

Question 1:

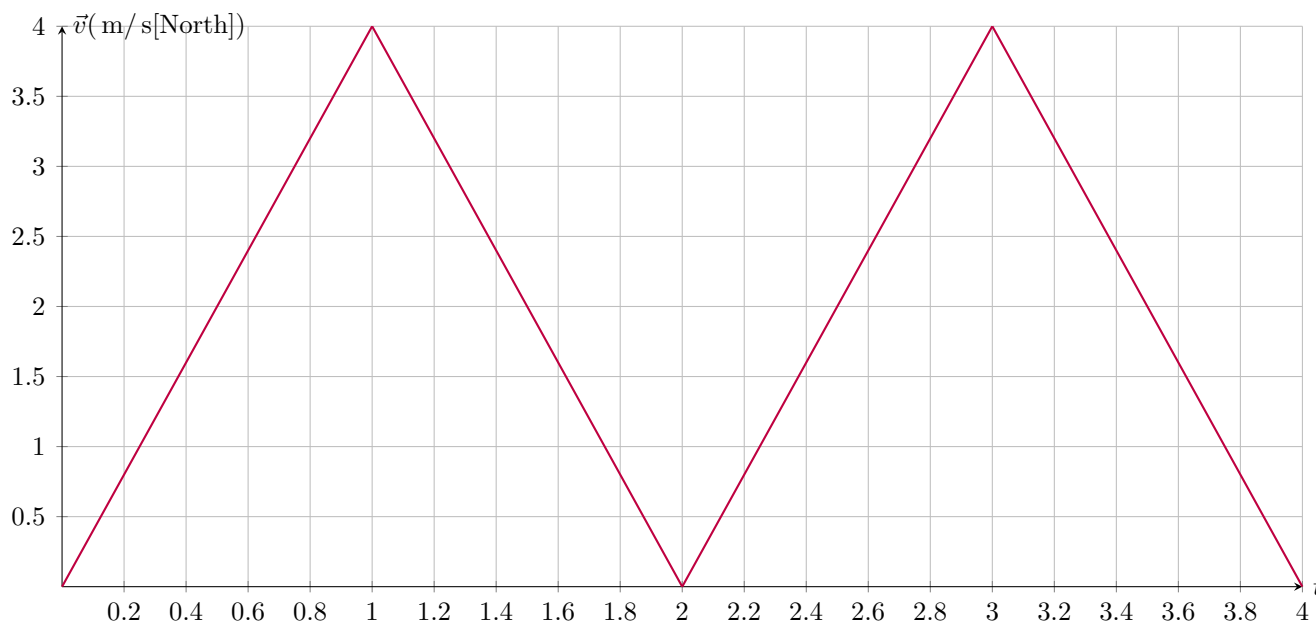
Answer the following True/False questions (**Assume [East] is positive**)

1. An object under uniform motion has a
 - (a) Non-zero average acceleration in the positive direction (T / F)
 - (b) Zero average acceleration (T / F)
2. De-acceleration is just acceleration in the same direction of motion (T / F)
3. Suppose that a bullet accelerates at $\vec{a}_{av} = +1.068 \text{ km/s}^2$ from rest to a final velocity of $\vec{v}_f = +356 \text{ m/s}$. Then,
 - (a) The time elapsed was $\Delta t = 3 \text{ s}$
 - (b) If I double the acceleration of the bullet, then Δt doubles as well. (T / F)
4. Suppose a Velocity V. Time plot is represented by $y = 2x + 4$,
 - (a) The average acceleration is uniform (T / F)
 - (b) The initial velocity of the body at $t = 0$ was $\vec{v}_i = +4 \text{ m/s}$ (T / F)
 - (c) The displacement over the time interval $[0, 2]$ was $\Delta \vec{d} = +12 \text{ m}$ (T / F)
 - (d) The average acceleration is $\vec{a}_{av} = +2 \text{ m/s}^2$ (T / F)
5. A secant line on a Velocity V. Time graph over the interval $[t_1, t_2]$ gives me the instantaneous acceleration over the time interval $[t_1, t_2]$. (T / F)
6. Suppose a Position V. Time plot is represented by $y = x^2 + 4$. Then,
 - (a) The object is slowing down in the positive direction. (T / F)
 - (b) The object is experiencing uniform motion. (T / F)
 - (c) The object may be experiencing uniform acceleration (T / F).
 - (d) The initial position vector of the object at $t = 0$ is $\vec{d}_i = 2 \text{ m}$
7. Suppose that the tangent line to a Position V. Time plot at $t = 4$ was represented by the equation $y = -3x + 7$. Then,
 - (a) The instantaneous velocity of the object at $t = 4$ was $\vec{v} = +3 \text{ m/s}$
 - (b) The instantaneous velocity of the object at $t = 5$ was $\vec{v} = -3 \text{ m/s}$
 - (c) Suppose that the Velocity V. Time plot for the object happened to be linear, then the average velocity of the object must have been $\vec{v}_{av} = -3 \text{ m/s}$. (T / F)
8. Suppose a Velocity V. Time plot is represented by $y = -x + 3$, then the displacement over the time interval $[0, 8]$ is $\Delta \vec{d} = +0 \text{ m}$. (T / F)
9. Suppose that the average acceleration of an object in motion differs at two distinct points in time, then the Velocity V. Time graph must have been linear. (T / F)

Question 2:

Answer the following multiple choice questions.

