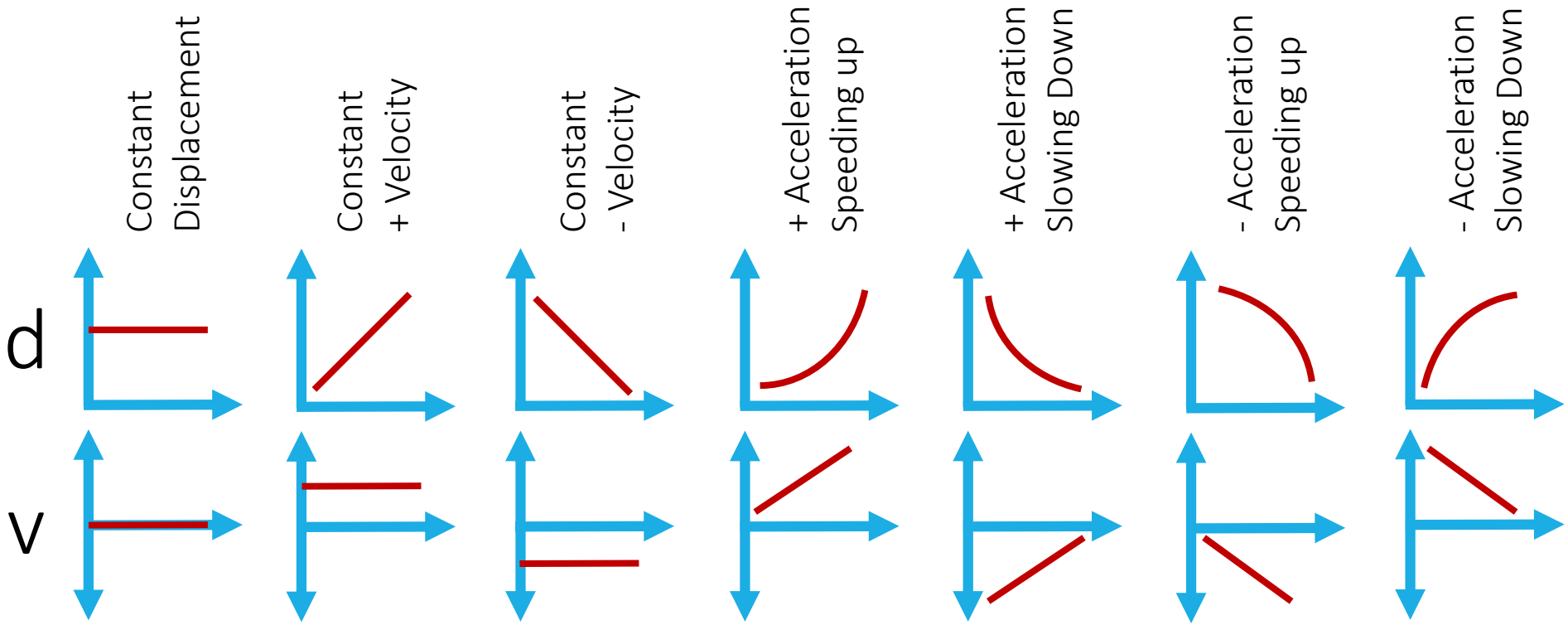
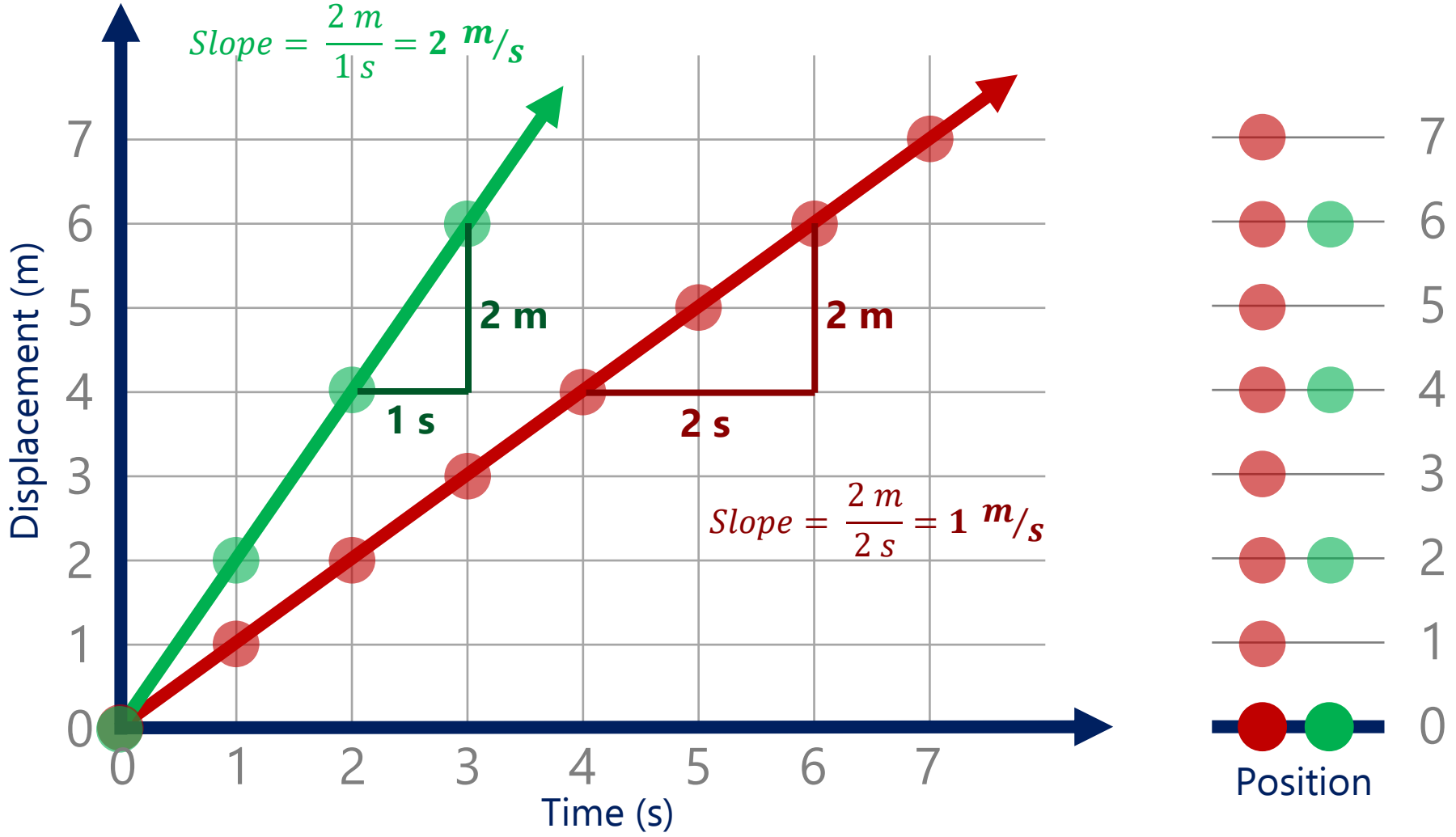
Calculating from Graphs

