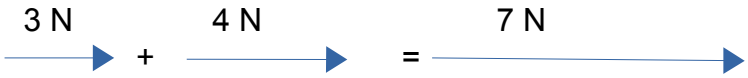
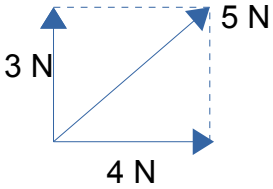
ANSWERS TO ACTIVITIES 1 TO 5 UNIT 6

1. *Billie Budten and Mia Neezhirt are having an intense argument at the lunch table. They are adding two force vectors together to determine the resultant force. The magnitude of the two forces are 3 N and 4 N. Billie is arguing that the sum of the two forces is 7 N. Mia argues that the two forces add together to equal 5 N. Who is right? Explain. Use the verbs can or must to write your answer.*

Both are right. 3 N and 4 N can give a resultant of 7 N in the following situation:



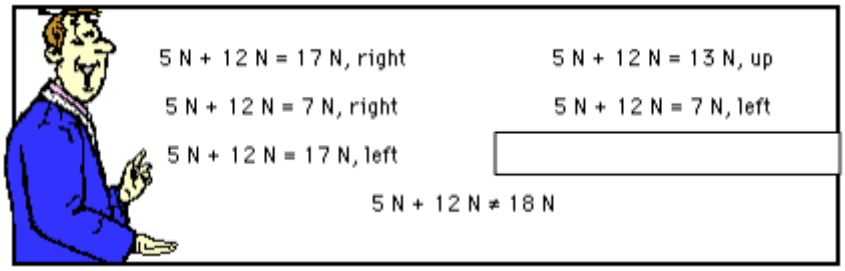
But they can also add to a net force of 5 N, as in this diagram:



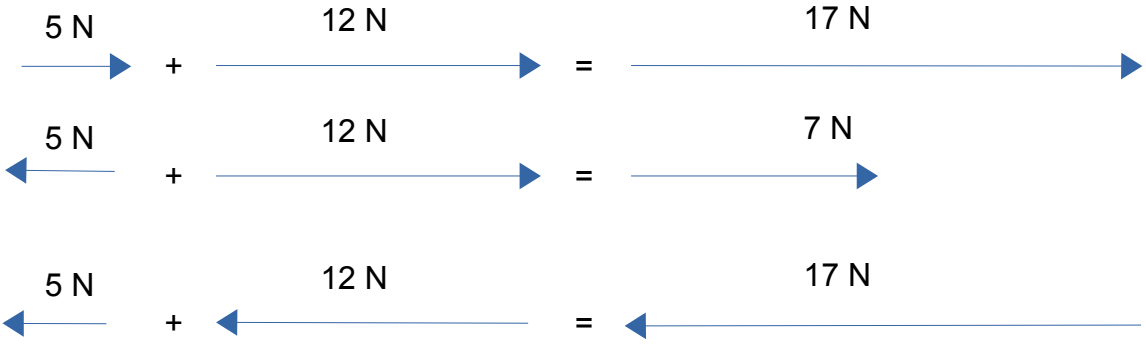
In this case, net force must be calculated using Pythagoras´ Theorem:

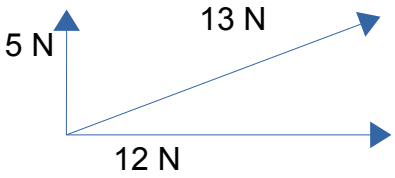
$$F_{net} = \sqrt{3^2 + 5^2} = \sqrt{25} = 5N$$

2. *Matt Erznott entered the classroom for his physics class. He quickly became amazed by the remains of some of teacher's whiteboard scribbling:*



Draw free-body diagrams for all the above equalities and explain the inequality, with a sentence using the verb can

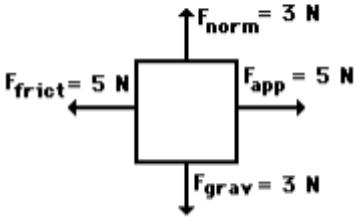




The sum of 5 N and 12 N cannot be 18 N, because it is greater that the sum of the two magnitudes of the forces. The maximum value for this two forces is 17 N, when both forces have the same direction.

