Pre-test 1 - Solutions

18. No. Remember a normal force is the force exerted by a plane or surface (example: table, desk, ramp, etc). So if the mass is hanging, it is not on a surface, so there is no normal force.

19. When you applied a force on an object, two things can happen to the object: 1) It won't move **OR** 2) it will move in the direct you apply the force. If friction is greater than the applied force, then the object will move in the opposite direction of the applied force, which cannot happen in real life. (There's no ghost moving the object!)

Example: You apply a force to the 10N to the right. Friction will act towards the left. Now the object will 1) stay where it is (F_R = 0) **OR** 2) it will move to the right. If friction is greater than the applied force, say friction = 20 N left, then F_R = 10 N right + 20 N left = 10 N left. This means the object will magically move to the left, which cannot happen.

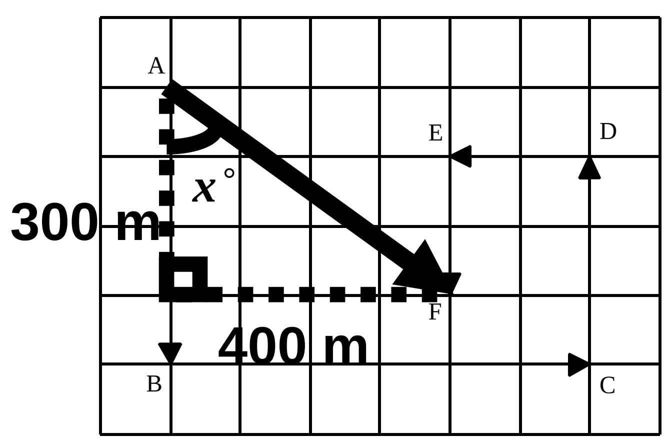
20. D) His weight is less on the Moon than on the Earth but his mass will be the same.

> ***Remember mass never changes no matter where you are, but weight depends on the gravitational pull of the place.*

21. D) The resultant of the two forces acting on the parachutist is zero.

> ** *Remember constant velocity = at rest = resultant force (*F_R*) of zero.*

22. Displacement is a vector!! So it has magnitude and direction.



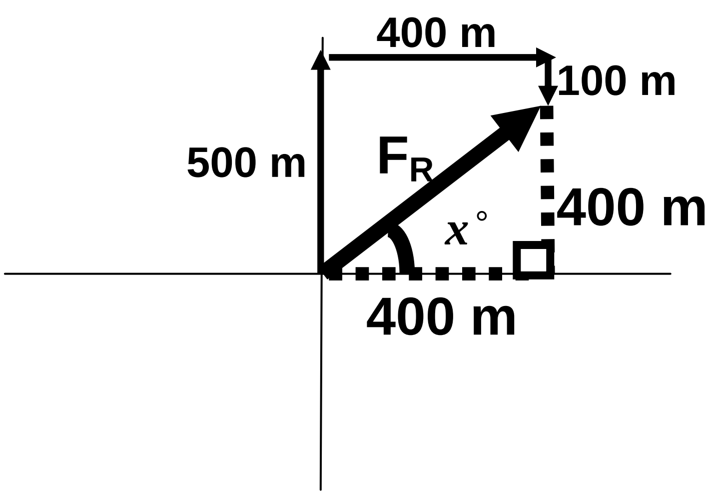
$\mathrm{F_R} = \sqrt{300^2 + 400^2} = 500\ N$

$\tan(x) = \frac{400}{300}$

$x = \tan^{-1}\left(\frac{400}{300}\right) = 53°$

Answer: $\mathbf{F_R = 500\ N \quad S\ 53°\ E}$

23.



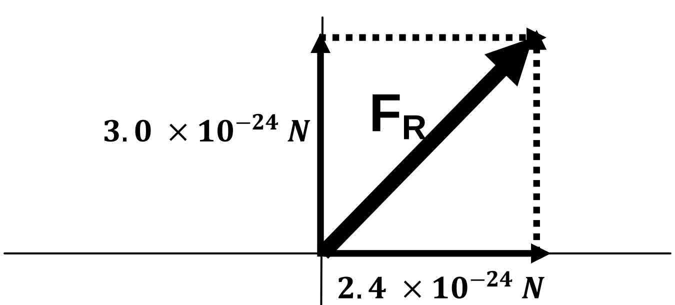
$\mathrm{F_R} = \sqrt{400^2 + 400^2} = 565.7N$