IB PHYSICS | MOTION

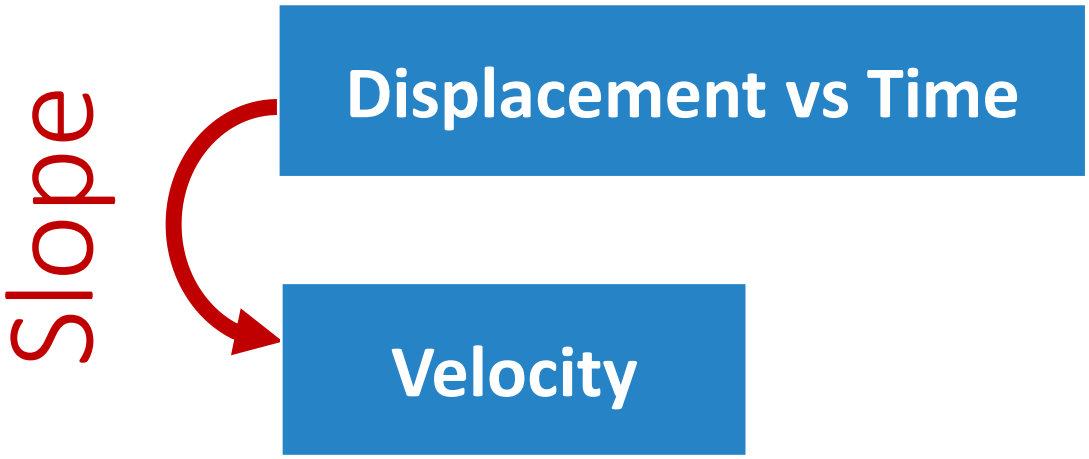
Motion Graphs Guide



Calculating Instantaneous Velocity



The power of the slope!



