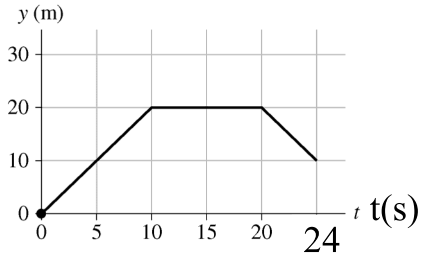
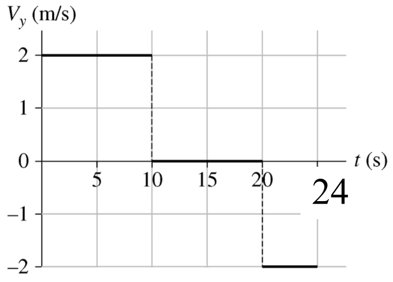
P2.7. Strategize: We want to indicate position relative to the ground on the vertical axis of one plot, and time on the horizontal axis.

Prepare: We assume the speed is roughly constant when the elevator is moving. We start with the position plot, and then we can determine the components of the velocity from the slope.

Solve: The entire trip takes 24 s and 10 s are spent stopped. So the motion takes a total of 14 s. If we assume the elevator has the same speed when going upward as it does downward, then the total distance of 7 floors (5 up and then 2 down) corresponds to 2 s per floor. Thus, we expect it took 10 s to get up to the fifth floor, and then 4 s to go back down to the third floor. Clearly, the slope of this plot is either ± 2 m/s or 0 m/s. This allows us to complete the velocity vs. time plot as well.





Assess: Note that the sign of the velocity is accurately reflected in the slope of the position vs. time plot.

P2.19. Strategize: Displacement is given by the area under the a velocity vs. time graph.
Prepare: In this case, the displacement is equal to the area under the velocity graph between t_i and t_f. We can find the car's final position from its initial position and the area.
Solve: (a) Using the equation $x_f = x_i$ + area of the velocity graph between t_i and t_f,

$$x_{2\text{ s}} = 10\text{ m} + \text{area of trapezoid between 0 s and 2 s}$$

$$= 10\text{ m} + \frac{1}{2}(12\text{ m/s} + 4\text{ m/s})(2\text{ s}) = 26\text{ m}$$

$$x_{3\text{ s}} = 10\text{ m} + \text{area of triangle between 0 s and 3 s}$$

$$= 10\text{ m} + \frac{1}{2}(12\text{ m/s})(3\text{ s}) = 28\text{ m}$$

$$x_{4\text{ s}} = x_{3\text{ s}} + \text{area between 3 s and 4 s}$$

$$= 28\text{ m} + \frac{1}{2}(-4\text{ m/s})(1\text{ s}) = 26\text{ m}$$

(b) The car reverses direction at $t = 3$ s, because its velocity becomes negative.
Assess: The car starts at $x_i = 10$ m at $t_i = 0$. Its velocity decreases as time increases, is zero at $t = 3$ s, and then becomes negative. The slope of the velocity-versus-time graph is negative which means the car's acceleration is negative and a constant. From the acceleration thus obtained and given velocities on the graph, we can also use kinematic equations to find the car's position at various times.

P2.27. Strategize: We will assume constant accelerations for both animals.
Prepare: We can calculate acceleration from Equation 2.8:
Solve: For the gazelle:

$$(a_x) = \left(\frac{\Delta v_x}{\Delta t}\right) = \frac{13\ \text{m/s}}{3.0\ \text{s}} = 4.3\ \text{m/s}^2$$

For the lion:

$$(a_x) = \left(\frac{\Delta v_x}{\Delta t}\right) = \frac{9.5\ \text{m/s}}{1.0\ \text{s}} = 9.5\ \text{m/s}^2$$