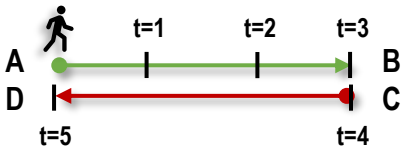
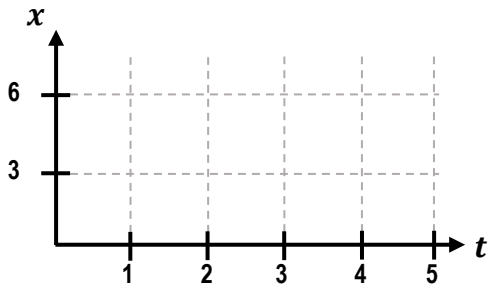
CONCEPT: POSITION-TIME GRAPHS & VELOCITY

● **Position-time** graphs show an object's _____ in the y-axis versus _____ in the x-axis.

Ex. "You walk 6m forward in 3s, stop for 1s, then run 6m back in 1s."

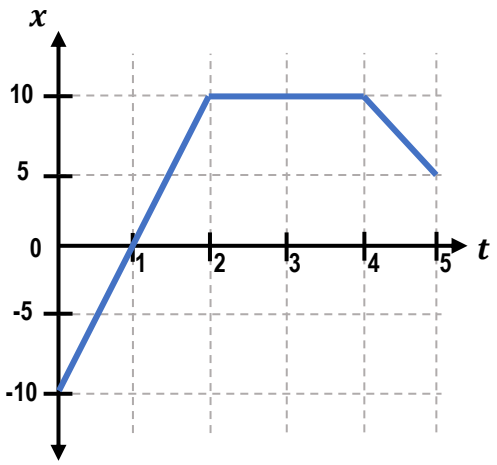




● Velocity: $v_{avg} = \frac{\Delta x}{\Delta t} \rightarrow$ _____ = _____ of the position graph

- Upward Slope → **[moving FORWARD | STOPPED | moving BACKWARD]**
- Horizontal / Flat Slope → **[moving FORWARD | STOPPED | moving BACKWARD]**
- Downward Slope → **[moving FORWARD | STOPPED | moving BACKWARD]**

EXAMPLE: For the given position-time graph, calculate v_{avg}:



a) from **t=0** to **t=2s**

b) from **t=2** to **t=4s**

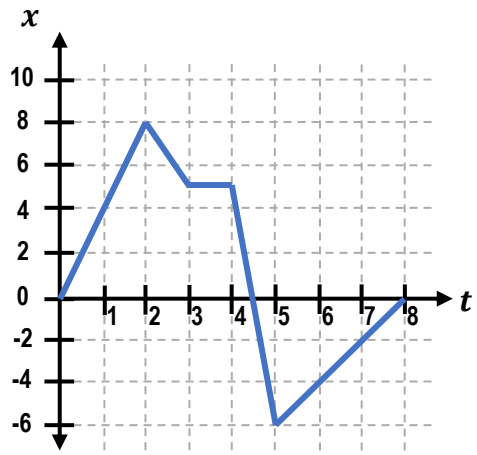
c) from **t=4** to **t=5s**

d) for the entire motion

● Can get $\vec{v}_{avg}$ between *any* two points if you know Δx and Δt!

- ***Steeper*** slopes = velocity has **[HIGHER | LOWER]** magnitude (Number only)
- ***Flatter*** slopes = velocity has **[HIGHER | LOWER]** magnitude (Number only)

PRACTICE: The position-time graph for a moving box is shown below.



a) What is the box's velocity from 0 to 5s?

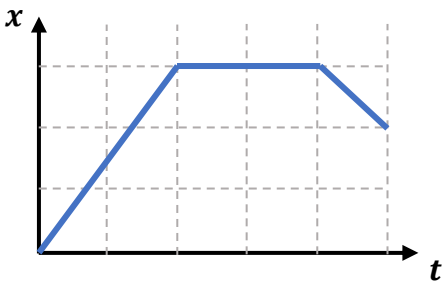
b) What is the box's velocity from 0 to 8s?

c) What is the box's velocity in the interval where it's moving fastest?

CONCEPT: CURVED POSITION-TIME GRAPHS & ACCELERATION

● Position graph is **curved** (not straight lines) when the velocity is _____ (acceleration is **NOT** zero).

