Net Force and Free-Body Diagrams

1. In each of the free-body diagrams below, calculate the **magnitude** and **direction** of the net force and draw it.
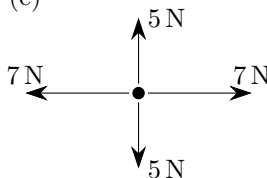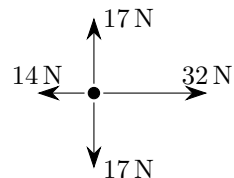
(a) 18 N ↑ · ↓ 18 N

(b) 40 N ↑ · ↓ 24 N

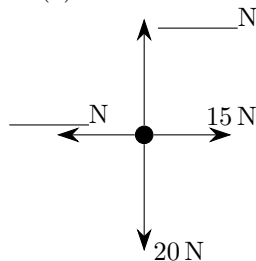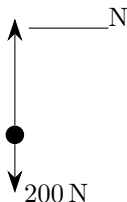(c) 5 N ↑ ; 7 N ← · → 7 N ; ↓ 5 N

(d) 17 N ↑ ; 14 N ← · → 32 N ; ↓ 17 N

2. In each of the free-body diagrams below, the net force is given, but one or more of the applied forces is missing. Find the missing forces.
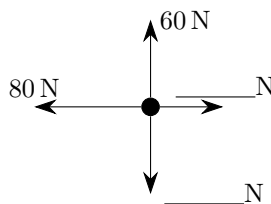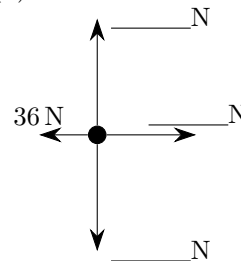
(a) _____ N ↑ ; _____ N ← · → 15 N ; ↓ 20 N

$\Sigma \vec{F} = 0$ N

(b) _____ N ↑ ; · ; ↓ 200 N

$\Sigma \vec{F} = 150$ N, up

(c) 60 N ↑ ; 80 N ← · → _____ N ; ↓ _____ N

$\Sigma \vec{F} = 45$ N, left

(d) _____ N ↑ ; 36 N ← · → _____ N ; ↓ _____ N
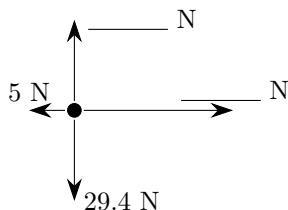
$\Sigma \vec{F} = 23$ N, right

3. Fill in the blanks in each of the situations depicted below. Draw the net force.

(a) _____ N ↑ ; 5 N ← · → _____ N ; ↓ 29.4 N
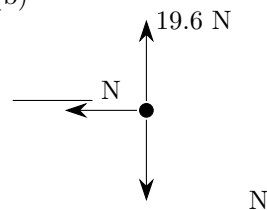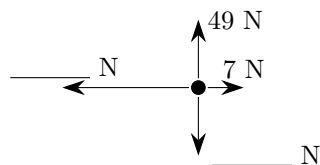
$m = $ 3 kg
$a = $ _____ m/s^2, _____
$\Sigma \vec{F} = $ 23 N, right

(b) 19.6 N ↑ ; _____ N ← · ; ↓ _____ N

$m = $ 2 kg
$a = $ 8 m/s^2, left
$\Sigma \vec{F} = $ _____ N, _____

(c) 49 N ↑ ; _____ N ← · → 7 N ; ↓ _____ N

$m = $ 5 kg
$a = $ 12 m/s^2, left
$\Sigma \vec{F} = $ _____ N, _____

(d) _____ N ↑ ; 17 N ← · → _____ N ; ↓ _____ N
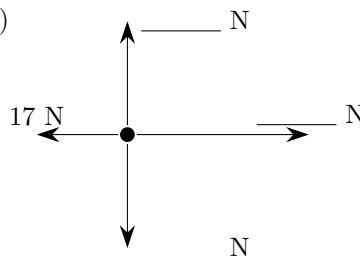
$m = $ 3 kg
$a = $ 18 m/s^2, right
$\Sigma \vec{F} = $ _____ N, _____

4. For each of the sketches below, identify all the forces applied on all objects and draw a free body diagram. Then come up with an expression for the net force.

(a) Lamp hanging from a chain

(d) A box being pushed forward on the ground (constant speed)

(b) A car moving at a constant speed.

(e) A skydiver before opening her parachute

(c) A car accelerating

(f) Object sliding down an inclined plane.