- Which of the following statements are correct about the plot below? (Assume that the motion lasted for 4 seconds)



- The body experienced uniform acceleration throughout the entire trip.
 - Within the time interval $[0, 2]$ the average acceleration was $\vec{a}_{av} = +0 \text{ m/s}^2$
 - Within the time interval $[3, 4]$ the average acceleration was $\vec{a}_{av} = -4 \text{ m/s}^2$
 - Within the time interval $[1, 4]$ the average acceleration was $\vec{a}_{av} = -1.333 \text{ m/s}^2$
 - At $t = 2 \text{ s}$, the instantaneous acceleration was $\vec{a}_{av} = +4 \text{ m/s}^2$
 - At $t = 3.4 \text{ s}$, the instantaneous acceleration was $\vec{a}_{av} = -4 \text{ m/s}^2$
 - The average acceleration is not the same as the instantaneous acceleration for each point in time.
- The Velocity V . Time plot for a body in motion is similar to $y = 4x + 7$.
 - The displacement over the first $t = 4 \text{ s}$ was $\Delta \vec{d} = +23 \text{ m}$.
 - The object experienced uniform motion.
 - The object experienced uniform acceleration.
 - The object was speeding up in the positive direction

Question 3:

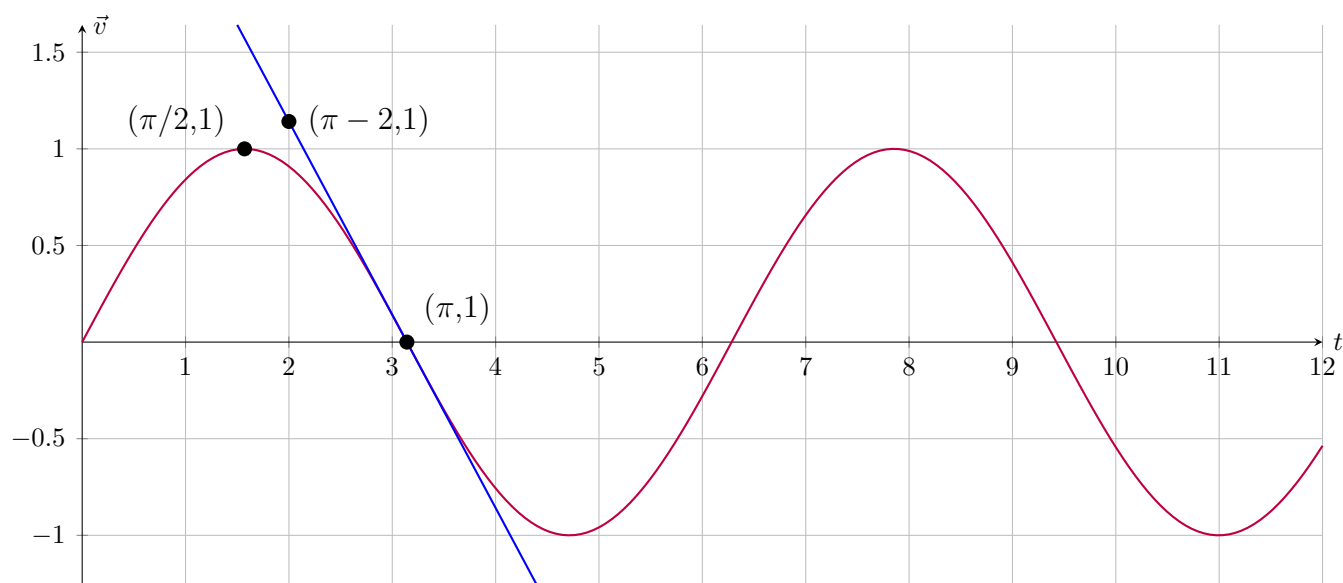
Answer the following inquiries about the plot below,



- (a) The displacement over the time interval $[1, 3]$.
- (b) The displacement over the time interval $[3, 8]$.
- (c) The displacement by the end of the trip ($\Delta t = 12 \text{ s}$)

Question 4:

