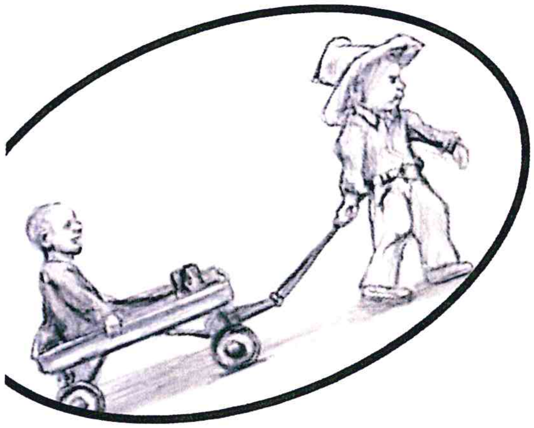
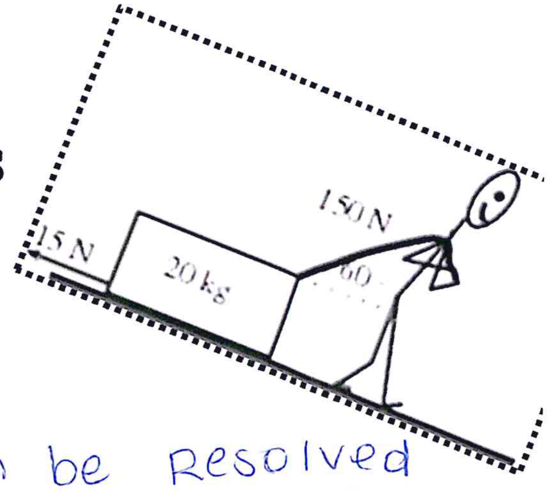
U2:L5

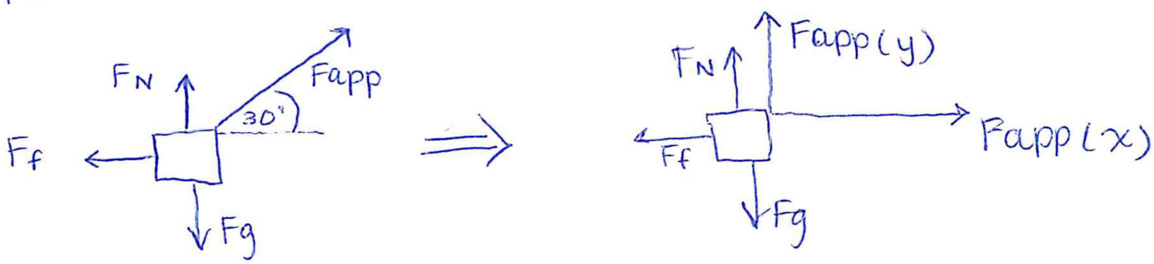


APPLIED FORCES AT ANGLES

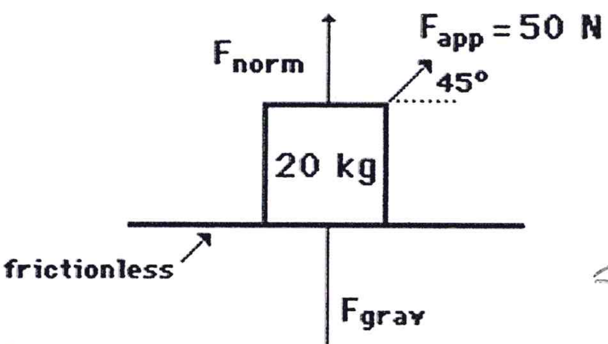


REMEMBER...

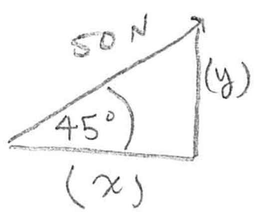
A force directed @ an angle can be resolved into TWO COMPONENTS. Together, these 2 components are a replacement for the single force



* Remember to calculate your HORIZONTAL (x) & VERTICAL (y) force components separately



In the situation of the FBD to the left, what is the acceleration and velocity after the box is pulled by the applied force for 2.0 seconds?



