Worksheet 3.1

1. Which of the following vehicles has the greatest net force acting on it?

   a. a 500 kg car traveling at a constant velocity of 25 m/s *No Netforce*
   b. a 1500 kg truck traveling at a constant velocity of 20 m/s *No net force*
   c. a 750 kg truck traveling at a constant velocity of 30 m/s *No net Force*
   d. a 100 kg human traveling at a constant velocity of 250 m/s *No net force*
   e. none of the above: all have zero net force acting on them

2. You have three cars, each with different mass. You want to accelerate each of them to a speed of 25 m/s in 5 seconds. Which would require the greatest *net force* to accomplish this? *highest mass, F=ma*

   a. Car A, with a mass of 500 kg
   b. Car B, with a mass of 750 kg
   c. Car C, with a mass of 1000 kg
   d. all of the above would require the same net force
   e. impossible to determine from information provided
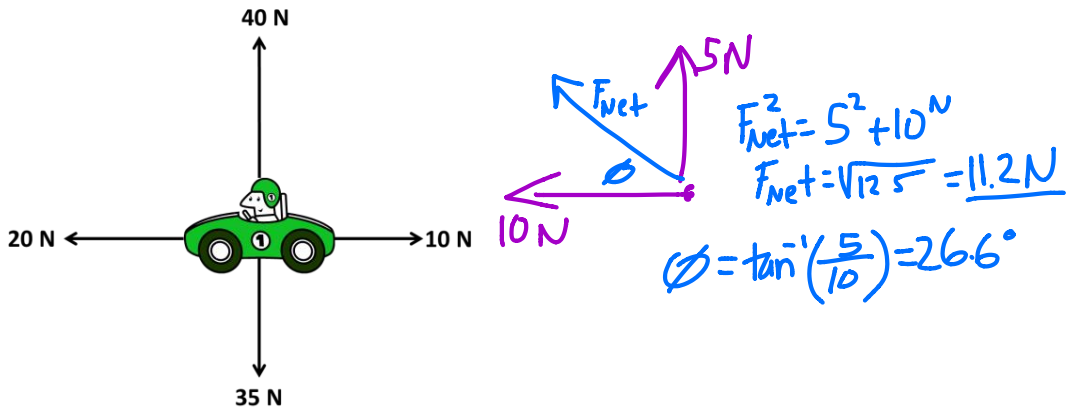
3. Consider the following free body diagram. None of the force *types* are specified, just their values and directions.
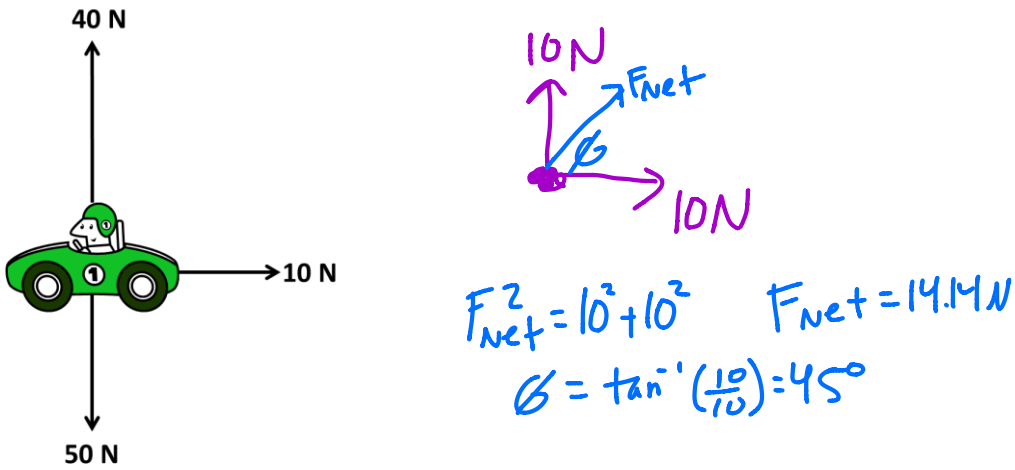
   100 N
   120 N
   100 N
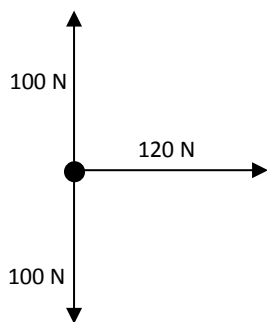
For which of the following situations would this free body diagram apply? Select all that apply.

