C_x + F - T - T \cos \alpha = 0$

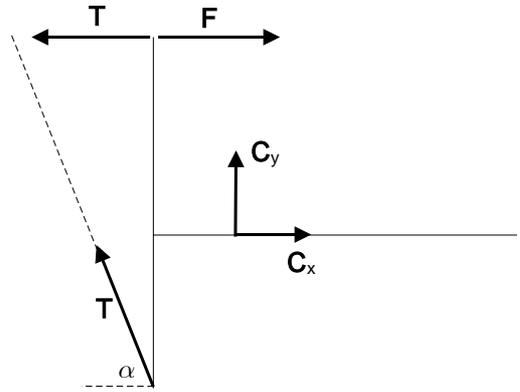
$$C_x = -F + T (1 + \cos \alpha) = -(40 \text{ N}) + (379 \text{ N}) (1 + \cos 63.43^\circ) = 509 \text{ N}$$

$F_y = 0$; $C_y + T \sin \alpha = 0$

$C_x = 509 \text{ N}$

$$C_y = -T \sin \alpha = -(379 \text{ N}) \sin 63.43^\circ = -339 \text{ N}$$

$C_y = 339 \text{ N}$



4. $F = 40 \text{ N}$

$d_{AB} = 20 \text{ cm}$,

$d_1 = 10 \text{ cm}$, $d_3 = 10 \text{ cm}$

$d_2 = (10 \text{ cm}) + (20 \text{ cm}) - (15 \text{ cm}) = 15 \text{ cm}$

$$\tan \alpha = \frac{d_{AB}}{d_1} = \frac{20 \text{ cm}}{10 \text{ cm}} = 2.0$$

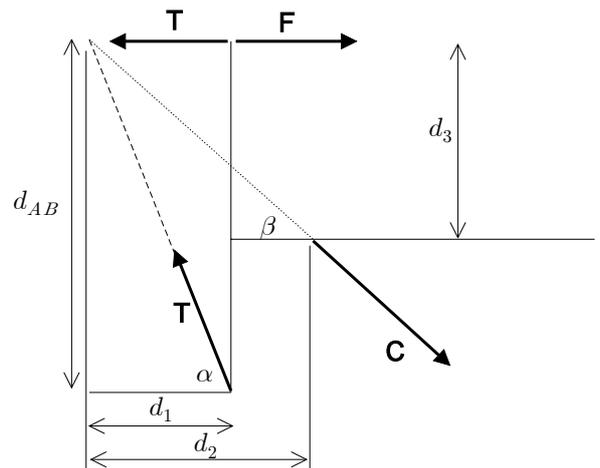
$$\alpha = \tan^{-1} 2.0 = 63.43^\circ$$

$$\tan \beta = \frac{d_3}{d_2} = \frac{10 \text{ cm}}{15 \text{ cm}} = 0.6667$$

$$\beta = \tan^{-1} 0.6667 = 33.69^\circ$$

$\gamma = \alpha - \beta = 63.43^\circ - 33.69^\circ = 29.74^\circ$

$\theta = 180^\circ - \beta - \gamma = 180^\circ - 33.69^\circ - 29.74^\circ = 116.57^\circ$



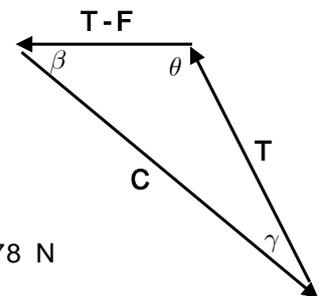
sine

$$\frac{\sin \gamma}{T - F} = \frac{\sin \beta}{T}$$

$$T \sin \gamma = (T - F) \sin \beta$$

$$T (\sin \beta - \sin \gamma) = F \sin \beta$$

$$T = F \frac{\sin \beta}{\sin \beta - \sin \gamma} = (40 \text{ N}) \frac{\sin 33.69^\circ}{\sin 33.69^\circ - \sin 29.74^\circ} = 378 \text{ N}$$



$$\frac{\sin \beta}{T} = \frac{\sin \theta}{C}$$

$$C = T \frac{\sin \theta}{\sin \beta} = (378 \text{ N}) \frac{\sin 116.57^\circ}{\sin 33.69^\circ} = 609 \text{ N}$$

$C = 609 \text{ N } \angle 33.7^\circ$

5. (a) 가 , , ()가 .

(b)

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