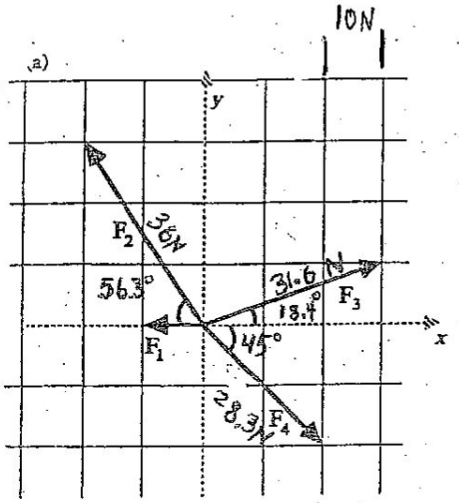
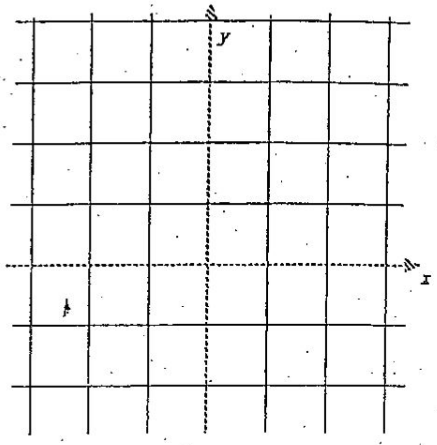
H

I

ALP II-16 (Revised): Find the x and y components of each vectors. Find the vector sum by a) mathematically finding the sums of the x and y components and b) graphically addi ng the vectors by connecting "head to tail". The answers from both methods should be the same.

a)

