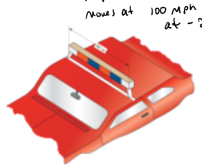
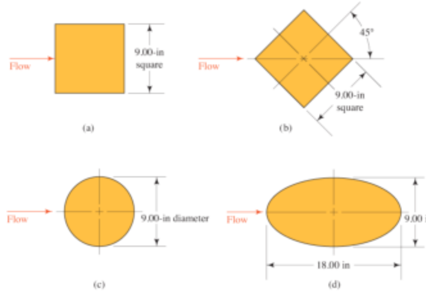
Chapter 17

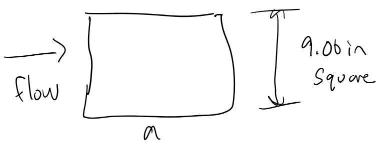
Thursday, February 23, 2023 3:20 PM

17.16 Compare the drag force exerted on each proposed design when the vehicle moves at 100 mph through still air at −20°F





$l = 60in$
$w = 9.00in$



Reys. $N = \frac{vL}{\nu}$

$= \frac{(146.7 \ ft/s)(0.75 \ ft)}{1.17 \times 10^{-4} \ ft^2/s}$

$= 940384.62$

flow →

$F = C_D \left(\frac{\rho v^2}{2}\right) A$

$b = 9.00 \ \frac{1}{12}$
$= 0.75ft$

$l = 5ft$

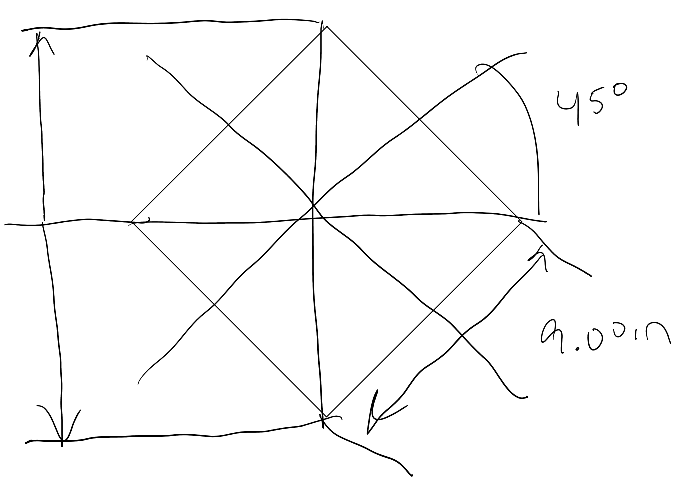
$V = (100)\left(\frac{5280 \ ft}{1 \ mile}\right)\left(\frac{1}{3600s}\right) =$
$146.7 \ ft/s$

$A = \left(\frac{60}{12}\right)\left(\frac{9}{12}\right)$
$= 3.75 \ ft^2$

kinematic viscosity at −20°
$\nu = 1.17 \times 10^{-4} \ \frac{ft^2}{s}$
$\rho = 2.80 \times 10^{-3} \ \frac{slugs}{ft^3}$

$2.10 \cdot \frac{(2.80 \times 10^{-3})(146.7 \ ft/s)^2}{2} \cdot 3$

$= 237.27 \ lb$

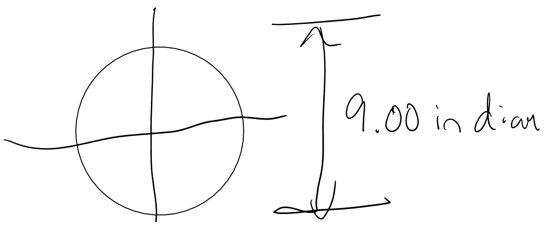


(b)

$y = 9 \sin 45°$

$\frac{6.364}{12} = 0.5$

$A = (4.5)(2)(0.53$



(C)

