

Unit 8 Practice: Answers and Solutions (P8-P14)

Your instructor greatly appreciates reports of any mistakes you find in these documents. ☺

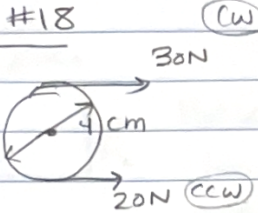
P8) Toward the bottom of the page

P9) Toward the top of the page

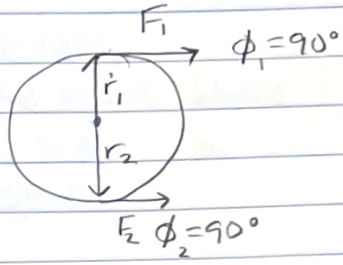
P10) p.330 #18

p. 330 #18

18)



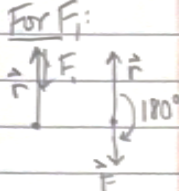
radius = 0.02m


$$\begin{aligned}\sum \tau &= -r_1 F_1 \sin \phi_1 + r_2 F_2 \sin \phi_2 \\ &= -(0.02\text{m})(30\text{N})\sin 90^\circ + (0.02)(20\text{N})\sin 90^\circ \\ &= -0.6 + 0.4 \\ &= \boxed{-0.2 \text{ Nm}}\end{aligned}$$

P11) p.331 #19

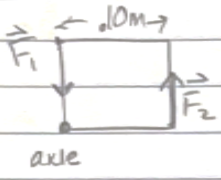
p. 331 #19

For F_1 :



These forces are shown, at the points where they are exerted on the object, so this is a proper FBD for the extended object.

with their tails



axis

$$\begin{aligned}\sum \tau &= r_1 F_1 \sin \phi + r_2 F_2 \sin \phi \\ 5\text{Nm} &= (0.10\text{m})(F)\sin(180^\circ) + (0.10\text{m})(F)\sin 90^\circ \\ 5\text{Nm} &= 0 + (0.1\text{m})F \\ \boxed{50\text{N}} &= F\end{aligned}$$

p.331 #22

B = beam, P = person

22)

F_{GB} = force of gravity on beam = $m_B g$
 $= (500 \text{ kg})(9.8 \frac{\text{N}}{\text{kg}})$
 $= 4900 \text{ N}$

F_{GP} = force of gravity on person = $m_P g$
 $= (70 \text{ kg})(9.8 \frac{\text{N}}{\text{kg}})$
 $= 686 \text{ N}$

$\Sigma \tau = -F_{GB}(r_B)\sin\phi_B - F_{GP}r_P\sin\phi_P$
 $= - (4900 \text{ N})(2.0 \text{ m})\sin 90^\circ - (686 \text{ N})(4.0 \text{ m})\sin 90^\circ$
 $= -9800 \text{ Nm} - 2744 \text{ Nm}$
 $= -1.25 \times 10^4 \text{ Nm}$

Ch 12 #38

a)

$\vec{A} \times \vec{B} = AB \sin \phi$
 $= (6)(5) \sin 45$
 $= 21, \text{ into the page}$

b)

$\vec{C} \times \vec{D} = CD \sin \phi$
 $= (4)(6) \sin 90$
 $= 24, \text{ out of the page}$

Ch 12 p.332 #39

$$39) \vec{A} = 3\hat{i} + \hat{j}$$

$$\vec{B} = 3\hat{i} - 2\hat{j} + 2\hat{k}$$

$$\vec{A} \times \vec{B} = (3\hat{i} + \hat{j}) \times (3\hat{i} - 2\hat{j} + 2\hat{k})$$

$$\vec{A} \times \vec{B} = (3\hat{i}) \times (3\hat{i} - 2\hat{j} + 2\hat{k}) + (\hat{j}) \times (3\hat{i} - 2\hat{j} + 2\hat{k})$$

$$\vec{A} \times \vec{B} = 9(\hat{i} \times \hat{i}) - 6(\hat{i} \times \hat{j}) + 6(\hat{i} \times \hat{k}) + 3(\hat{j} \times \hat{i}) - 2(\hat{j} \times \hat{j}) + 2(\hat{j} \times \hat{k})$$

$$\vec{A} \times \vec{B} = -6\hat{k} + 6(-\hat{j}) + 3(-\hat{k}) + 2\hat{i}$$

$$\vec{A} \times \vec{B} = 2\hat{i} - 6\hat{j} - 9\hat{k}$$

$$\vec{A} \times \vec{B} = \boxed{2\hat{i} - 6\hat{j} - 9\hat{k}}$$

→ This step uses the distributive property, but instead of regular multiplication, it is "cross product" as the operator.

Here is what it looks like for regular multiplication:

$$(a+b)(r+s+t) = a(r+s+t) + b(r+s+t)$$

$$= ar + as + at + br + bs + bt$$