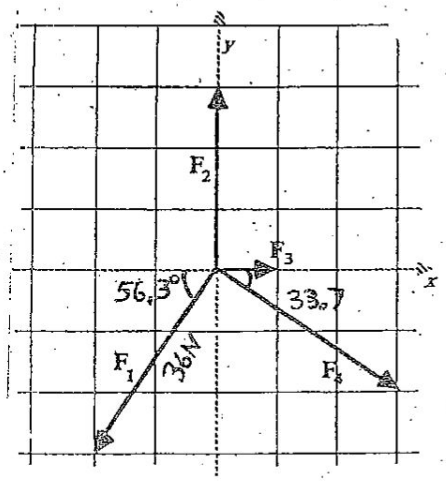


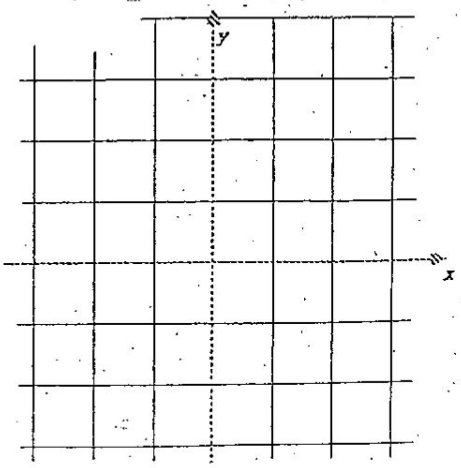


	x comp	y comp
F_1		
F_2		
F_3		
F_4		
Sum		

resultant: length: _____

direction: _____





	x comp	y comp
F_1		
F_2		
F_3		
F_4		
Sum		

resultant: length: _____

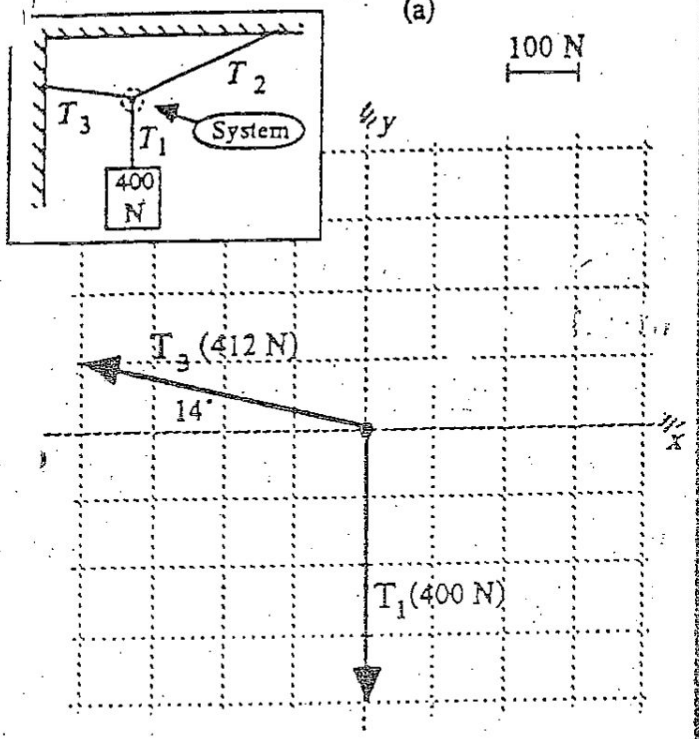
direction: _____

2

Vector Components

For each situation below, by inspecting of the force diagram, list the value of each component of each force vector. Then, calculate the components of the vectors using the standard rules.

(a)



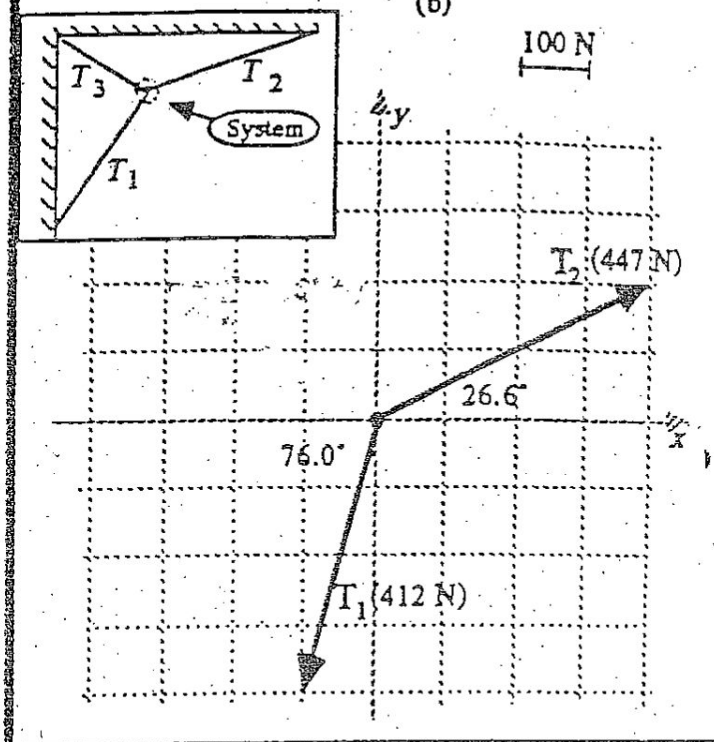
By inspection, the values of the components are:

Vector	x component	y component
T_1		
T_2	?	?
T_3		

Use the standard rules for determining the components of these vectors.

Solve for the x and y components of T_2. Find the magnitude and direction of T_2.

(b)



By inspection, the values of the components are:

Vector	x component	y component
T_1		
T_2		
T_3	?	?

Use the standard rules for determining the components of these vectors.

Solve for the x and y components of T_3. Find the magnitude and direction of T_3.

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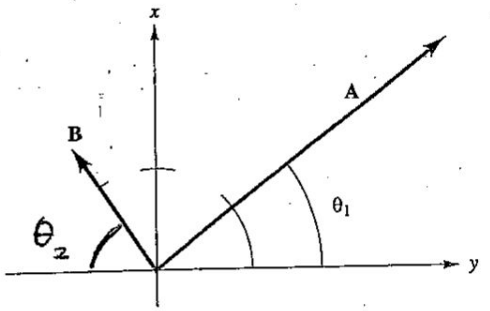
A FIPSE Project

1.



