1. A student pulls a 60.-newton sled with a force having a magnitude of 20. newtons. What is the magnitude of the force that the sled exerts on the student?

   A) 20. N   B) 40. N   C) 60. N   D) 80. N

2. Base your answer to the following question on Two students push on a sled. One pushes with a force of 30. newtons east and the other exerts a force of 40. newtons south, as shown in the topview diagram below.

   ┌──────────┐
   │ Top of │ ────────► 30. N east
   │   sled   │
   └──────────┘
        │
        │
        ▼
     40. N south
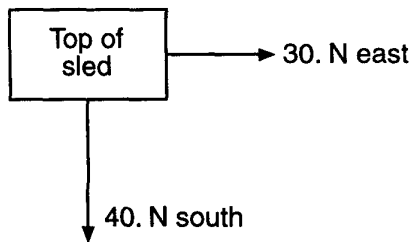
   Which vector best represents the resultant of these two forces?

   A)   70. N

   B)   70. N

   C)   50. N

   D)   50. N
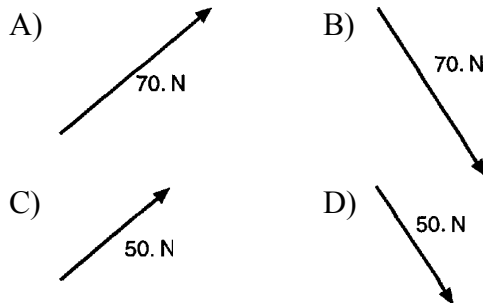
   Base your answers to questions **3** and **4** on The information below.

   A force of 60. newtons is applied to a rope to pull a sled across a horizontal surface at a constant velocity. The rope is at an angle of 30. degrees above the horizontal.

   F = 60. N

   30.°

   Horizontal surface
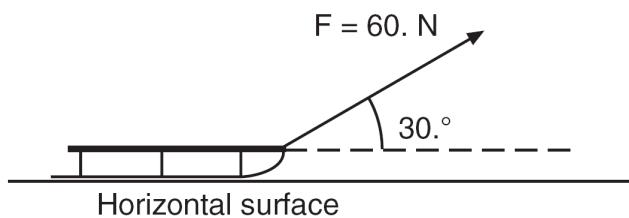
3. Determine the magnitude of the frictional force acting on the sled.

4. Calculate the magnitude of the component of the 60.-newton force that is parallel to the horizontal surface. [Show all work, including the equation and substitution with units.]
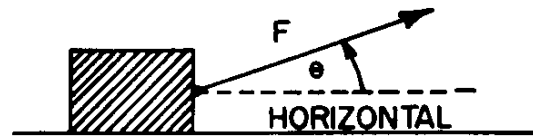
5. Base your answer to the following question on The diagram below shows a child pulling a 50.-kilogram friend on a sled by applying a 300.-newton force on the sled rope at an angle of 40.° with the horizontal.
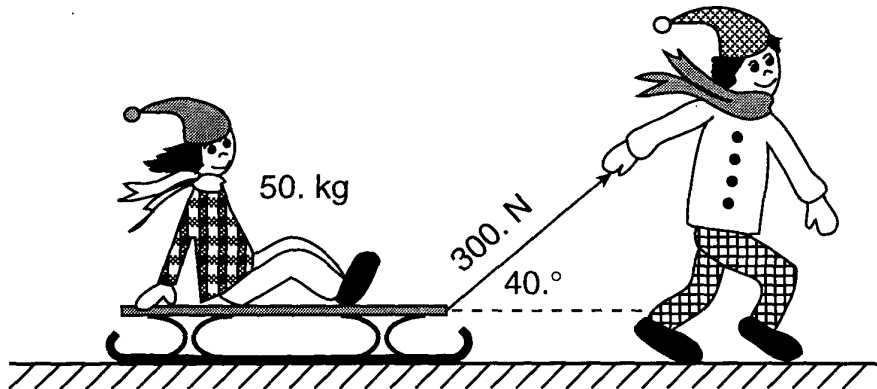

The vertical component of the 300.-newton force is approximately

A) 510 N   B) 230 N   C) 190 N   D) 32 N

6. Which diagram represents a box in equilibrium?

A)

B)

C)

D)

7. The diagram below represents a constant force F acting on a box located on a frictionless horizontal surface.

As the angle between the force and the horizontal increases, the acceleration of the box will

A) decrease   B) increase
C) remain the same

8. Base your answer to the following question on In the diagram below, a box is on a frictionless horizontal surface with forces F_1 and F_2 acting shown.

Frictionless surface
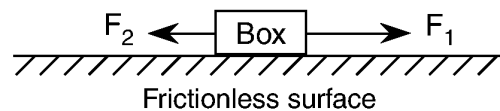
If the magnitude of F_1 is greater than the magnitude of F_2 , then the box is

A) moving at constant speed in the direction of F_1
B) moving at constant speed in the direction of F_2
C) accelerating in the direction of F_1
D) accelerating in the direction of F_2

Lawnmowers and Sleds

9. Base your answer to the following question on The handle of a lawn roller is held at 45° from the horizontal. A force, *F*, of 28.0 Newtons is applied to the handle as the roller is pushed across a level lawn, as shown in the diagram below.

What is the magnitude of the force moving the roller forward?

A) 7.00 N   B) 14.0 N
C) 19.8 N   D) 39.0 N

10. A lawnmower is pushed with a constant force of *F*, as shown in the diagram below:

As angle θ between the lawnmower handle and the horizontal increases, the horizontal component of *F*

A) decreases   B) increases
C) remains the same