   a. a 10 kg object moving rightward at constant speed 12 m/s *No Fnet*
   b. a 10 kg object moving leftward but slowing down by 12 m/s each second ✔
   c. a 10 kg object moving rightward and speeding up by 12 m/s each second ✔
   d. a 10 kg object moving leftward and speeding up by 12 m/s each second ✗
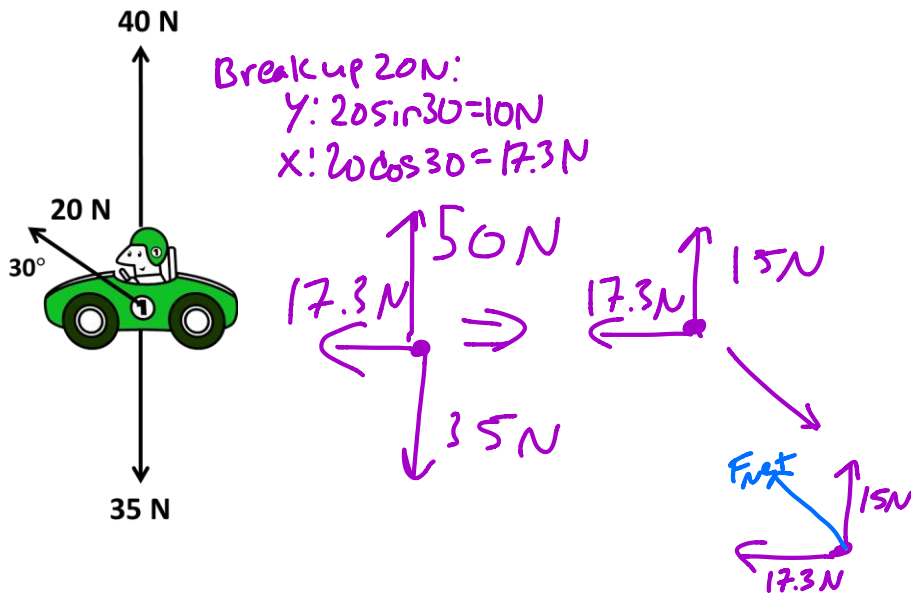   e. none of the above applies

4. For each picture below, determine the direction and magnitude of the overall force vector for objects below and answer any additional questions using Newton's Second Law.
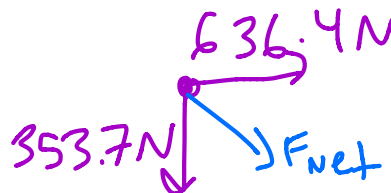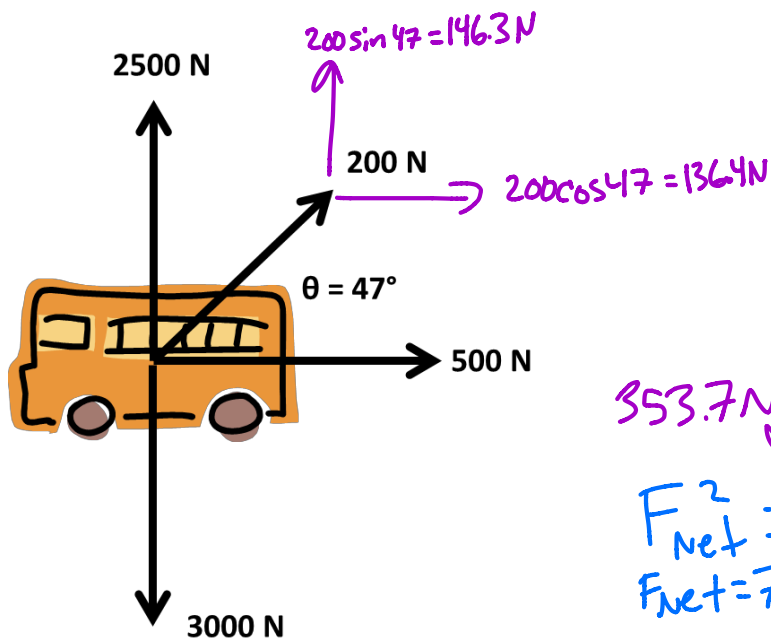
a.

40 N (up)
20 N ← (car) → 10 N
35 N (down)

$$F_{net}^2 = 5^2 + 10^N$$
$$F_{net} = \sqrt{125} = 11.2N$$
$$\emptyset = \tan^{-1}\left(\frac{5}{10}\right) = 26.6°$$

5N, F_{net}, 10N

b.

40 N (up)
(car) → 10 N
50 N (down)

$$F_{net}^2 = 10^2 + 10^2 \qquad F_{net} = 14.14N$$
$$\emptyset = \tan^{-1}\left(\frac{10}{10}\right) = 45°$$

10N, F_{net}, 10N

c.