$\tan(x) = \frac{400}{400}$

$x = \tan^{-1}\left(\frac{400}{400}\right) = 45°$

Answer: $\mathbf{F_R = 565.7\ N \quad E\ 45°\ N}$

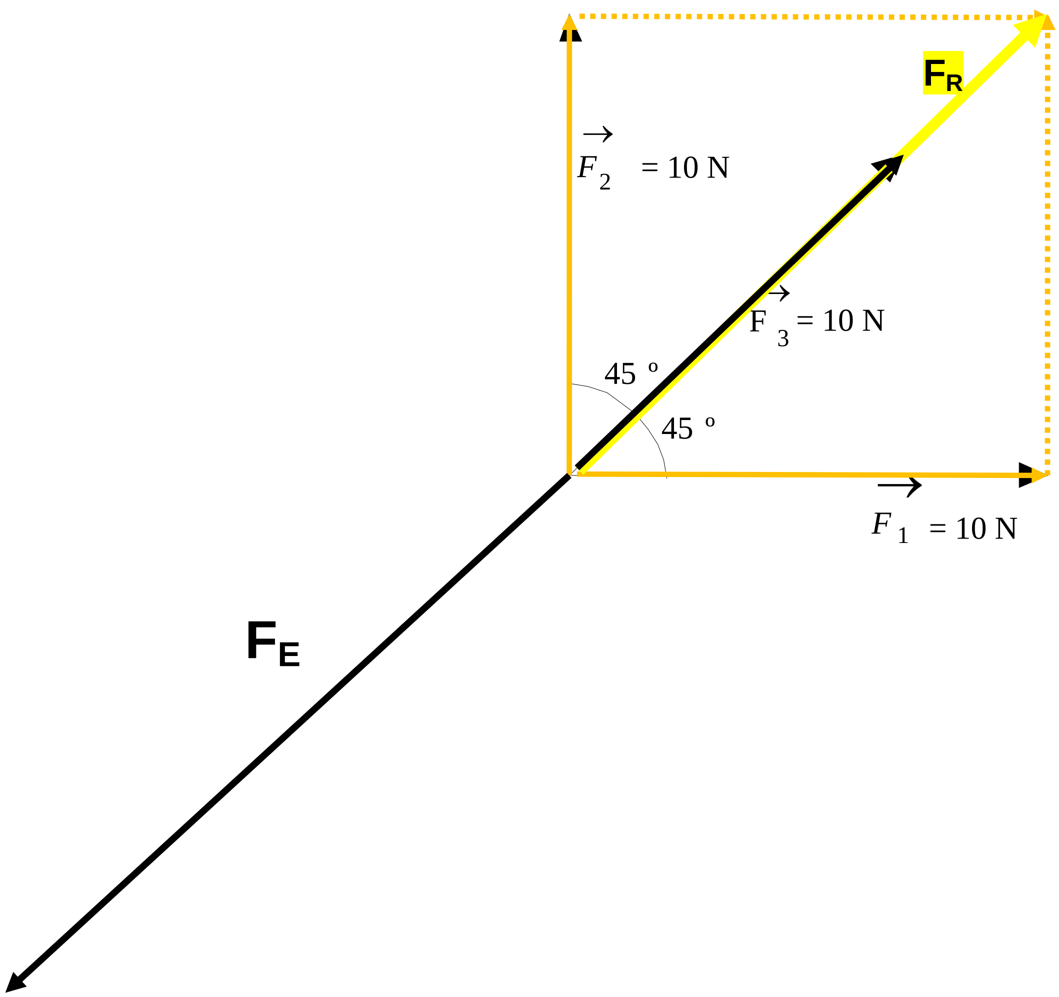
24. The problem on asks for the magnitude, so we don't need to care for the direction.



$$F_R = \sqrt{(\mathbf{3.0} \times \mathbf{10^{-24}})^2 + (\mathbf{2.4} \times \mathbf{10^{-24}})^2} = \mathbf{3.84} \times \mathbf{10^{-24}} \boldsymbol{N}$$

Answer: $F_R = \mathbf{3.84} \times \mathbf{10^{-24}} \boldsymbol{N}$

25.



Step 1: Choose 2 forces and find the resultant force (F_R) of these 2 forces.