3. *Free-body diagrams for four situations are shown below. For each situation, determine the net force acting upon the object.*

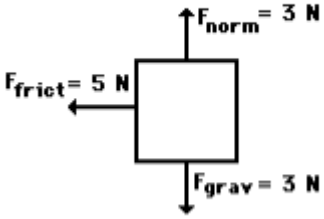
Situation A



Horizontal : $F_{net} = F_{app} - F_{frict} = 5 - 5 = 0$ N
Vertical : $F_{net} = F_{norm} - F_{grav} = 3 - 3 = 0$ N

F_{net} (total) = 0 N

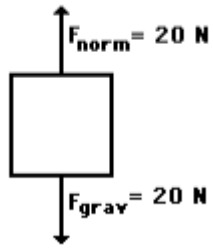
Situation B



Horizontal : $F_{net} = F_{frict} = -5$ N
Vertical : $F_{net} = F_{norm} - F_{grav} = 3 - 3 = 0$ N

F_{net} (total) = 5 N, left

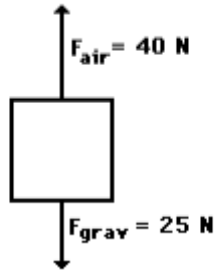
Situation C



Vertical : $F_{net} = F_{norm} - F_{grav} = 20 - 20 = 0$ N

F_{net} (total) = 0 N

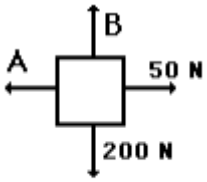
Situation D



Vertical : $F_{net} = F_{air} - F_{grav} = 40 - 25 = 15$ N

F_{net} (total) = 15 N (upwards)

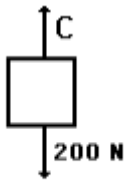
4. *Free-body diagrams for four situations are shown below. The net force is known for each situation. However, the magnitudes of a few of the individual forces are not known. Analyze each situation individually and determine the magnitude of the unknown forces.*



F_{net} = 0 N

As F_{net} = 0 N

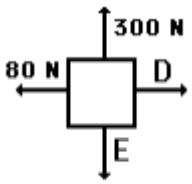
A = 50 N
B = 200 N



F_{net} = 900 N, up

F_{net} = 900 N up → 900 = C -200

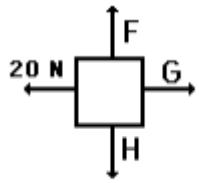
C = 900 + 200 = 1100 N



F_{net} = 60 N, left

Horizontal : F_{net} = 60 N, left 60 = 80 – D → D = 20 N

Vertical : F_{net} = 0 → 300 – E = 0 N → E = 300 N

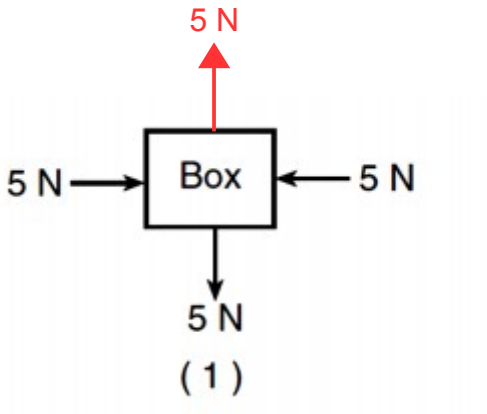


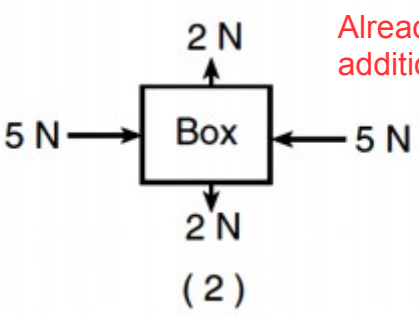
F_{net} = 30 N, right

Vertical: F = G (but numerical values cannot be determined)

Horizontal : F_{net} = 30 N, right 30 = G – 20 → G = 50 N

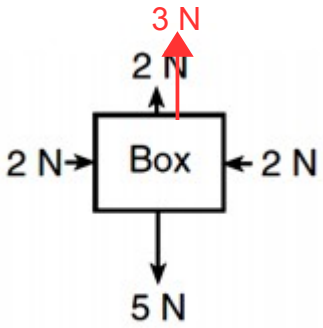
5. *Draw an additional force to each one of the diagrams below so that the objects are in equilibrium:*



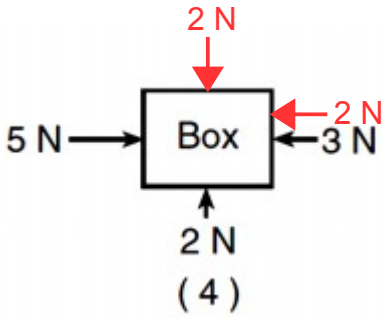


(2)

Already at equilibrium.No additional force needed



(3)



(4)