A is 100 N. $\theta_1 = 40°$

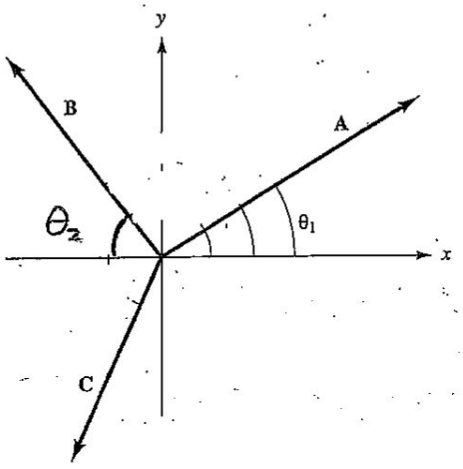
B = 50N $\theta_2 = 50°$.

a) Find A_x, A_y, B_x, B_y

b) Find the sum $\vec{A} + \vec{B} = \vec{R}$

(Find the magnitude and direction ↓angle of R.)

2.



A = 100 N. $\theta_1 = 30°$

B = 80N $\theta_2 = 50°$.

What is the magnitude and direction (angle) of C such that $\vec{A} + \vec{B} + \vec{C} = 0$.

4

PHY 111 Forces in 2 dimensions

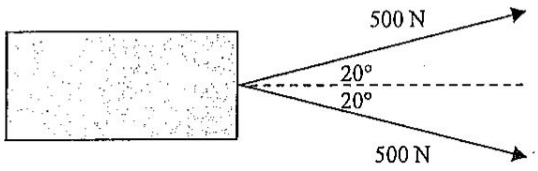
1. Two men pull on a 1200-kg vehicle with a force of 500 N each at an angle as shown. Ignore any friction on the car.

a) Break each force into x and y components.

b) Find the net force on the vehicle.

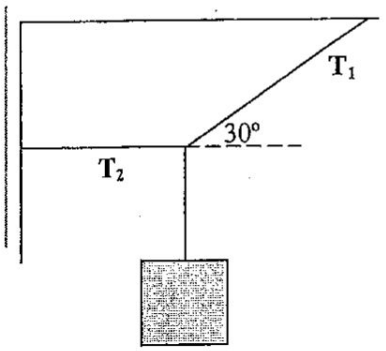
c) Find the acceleration of the vehicle.

view from above

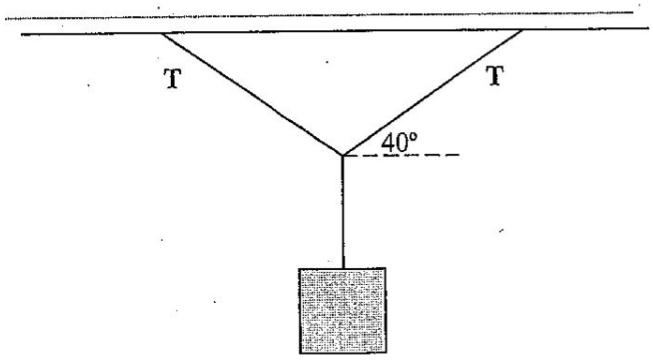


d) Now include a 400-N friction force acting on the car. The men still pull with the same force and same angle. What is the acceleration of the vehicle?

2. A 50-kg mass is supported by two cables as shown. What is the tension in each cable?



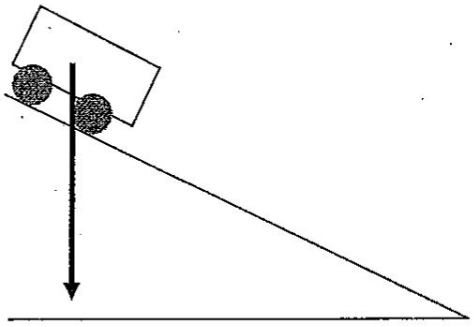
3. A 30 kg mass is supported by two wires as shown. Each wire has the same angle. What is the tension in each wire?