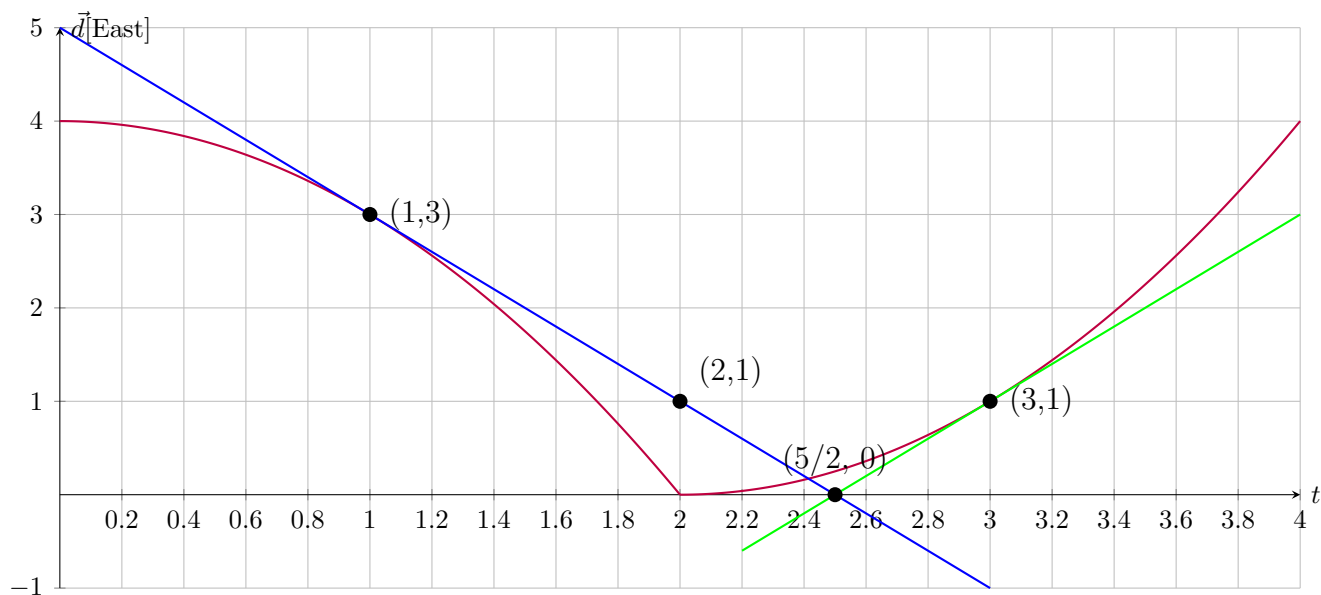
Answer the following inquiries about the Velocity V . Time plot below,



- Determine the average acceleration within the time interval $[\pi/2, \pi]$.
- Determine the instantaneous acceleration at time $t = \pi$.
(**Hint:** The line in blue is a tangent line to the plot at $t = \pi$)
- Prove that $\vec{a}_{av} = +0 \text{ m/s}^2$ over the interval $[0, \pi]$.

Question 5:

Given the Position V. Time plot below, answer the following inquiries.



- Determine the average velocity over the time interval $[0, 2]$.
- Describe the motion over the time interval $[0, 2]$
- Determine the instantaneous velocity at $t = 1$.
(**Hint:** The line in blue is a tangent line to the plot at $t = 2$)
- Describe the motion of the plot after $t = 2$ seconds.
- The slope of the tangent line in green is $m = +12$. Determine the equation of the line ($y = mx + b$).

Question 6:

A ball kicked with an initial velocity of $\vec{v}_i = 80 \text{ m/s}[\text{South}]$. It experiences a drag force and decelerates at $\vec{a}_{av} = 5 \text{ m/s}^2[\text{North}]$.

- (a) Determine the final velocity of the ball after $\Delta t = 40 \text{ s}$
- (b) At what time t did ball start to travel in the Northward direction.

Question 7:

Patrick has decided to embark on a journey throughout the sea on a boat. The boat has a relative velocity of $\vec{v}_{PG} = 400 \text{ m/s [East]}$ relative to the ground (G). On the boat, Patrick is walking with a relative velocity of $\vec{v}_{PB} = +50 \text{ m/s}$ relative to the boat. Determine the average acceleration of patrick relative to the ground. Determine,

- (a) The velocity of patrick relative to the ground (\vec{v}_{PG})
(**Hint:** Use the exact same technique from when we were working with position vectors, i.e $\vec{v}_{AC} = \vec{v}_{AB} + \vec{v}_{BC}$)
- (b) The average acceleration of Patrick relative to the ground over a time period of $\Delta t = 40 \text{ s}$ if everything was initially at rest.

Question 8:

A car is initially traveling at an initial velocity $\vec{v}_i = 412 \text{ m/s [East]}$. The car then de-accelerates at an average acceleration of \vec{a}_{av} to come to a rest at a red light over a duration of Δt . When the light turns green, the car accelerates at an average acceleration $-\vec{a}_{av}$ over a time period $2\Delta t$, to reach a final velocity of $\vec{v}_f = 240 \text{ m/s [East]}$. Determine the average acceleration \vec{a}_{av} .

(**Hint :** Setup the correct equations to get rid of Δt)