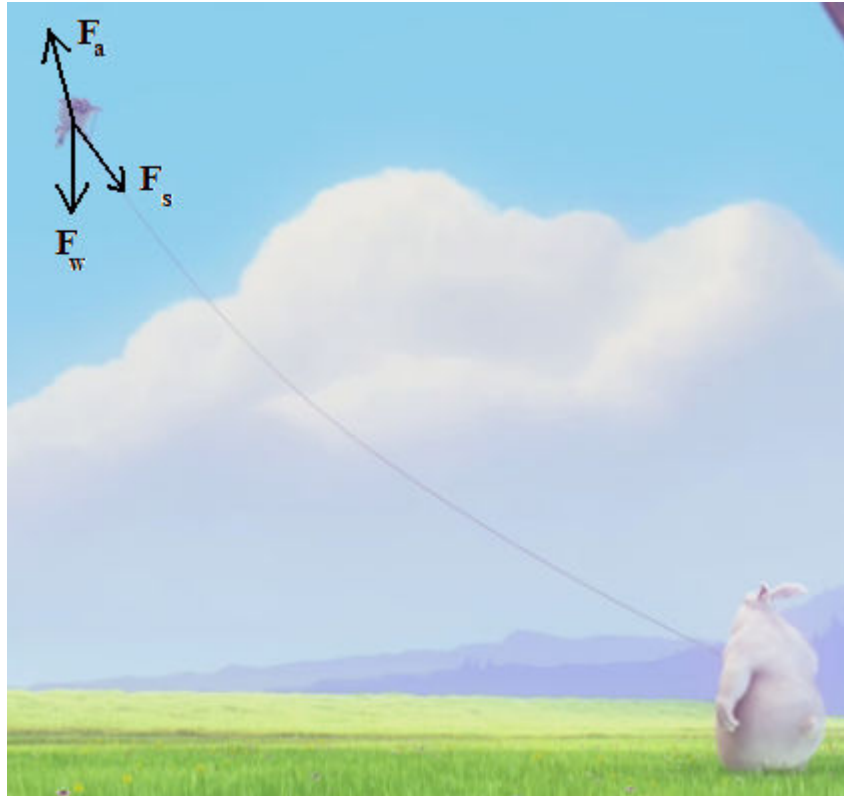
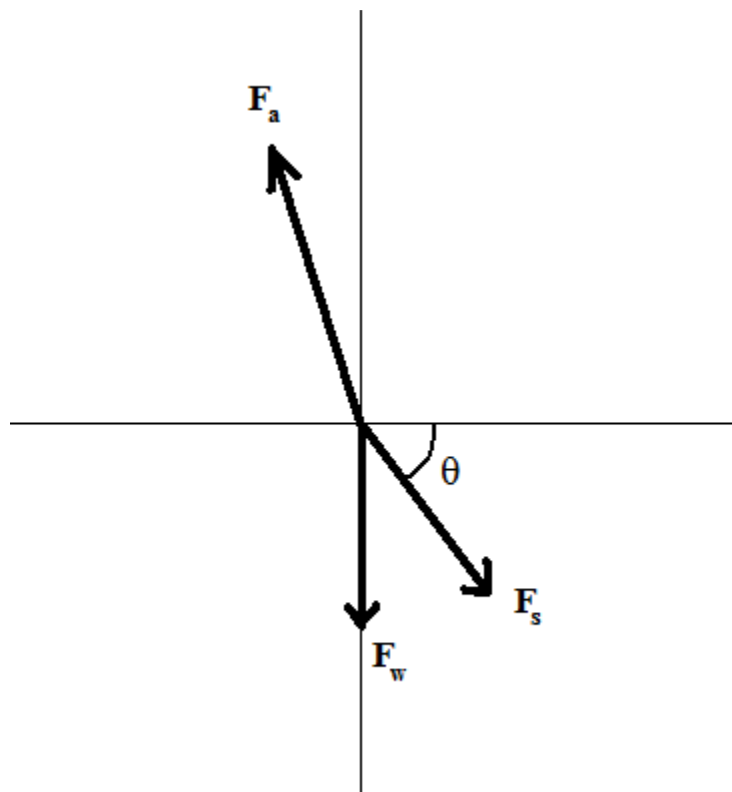


Big Buck Bunny is about an overgrown and very sensitive bunny that takes vengeance on the forest bullies, who are led by a cruel flying squirrel. This movie is created by the Peach Open Movie Project, which offers this movie at www.bigbuckbunny.org.

This scene offers a nice example of forces in multiple dimensions. Big Buck Bunny finally realizes his revenge on the flying squirrel; he uses the squirrel to create a kite, flying high above the ground. First, have your students sketch the force vectors acting on the squirrel, as in this figure:



Then, have the students make some assumptions about the mass of the squirrel ($m_s = 1 \text{ kg}$) and the force exerted by Big Buck bunny on the string and, thus the force exerted by the string on the kite ($F_{BBB} = F_s = 10 \text{ N}$). Then, assuming the angle between the ground and string is 45° , the vector diagram looks like this:



As the students complete this diagram, have them estimate the magnitude and direction of force vector F_a . Is it equal to the sum of F_s and F_w ? (No) Does it directly oppose F_s ? (No.)

Now, have the students find the x- and y-components of the vectors F_w and F_s and put their answers in a table like this:

Vector	x-component	y-component
F_w	0 N	-10 N
F_s	10 N ($\cos -45^\circ$)=7 N	-10 N ($\sin -45^\circ$)=-7 N
$F_w + F_s$	7 N	-17 N
$-(F_w + F_s)$	-7 N	17 N

Now, the vector F_a is the equilibrant vector to $F_w + F_s$, so $F_a = -(F_w + F_s)$. Then, the magnitude and direction for F_a is found in this way:

$$F_a = \sqrt{(-7)^2 + 17^2} = 18 \text{ N}$$

$$\theta_a = \tan^{-1} \left(\frac{17}{-7} \right) = -67^\circ$$

So the final answer is that the force exerted on the squirrel by air resistance is 18 N at 67° above the $-x$ axis.

Students might also find it useful to use the PHET simulation for vector addition:

http://phet.colorado.edu/simulations/sims.php?sim=Vector_Addition