40 N (up)
20 N, 30°
(car)
35 N (down)

Break up 20N:
Y: 20sin30 = 10N
X: 20cos30 = 17.3N

50N, 17.3M, 35N

17.3N, 15N, F_{net}, 15N, 17.3N

$$F_{net}^2 = 15^2 + 17.3^2$$
$$F_{net} = 22.9N$$
$$\emptyset = \tan^{-1}\left(\frac{15N}{17.3N}\right) = 40.9°$$

2500 N

$200\sin 47 = 146.3N$

200 N

$200\cos 47 = 136.4N$

$\theta = 47°$

500 N

3000 N

$636.4N$

$353.7N$ F_{net}

$F_{net}^2 = 636.4^2 + 353.7^2$
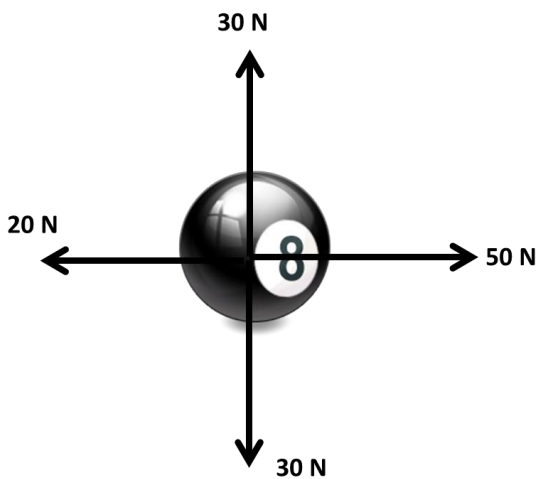
$F_{net} = 728.1N$ $\theta = \tan^{-1}\left(\frac{353.7}{636.4}\right) = 29.1°$

d.

If the bus has a mass of 300 kg (it's a small bus), what will the acceleration on the bus be? $F = ma$

$728.1N = (300kg)a$ $a = 2.43 m/s^2 @ 29.1°$

30 N

20 N

50 N

30 N

e.
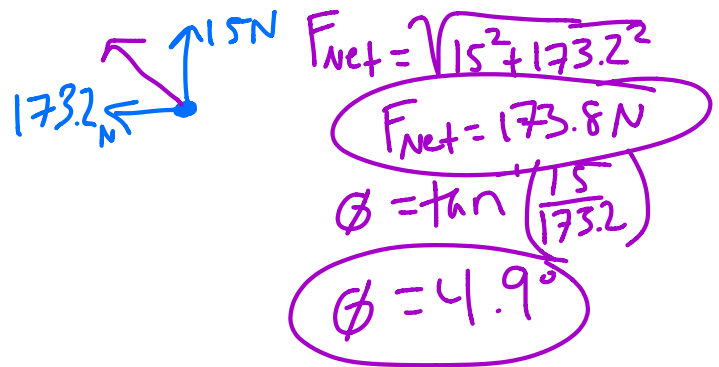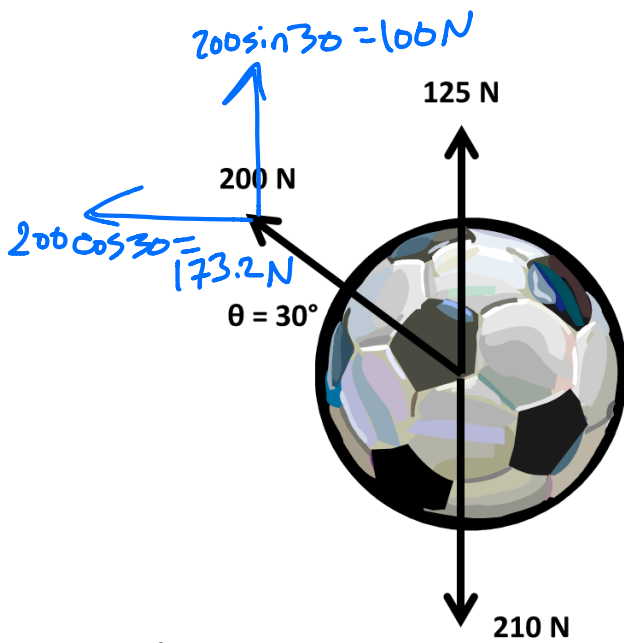
If the 8-ball accelerates at a rate of 28 m/s^2, what is the mass of the ball?

$F_{net} = 30N$ Rightward

$F_{net} = ma$

$30N = m(28m/s^2)$

$m = 1.1 kg$

$200 \sin 30 = 100N$

125 N

200 N

$200 \cos 30 = 173.2N$

$\theta = 30°$

15N $\quad F_{Net} = \sqrt{15^2 + 173.2^2}$

173.2_N $\quad \boxed{F_{Net} = 173.8N}$

$\emptyset = \tan\left(\dfrac{15}{173.2}\right)$

$\boxed{\emptyset = 4.9°}$

210 N

f.
   If the ball has a mass of 1.4 kg, what is the acceleration of the ball?

$173.8N = 1.4(a)$

$124 m/s^2$