$$F_1 + F_2 = F_R = \sqrt{10^2 + 10^2} = 14.1N$$

$\tan(x) = \frac{10}{10}$

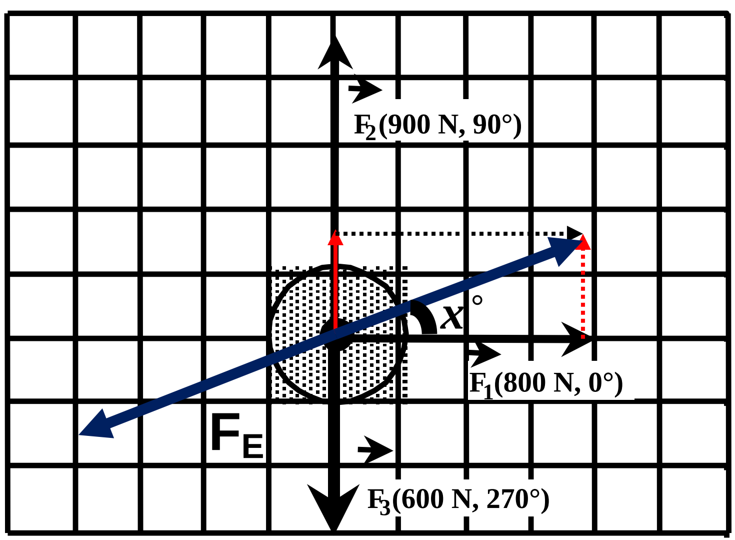
$x = \tan^{-1}\left(\frac{10}{10}\right) = 45°$ *this means that* F_R *falls directly on* F_3

Step 2: Find the resultant force using the force you found in step 1 and the 3rd forced that you did not used yet.

$F_R + F_3 = \mathbf{F_R} = \mathbf{14.1}\boldsymbol{N} + \mathbf{10}\ \boldsymbol{N} = \mathbf{24.1}\ \boldsymbol{N}$ **E 45˚ N**

Answer: $\mathbf{F_E = 24.1\ N \quad W\ 45°\ S}$

26.



Step 1: Choose 2 forces and find the resultant for (F_R) of these 2 forces.

$F_2 + F_3 = \mathbf{F_R} = 900\ \text{N up} + 600\ \text{N down} = 300\ N$ up (red vector)

Step 2: Find the resultant force using the force you found in step 1 and the 3rd forced that you did not used yet.

$\mathbf{F_R} + F_1 = \mathbf{F_R} = \sqrt{300^2 + 800^2} = 854.4\ \text{N}$

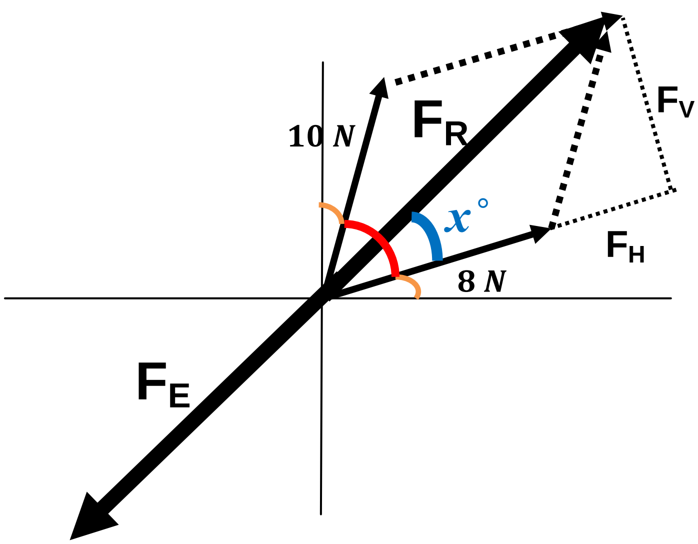
$\tan(x) = \frac{300}{800}$

$x = \tan^{-1}\left(\frac{300}{800}\right) = 20.6°$

F_R = 854.4 N E 20.6˚ N

Answer: $\mathbf{F_E = 854.4\ N \quad W\ 20.6°\ S}$

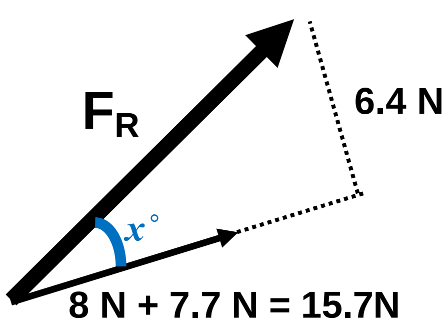
27.



