1. Can a car with negative velocity move faster than a car with positive velocity? Explain.

2. A truck full of corn is parked at $x = 0$ and is pointed in the negative direction. If the driver puts it into reverse and holds down the accelerator, will the following quantities be positive, zero, or negative after one second? (a) position, (b) velocity, (c) acceleration.

3. The school bus picks up Brian in front of his house and takes him on a straight-line 2.1 km bus ride to school in the positive direction. He walks home after school. If the front of Brian's house is the origin, (a) what is the position of the school, (b) what is his displacement on the walk home, and (c) what is his displacement due to the combination of the bus journey and his walk home?

4. A jogger is moving at a constant velocity of +3.0 m/s directly towards a traffic light that is 100 meters away. If the traffic light is at the origin, $x = 0$ m, what is her position after running 20 seconds?

5. You own a yacht that is 14.5 meters long. It is motoring down a canal at 10.6 m/s. Its bow (the front of the boat) is just about to begin passing underneath a bridge that is 30.0 m across. How much time is required until its stern (the back end of the boat) is no longer under the bridge?

6. The velocity versus time **graph** of a unicycle is shown. What is
(a) sign of acceleration at t = 1.0s
 (b) the instantaneous velocity of the unicycle at $t = 5.0$ s,
 (c) sign of acceleration at t = 9.0s?

Velocity vs Time
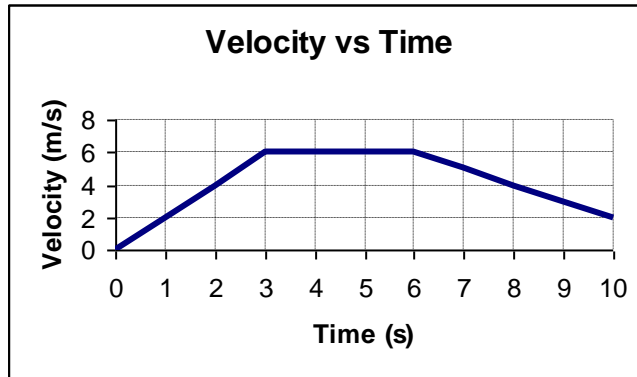
7. On a planet that has no atmosphere, a rocket 14.2 m tall is resting on its launch pad. Freefall acceleration on the planet is 4.45 m/s^2. A ball is dropped from the top of the rocket with zero initial velocity. (a) How long does it take to reach the launch pad? (b) What is the speed of the ball just before it reaches the ground?

8. Two girls decide to jump off a diving board. Katherine steps off the diving board. Anna runs straight off the diving board so that her initial velocity is solely horizontal. They both leave the diving board at the same time. Which one lands in the water first and why?

9. A cannon mounted on a pirate ship fires a cannonball at 125 m/s horizontally, at a height of 17.5 m above the ocean surface. Ignore air resistance. (a) How much time elapses until it splashes into the water? (b) How far from the ship does it land?

10. A college rower can easily push a small car along a flat road, but she cannot lift the car in the air. Since the mass of the car is constant, how can you explain this discrepancy?

11. An acrobat who weighs 800 N is clinging to a vertical pole using only his hands, neither moving up nor down. Can we determine the static friction force between his hands and the pole? Explain your answer.

12. How much does a 70.0 kg person weigh on the Earth? (b) How much would she weigh on the Moon (g_{moon} = 0.166g)? (c) How much would she weigh on a neutron star where g_{star} = 1.43×10^{11}g?

13. Three blocks are arranged in a stack on a frictionless horizontal surface. The mass of the block on the bottom is 37.0 kg; the mass of the block in the middle is 18.0 kg; and the mass of the block on the top is 8 kg. A downward vertical force of 170 N is applied to the top block. What is the magnitude of the normal force exerted by the bottom block on the middle block?

14. A force F pulls on a 4.00 kg block, which sits on a horizontal frictionless surface. F is 17.0 N and is directed at 30.0° above the horizontal. Draw a free-body diagram of the forces acting on the block, including the normal force, and label the forces. Make sure the vectors are roughly proportional to the forces.

Free body

F = 39.2 N

17 N

30°

F = 39.2 N

F = 39.2 N
(normal force)

17 N

F = 39.2 N
(weight)
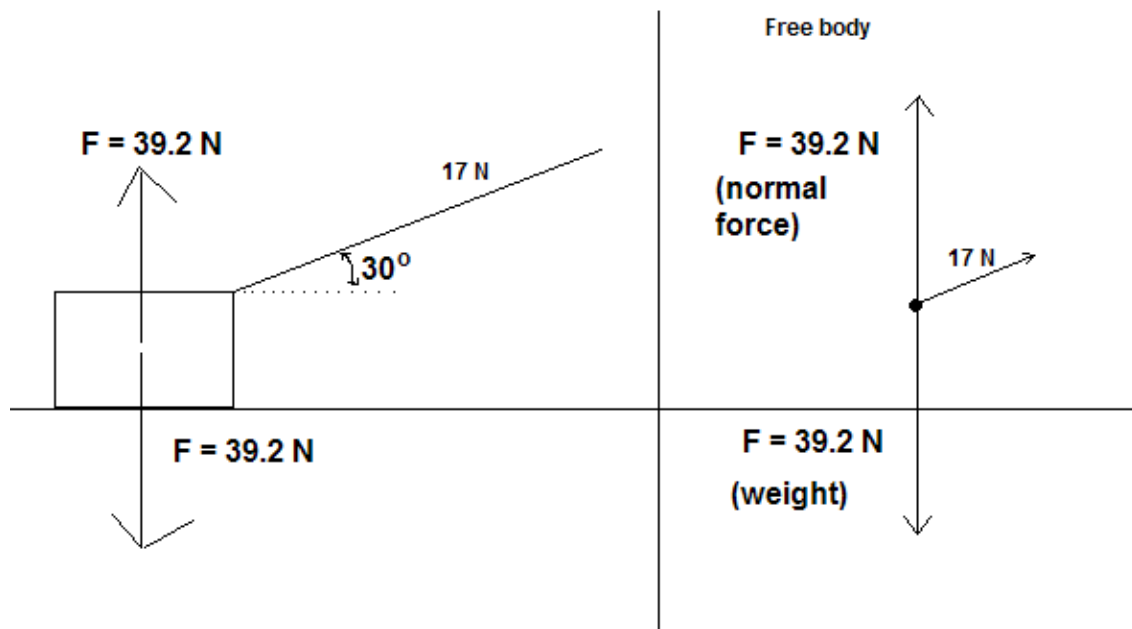
15. Charlie pulls horizontally to the right on a wagon with a force of 37.2 N. Sara pulls horizontally to the left with a force of 22.4 N. How much work is done on the wagon after it has moved 2.50 meters to the right?

16. 0.50 kg cream pie strikes a circus clown in the face at a speed of 5.00 m/s and stops. What is the change in kinetic energy of the pie?

17.What is the change in kinetic energy of a baseball as it accelerates from rest to 45.0 m/s? The mass of a baseball is 0.145kg.

18. A weightlifter raises a 115 kg weight from the ground to a height of 1.95 m in 1.25 seconds. What is the average power of this maneuver?