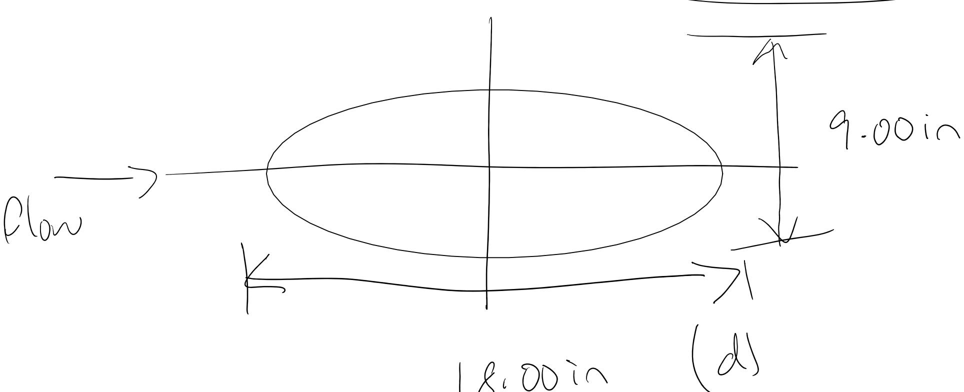
$A = \left(\frac{60}{12}\right)\left(\frac{9}{12}\right)$

$3.75\,ft^2$

$F = 0.30 \cdot \left(\frac{(2.80 \times 10^{-3})(146.7)^2}{2}\right) \cdot 3.75$

$.75ft^2$

$= 3416$



(d)

$RN = \frac{146.7}{1}$

$5\ 30ft$

$= 1.$

o)

$0.25 \cdot (2.$

$$\times\left(\frac{18}{1L}\right)$$

$$.17\times10^{-4}$$

$$9\times10^{6}$$

$$\frac{(80\times10^{-3})(146.7)^2}{2} = 3.75$$

(b)

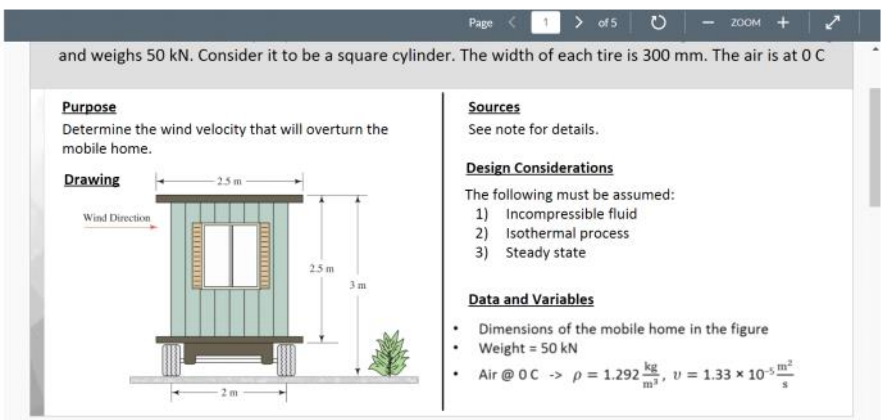
$A = (4.5)(2)(0.53$

$= 4.8 \, ft^2$

$F = 1.6 \, \frac{(2.80 \times 10^{-3})(146.6}{2}$

$= 231.30 \, lb$

Paragraph



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and weighs 50 kN. Consider it to be a square cylinder. The width of each tire is 300 mm. The air is at 0 C

Purpose

Determine the wind velocity that will overturn the mobile home.

Drawing

Sources

See note for details.

Design Considerations

The following must be assumed:

1) Incompressible fluid
2) Isothermal process
3) Steady state

Data and Variables

- Dimensions of the mobile home in the figure
- Weight = 50 kN
- Air @ 0 C -> $\rho = 1.292 \frac{kg}{m^3}$, $\upsilon = 1.33 \times 10^{-5} \frac{m^2}{s}$

In class, we went over the discussion of this problem regardin
when taking on problems, we have to utilize Reynolds
drag coefficient depends on it $Re = \frac{VD}{D}$ and $C_D = \frac{F_D/A}{\frac{1}{2}\rho V^2}$
these types of problems the drag force equation comes to play:
After solving this problem I learned more concepts when it

o)

0.25. (2.

$7)^2$
- . 4.8 ft ^{2}

F = 28

)

g drag/lift.

number because

. Also, for

$F_D = \left(\frac{\rho V^2}{2}\right) A$.

ong to lift/drag.

Example, Reynold's number, this represents the density /

velocity / viscosity.