6

4. A cart is on an incline. The force of gravity will accelerate the cart down the incline, but with an acceleration that is less than 10 m/sec^2.
The mass of the cart is 100 kg. (Therefore its weight is 1000 N.) The angle of the incline is 30°.
a) The force of gravity (always toward the center of the earth) is shown.

Break this force vector into two components. Draw the components.
The two components must be perpendicular to each other. One vector is parallel to the surface of the incline. The other is perpendicular to the surface of the incline. (The original weight vector is the hypotenuse of the two components.)

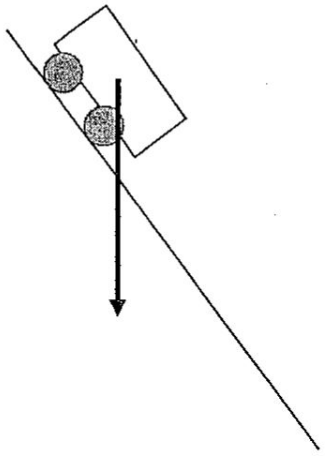


b) What is the acceleration of the cart down the incline?

c) The incline is 10 m long. If the cart starts at rest, what is the speed of the cart at the bottom? (Use the "2ad" formula.)

d) Use energy concepts the find the speed of the cart at the bottom.

5. a) The same cart is now on a 53° incline. Break the gravity force vector into components. Draw the components.



b) What is the acceleration of the cart down the incline?

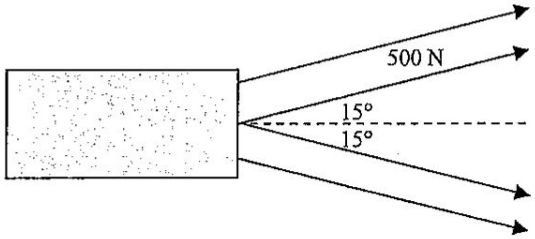
8

PHY 111 Forces in 2 dimensions: Homework

1. Four horses are pulling a large float in a parade. Each horse is pulling with a force of 500 N. What is the net pulling of the four horses.

a) Break each force into x and y components.

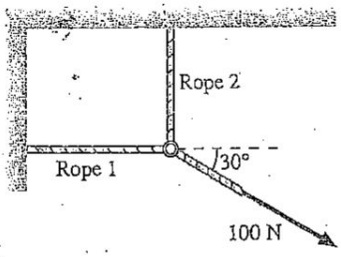
view from above



b) Find the net pulling force of the horses on the float.

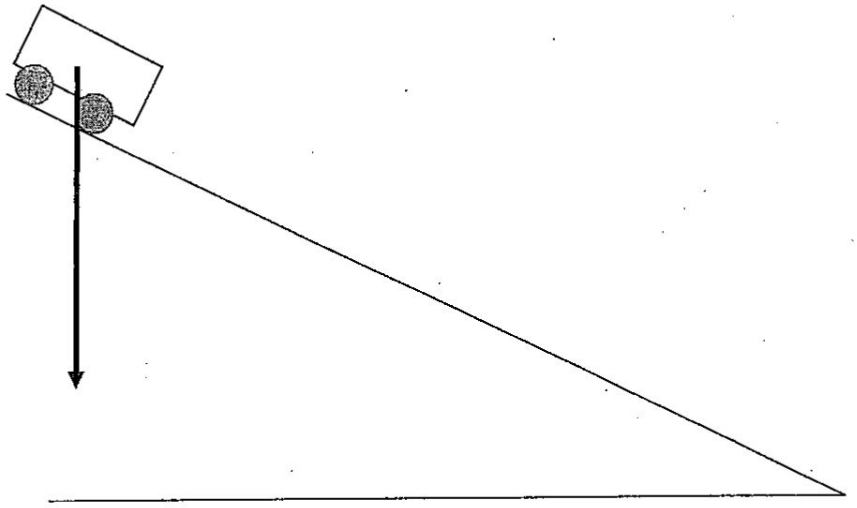
c) The mass of the float is 3000 kg. There is a friction force of 1500 N against the float. What is the acceleration of the float?

