I. While approaching a school zone you steadily reduce your speed from 45 mph to 25 mph in 5s. It takes you 10 seconds to drive through the school zone at 25 mph, then 3 more seconds to speed up steadily to 45 mph again. (1 m/s = 2.2 mph)

a) Plot \(v_x\) vs \(t\) graph the diagram below (be sure to label the vertical axes).

\[\begin{array}{c|c|c|c|c|c|}
\hline
5 & 10 & 15 & 20 & \\
\hline
\end{array}\]

b) Plot \(a_x\) vs \(t\) graph the diagram below (be sure to label the vertical axes).

\[\begin{array}{c|c|c|c|c|c|}
\hline
5 & 10 & 15 & 20 & \\
\hline
\end{array}\]

c) How far do you drive in the 18 seconds of your motion described above?
II. Your little sister is running at 2 m/s toward a mud puddle that is 6.0 m in front of her. You are 10 m behind her running at 5.0 m/s to catch her before she enters the mud.

a) Make an $x(t)$ vs $t$ graph of your motion and of your sister’s motion on the axes below. Use the same axes for both graphs, but label them.

b) Write an equation below that describes your motion, $x(t)$, and do the same for your sister assuming the same coordinate system. Replace symbols with any numeric values that you know.

YOU:

YOUR SISTER:

c) Determine whether or not you will catch your sister before she reaches the mud puddle. Show your work and explain your reasoning.
3. An airplane is heading due east and is moving at a speed of 370 km/h relative to the air. The wind is blowing northeast (45 degrees north of east) at a speed of 92.5 km/h. What is the speed of the airplane relative to the ground?

a) 463 km/h  
b) 381 km/h  
c) 417 km/h  
d) 370 km/h  
e) 440 km/h

4. Traffic moves steadily through the Holland Tunnel traveling $n$ miles in 3.5 minutes. A transportation engineer characterizes the traffic with a traffic index $\text{traffic}_H = \frac{3.5}{n}$. The traffic index for the Lincoln Tunnel, $\text{traffic}_L$, is larger than $\text{traffic}_H$. Select the best answer from the answers below.

a) The traffic is moving faster in the Lincoln Tunnel.  
b) The traffic is moving faster in the Holland Tunnel.  
c) The traffic is moving at the same rate in both tunnels.  
d) $\text{traffic}_L = n \times \text{traffic}_H$.  
e) there is not enough information to compare

5. If you drove night and day without stopping for one year without exceeding the speed limit of 60 miles/hour, the maximum number of miles you could drive would be closest to:

a) $5 \times 10^5$  
b) $9 \times 10^3$  
c) $1 \times 10^6$  
d) $3 \times 10^5$  
e) $3 \times 10^7$
6. A toy car starts from rest, speeds up gradually to a constant speed, and slows down until it comes to rest. It speeds up gradually in the opposite direction, slows down, and comes to rest at its starting point. Which of the following graphs of $x(t)$ represents this motion?

![Graphs of x(t)](image)

7. In normal traffic driving at an average speed of 60 km/hr, it takes one hour to go from New Brunswick, NJ to Brooklyn, NY. In heavy traffic cars make the same trip at an average speed of 45 km/hr. How much longer does this trip take in heavy traffic?

a) 90 mins  

b) 80 mins  

c) 30 mins  

d) 20 mins  

e) 15 mins

8. You are standing at the edge of a cliff and throw a rock straight down with an initial speed of 2.0 m/s. The rock hits the ground 3.0 s later. You take a second rock and drop it from the same cliff. How long will it take to hit the ground?

a) 1.8 s  

b) 2.2 s  

c) 2.8 s  

d) 3.5 s  

e) 3.2 s