The drag force acting on an object immersed in a flowing fluid is found using,

$$D = C_D \frac{1}{2} \rho V^2 A,$$

where D is the drag force, C_D is a drag coefficient, ρ is the density of the fluid, V is the velocity of the fluid relative to the object, and A is the frontal projected area of the object, i.e., the area one would see looking at the object from the front.

How much power must a bicyclist exert to overcome the air drag if the person is biking at 20 mph into still air? Assume the drag coefficient for the bicyclist is 0.88 and their frontal projected area is 3.9 ft^2.

SOLUTION:
The power P is given by,

$$P = DV, \tag{1}$$

where D is the drag force acting on the bicyclist and V is the speed of the air relative to the biker. Using the drag force formula given in the problem statement and the given values,

$C_D = 0.88$,
$\rho = 0.0765\ lb_m/ft^3$ (density at Standard Temperature and Pressure, i.e., STP),
$V = 20$ mph = 29.3 ft/s,
$A = 3.9\ ft^2$,
=> $D = 3.50\ lb_f$. (Note: $1\ lb_f = 32.2\ lb_m.ft/s^2$.)

The power is then,

$\boxed{P = 103\ lb_f.ft/s = 0.186\ hp}$. (Note: $1\ hp = 550\ lb_f.ft/s$.)