2. The three ropes in **FIGURE EX6.1** are tied to a small, very light ring. Two of the ropes are anchored to walls at right angles, and the third rope pulls as shown. What are T_1 and T_2, the magnitudes of the tension forces in the first two ropes?



3. A cart is on an incline. The force of gravity will accelerate the cart down the incline.

The mass of the cart is 500 kg. The angle of the incline is 37°.
a) Break the gravity force vector into components. Draw the components.



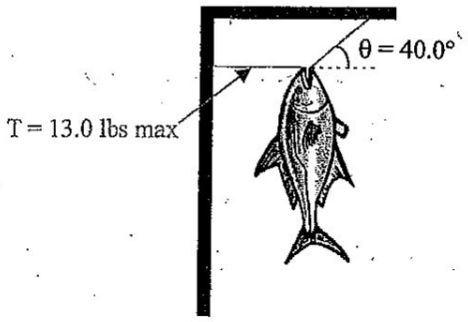
b) What is the acceleration of the cart down the incline?

c) The incline is 20 m long. If the cart starts at rest, what is the speed of the cart at the bottom? (Use the "2ad" formula.)

d) Use energy concepts the find the speed of the cart at the bottom.

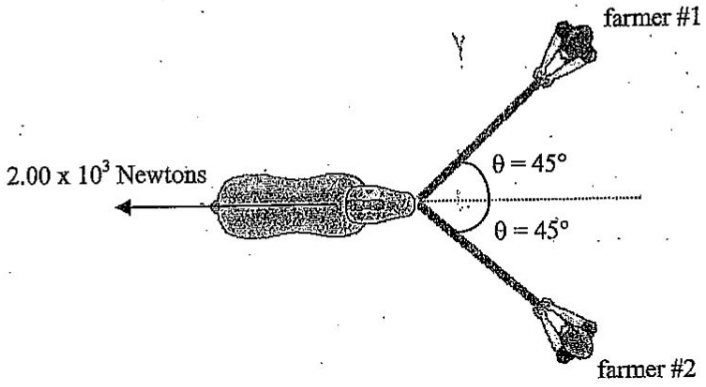
10

4. A fisherman is displaying his catch by hanging it as illustrated below. The horizontal string can only hold a maximum tension of 13 lbs. What is the maximum weight of the fish? (Keep all the forces in pounds. No need to multiple by 9.8.)



11

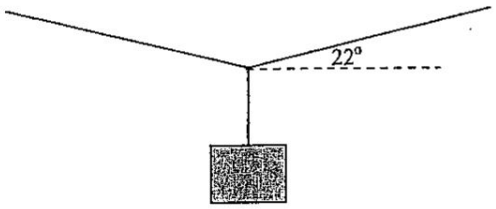
6.1 Two farmers are trying to pull a mule into a barn. The mule does not want to go, so she is pulling back against the farmers with a force of 2.00×10^3 Newtons, including the effects of friction. If the farmers are pulling as illustrated below and the mule does not move, what is the tension in their rope?



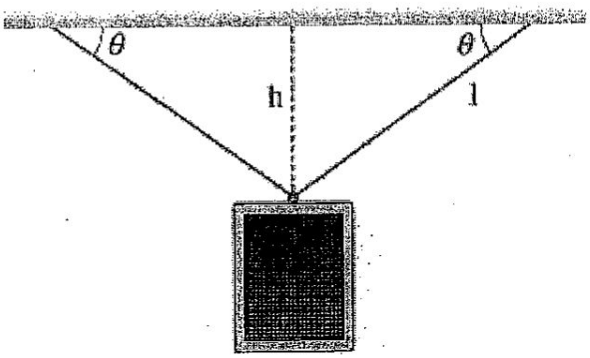
12

PHY 111 **Tension in a cable at an angle**

1. A 15-kg object hangs from a clothesline. The clothesline makes an angle of 22° with the horizontal on both the right and left sides. Calculate the tension in the clothesline.