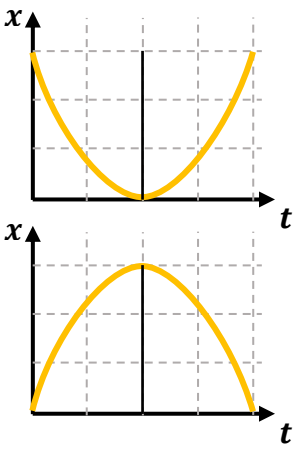
STRAIGHT POSITION GRAPH



● Straight lines → v = constant, $\boldsymbol{a}$ **= 0**

CURVED POSITION GRAPH

Left Side: Object
_____



Right Side: Object
_____

● Curving **UP** (Smiley ☺) → **[POSITIVE | NEGATIVE]** acceleration

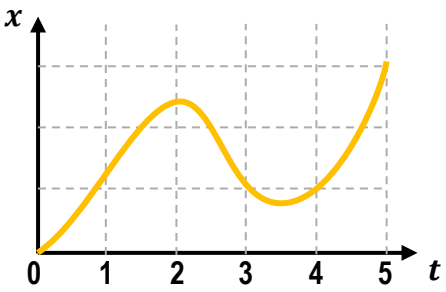
● Curving **DOWN** (Frowny ☹) → **[POSITIVE | NEGATIVE]** acceleration

CONCEPT: POSITION-TIME GRAPHS & INSTANTANEOUS VELOCITY

- There are 2 different types of velocity you'll need to calculate in position-time graphs.

AVERAGE Velocity

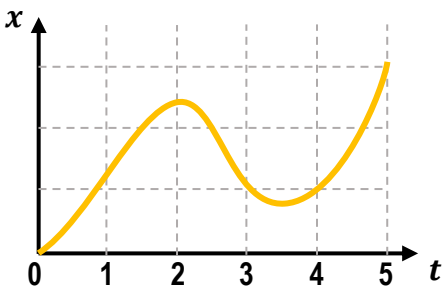
→ between *TWO* points



- $\vec{v}_{avg} = \frac{\Delta x}{\Delta t}$ = slope of line between 2 points

INSTANTANEOUS Velocity

→ at *ONE* point (instant)



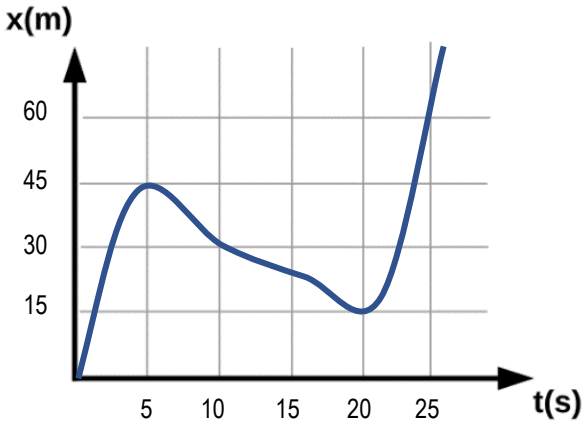
- $\vec{v}$ = slope of **tangent line** ⇒ line touches graph ONLY _____
  - Use an approximated line (best guess) if not given

EXAMPLE: Using the position-time graph for a moving object,

a) Calculate the object's velocity between t=10 & t=25

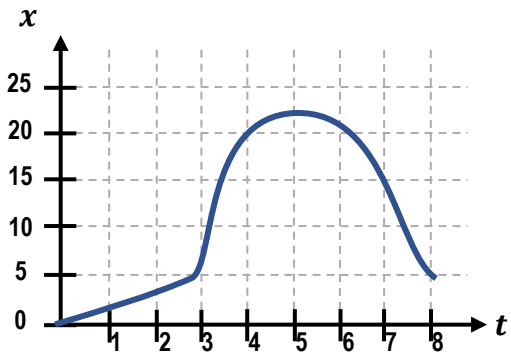
b) Calculate the object's velocity at t=10

c) Calculate the object's velocity at t=5



- $\vec{v} = 0$ at _____ & _____ of position graph.

PRACTICE: The position-time graph for a ball on a track is shown below.



a) What is the ball's velocity at t=4s?

b) At what time(s) is the ball approximately travelling at -10m/s?

c) From t = 3 to 7s, what is the sign of the acceleration?