$90° - 25° - 25° = 40°$

$\mathbf{F_V = 10\ \sin 40 = 6.4\ N}$

$\mathbf{F_H = 10\ \cos 40 = 7.7\ N}$



$\mathbf{F_R} = \sqrt{15.7^2 + 6.4^2} = 16.96\ \mathrm{N}$

$\tan(x) = \frac{6.4}{15.7}$

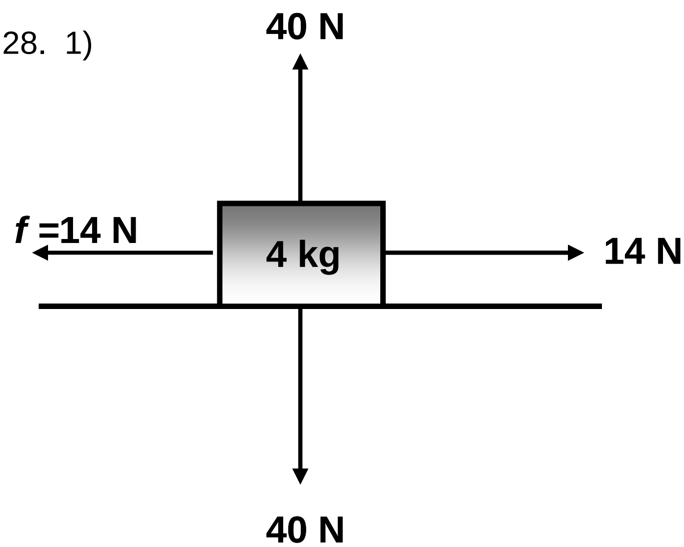
$x = \tan^{-1}\left(\frac{6.4}{15.7}\right) = \mathbf{22°}$

$\mathbf{22°} + \mathbf{25°} = 47°$

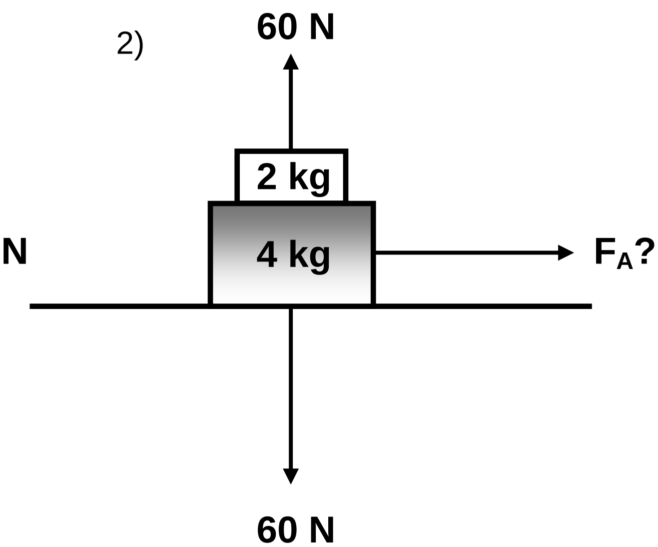
F_R = 16.96 N E 47˚ N

Answer: $\mathbf{F_E = 16.96N \quad W\,47°\,S}$

28. 1)



2)



The objects are moving at constant velocity = the system is at rest = $F_R = 0$

From diagram 1 you can find k (coefficient of friction)

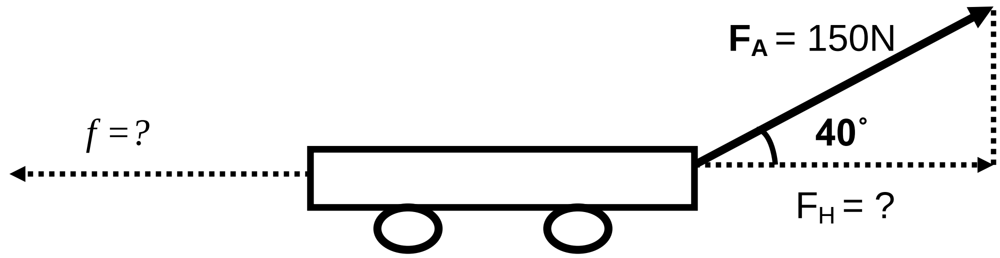
$$f = k\,F_N \rightarrow k = \frac{f}{F_N} = \frac{40}{14} = 0.35$$

From diagram 2 you can find the applied force (F_A) to move the object at constant velocity.

$$f = k\,F_N = 0.35\,(60) = 21\,N$$

Answer: 21 N

29. The wagon is moving at constant velocity = the system is at rest = F_R = 0, so that means F_H = f (look at diagram below)



$$\mathbf{F_H = 150\cos 40 = 114.9\ N = \mathit{f}}$$

Answer: 114.9 N

30.

$$f = w\sin A \rightarrow w = \frac{f}{\sin A} = \frac{120}{sin\ 20} = 350.9N$$

$$w = mg \rightarrow m = \frac{w}{g} = \frac{350.9}{10} = 35.9\ kg$$

Answer: 35.6 kg

31.

$$w = mg = 10(10) = 100$$

$$f = w\sin A \rightarrow A = \sin^{-1}(\frac{f}{w}) = \sin^{-1}(\frac{34}{100}) = 19.9°$$

Answer: $\mathbf{19.9°}$

32.

$$f = w\sin A = 6\ (10)(\sin 25) = 25.4\ N$$

Answer: $\mathbf{25.4\ \mathit{N}}$