2. The object in the figure has a mass of 20 kg. h is 50 cm. l is 90 cm?



a) What is θ? (Use the distances h and l to find θ.)
b) What is the tension in each cable?

5–11 Figure 5–17 illustrates a mountaineering technique called a Tyrolean traverse. A rope is stretched tightly

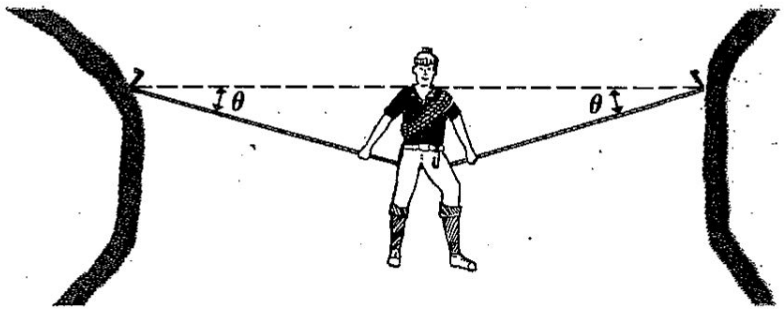


FIGURE 5–17

between two points, and the climber slides across the rope. The climber's weight is 800 N, and the breaking strength of the rope is 20,000 N.

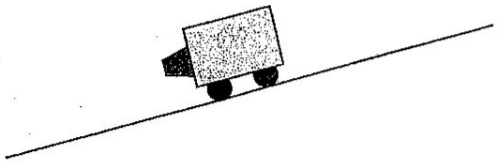
a) If the angle θ is 15°, find the tension in the rope.

b) What is the smallest value the angle θ can have if the rope is not to break?

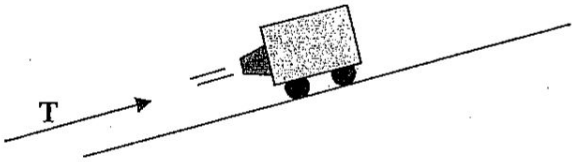
14

PHY 111 Forces in 2D: A rocket powered car on a hill

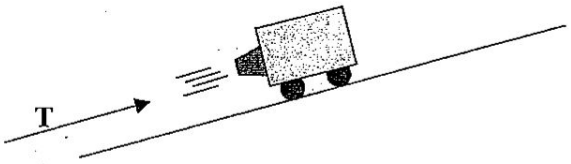
1. A 1000-kg is initially at rest on a hill inclined at 20°. If the car is allowed to roll down the hill, what would be the car's acceleration?
(Draw the weight vector of the car and break the weight vector into components.)



2. A rocket engine is attached to the car which can exert an uphill force on the car. What thrust force **T** would be needed to maintain the car at rest (that is to counteract the downhill force on the car)?



3. What thrust force would be needed to accelerate the car uphill at 2 m/sec^2?



1. A 1000 kg steel beam is supported by the two ropes shown in Figure P5.4.

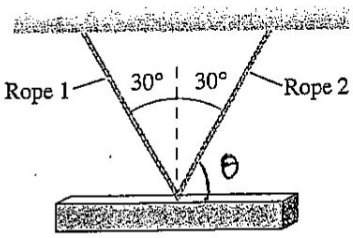


FIGURE P5.4

Find the tension in each rope.

Note: We usually measure our angle θ with respect to the horizontal.

2. A football coach sits on a sled while two of his players build their strength by dragging the sled across the field with ropes. The friction force on the sled is 1.0 kN and the angle between the two horizontal ropes is 20°. How hard must each player pull to drag the coach at a steady 2.0 m/s?