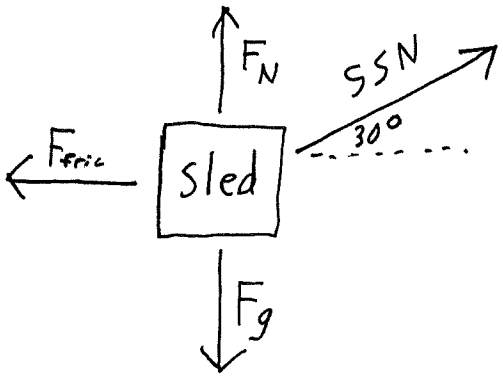
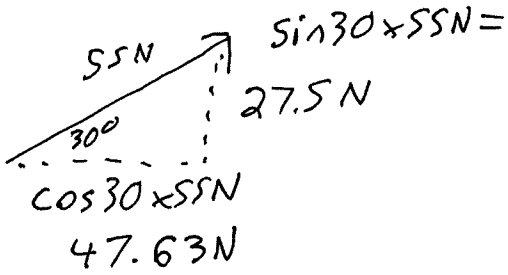
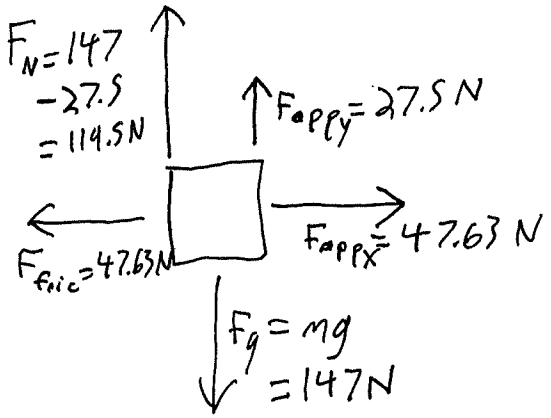
Forces in 2D Practice Name:_____

1. A person pulls a 15 kg sled using a rope at an angle of 30.0° above the horizontal with 55 N of force. If the sled moves at a constant velocity horizontally through the snow what is
   a. The normal force acting between the sled and the snow?
   b. The coefficient of friction between the snow and the sled?







a) Since sled is not accelerating up or down

Upwards force = Downwards force

$F_N + F_{appy} = F_g$

$F_N = F_g - F_{app}$

$F_N = 147N - 27.5N$

$= 119.5N$

$= \boxed{120N}$

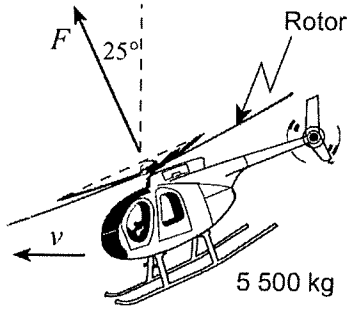
b) $F_{fric} = F_{appx}$ since the sled is moving at constant velocity

$F_{fric} = 47.63N = \mu F_N$

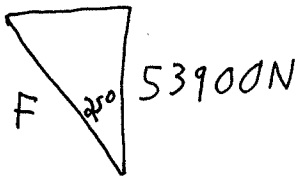
$\rightarrow \frac{47.63N}{119.5N} = \boxed{0.40}$

Forces in 2D Practice Name:_____

2. A 5 500 kg helicopter is travelling at constant speed in level flight.



What is the force F provided by the rotor?



Force up = Force down

Upwards component of force from rotor $= F_g$

$= mg = 5500 \times 9.8$

$= 53900\ N$

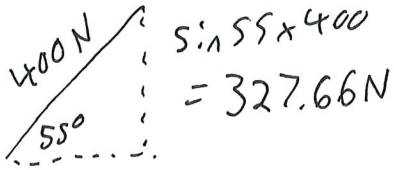
Solve for F, $\cos 25^\circ = \frac{53900N}{F}$

$F = \frac{53900N}{\cos 25^\circ} = 59472\ N$

$\approx 59000\ N$

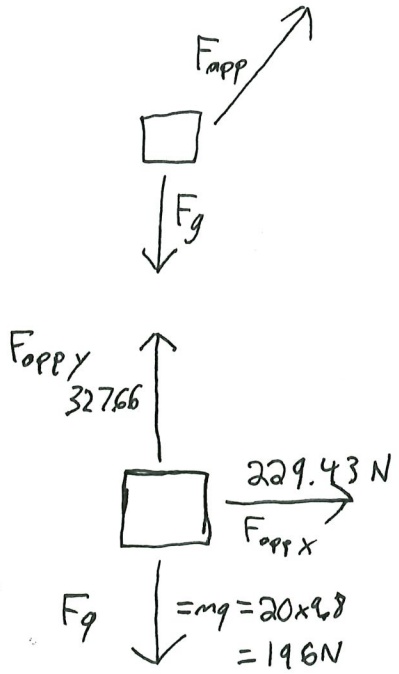
Forces in 2D Practice Name:_____

3. A 20.0 kg rocket is launched from Earth aimed 55° above the horizontal. The force output of the rocket engine is 400.0 N. What is the acceleration of the rocket (magnitude and direction)?



$\sin 55 \times 400 = 327.66\text{N}$

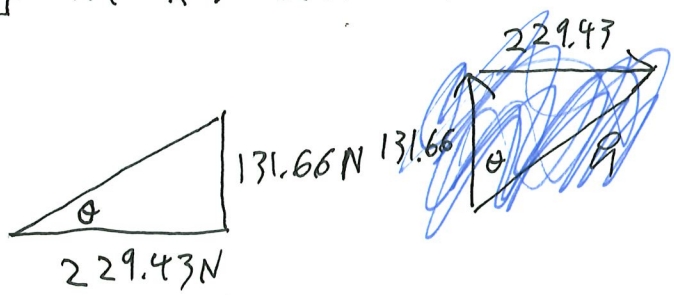
$\cos 55 \times 400 = 229.43\text{N}$



F_{net} in y: $327.66 - 196$

$= 131.66\text{N}$ upwards

F_{net} in x: 229.43



$\sqrt{131.66^2 + 229.43^2}$

$= 264.52\text{N}$

$\theta = \tan^{-1}\left(\frac{131.66}{229.43}\right)$

$= 30°$

$F_{net} = ma \rightarrow \frac{F_{net}}{m} = a$

$\frac{264.5\text{N}}{20.0\text{kg}} = 13.2\text{m/s}^2$

13m/s^2, 3.0×10^1° above the horizontal