$\cos 45° = x / 50\ N$

$x = \cos 45° (50\ N)$

$x = 35.36\ N$

$\vec{a} = \frac{\Delta V}{\Delta t} = \frac{V_F - V_0}{\Delta t}$

$\vec{a}\Delta t = V_F - V_0$

$\vec{a}\Delta t + V_0 = V_f$ ⟶

$\Sigma F = F_{(x)} = 35.36N = (m)(a) = 20 Kg (a)$

$a = \frac{35.36N}{20\ Kg} = \boxed{1.768\ m/s^2\ [E]}$

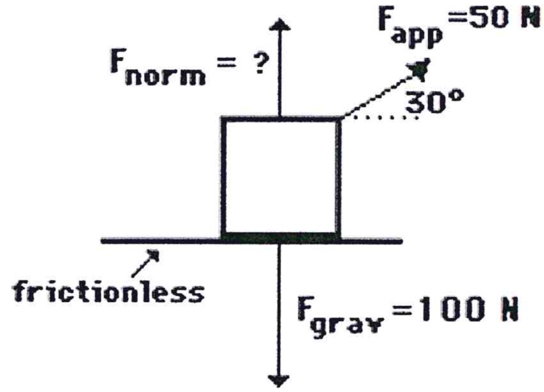
↳ s.f $2 m/s^2$

$V_2 = V_1 + a\Delta t$

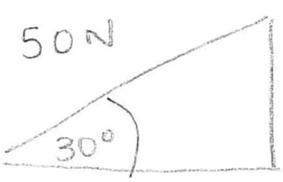
$V_2 = (1.768 m/s^2)(2 s)$ ⟶ s.f $4 m/s$.

$\boxed{V_2 = 3.536\ m/s}$

1. A 50-N applied force (30 degrees to the horizontal) accelerates a box across a horizontal sheet of ice (see diagram). Glen Brook, Olive N. Glenveau, and Warren Peace are discussing the problem. Glen suggests that the normal force is 50 N; Olive suggests that the normal force in the diagram is 75 N; and Warren suggests that the normal force is 100 N. While all three answers may seem reasonable, only one is correct. Indicate which two answers are wrong and explain why they are wrong.



NET force will be ONLY Fapp (x) due to no friction $ no motion in (y) direction.



cos 30° = x / 50N
x = cos 30° (50 N)
x = 43.30 N [E]

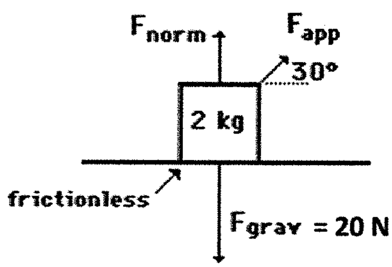
Due to NO motion in (y) direction
a = 0

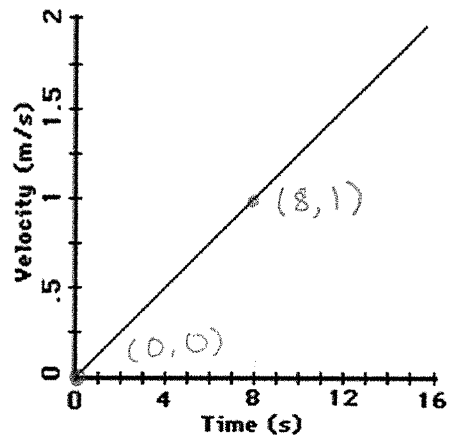
↑(+) NORMAL Force must be (w/ Fapp (y)) = Fgrav

ΣFy = Fapp (y) + FN + Fg
↳ ΣFy = 0
→ 0 = (+25 N) + (FN) + (−100 N)
0 = (FN) + (−75 N)
FN = 75 N

x = sin 30° (50 N)
x = 25 N [N]

A student pulls a 2-kg backpack across the ice (assume friction-free) by pulling at a 30-degree angle to the horizontal. The velocity-time graph for the motion is shown. Perform a careful analysis of the situation and determine the applied force.





$a = \frac{\Delta v}{\Delta t}$

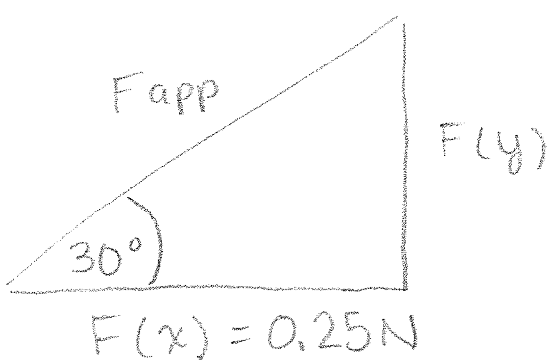
$a = \frac{1-0}{8-0}$

$a = 0.125\ m/s^2$

$\Sigma F = (m)(a)$

$\Sigma F = (2kg)(0.125\ m/s^2)$

$\Sigma F = 0.25\ N = F_{app}(x)$

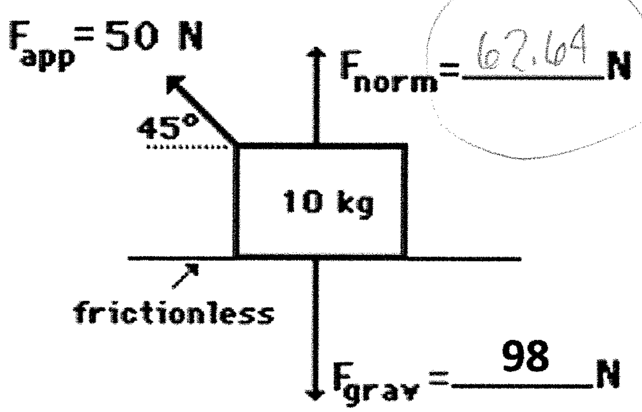


$\cos 30° = F(x) / F_{app}$

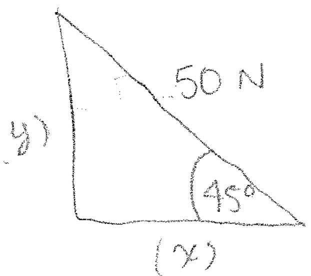
$F_{app} = 0.25N / \cos 30°$

$F_{app} = 0.289\ N$ [E 30° N]

Fill in the blanks for the following diagram. Determine the net force and acceleration of the object as well.



Time (s)	Vel (m/s)
0.0	21.0
1.0	24.5
2.0	28.0
3.0	31.6
4.0	35.1
5.0	38.7
6.0	42.2



$\Sigma F = F_{app}(x)$

$\cos 45° = F_{app}(x) / 50\,N$

$F_{app}(x) = 35.36\,N$

$F_{app}(y) = \sin 45° (50\,N)$

$= 35.36\,N$

$\Sigma F = (m)\ (a)$

$a = \Sigma F / m$

$a = \frac{35.36\,N}{10\,kg}$

$a = 3.536\,m/s^2$

FILL TABLE

$a = \frac{\Delta v}{\Delta t}$ (0-1)

$a = \frac{v_2 - 21\,m/s}{1s}$

$(1s)\,3.536\,m/s^2 = v_2 - 21\,m/s$

$v_2 = 24.536\,m/s$

Fnorm

$\Sigma F(y) = F_N + F_{app}(y) + F_g$

$\Sigma F(y) = 0$

$0 = F_N + (35.36\,N) + (-98\,N)$

$F_N = 62.64\,N$

Information adapted from: www.physicsclassroom.com