Average Speed and Velocity

$$\text{Average Speed} = \frac{Total\ Distance}{Total\ Time}$$

* Always Positive

$$\text{Average Velocity} = \frac{Total\ Displacement}{Total\ Time}$$

* Includes Direction

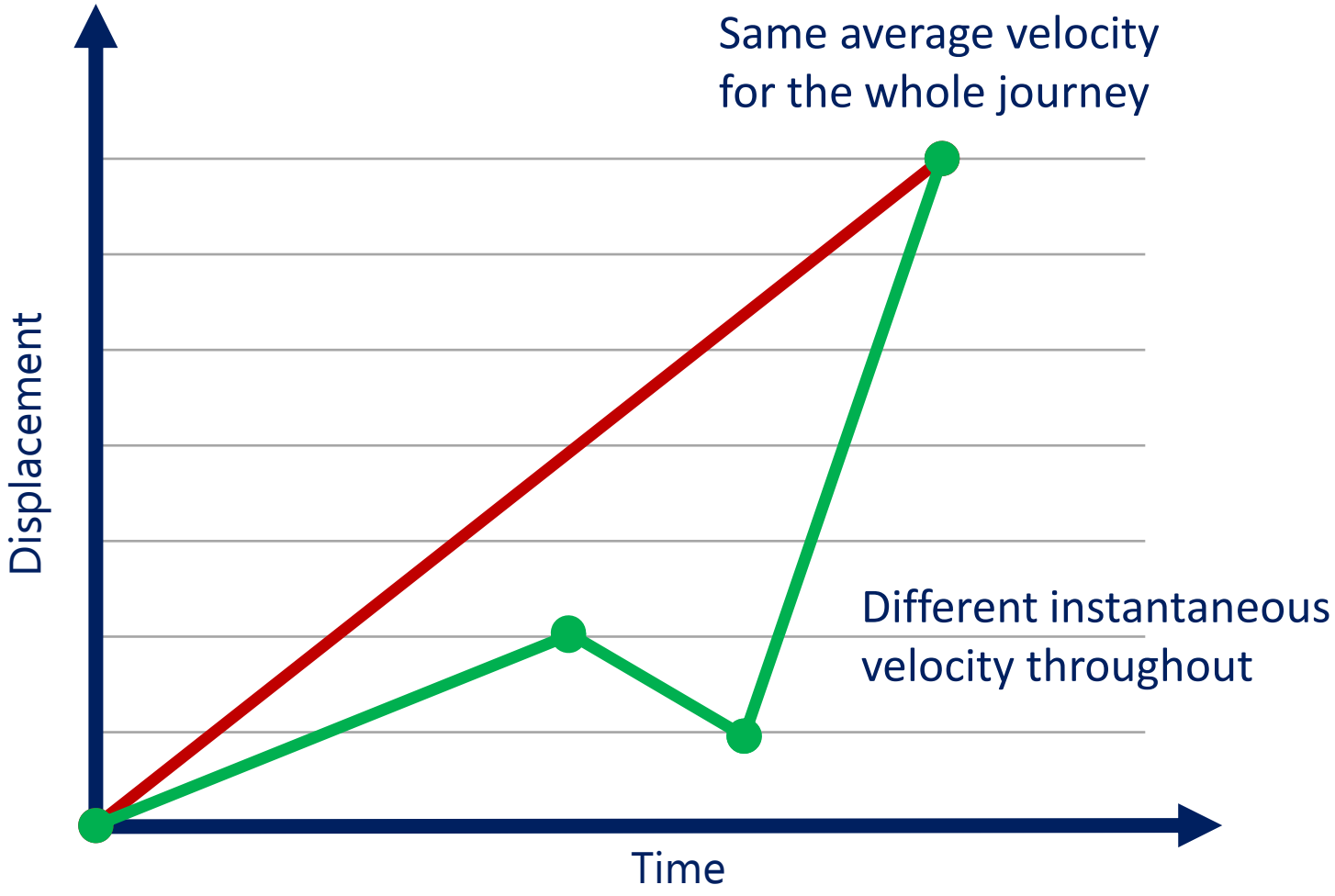
Calculating Average Speed

Eliud Kipchoge broke the 2-hour marathon (26.2 miles) in October of 2019. Kipchoge finished in 1.99 hours. What was his average speed in mph?

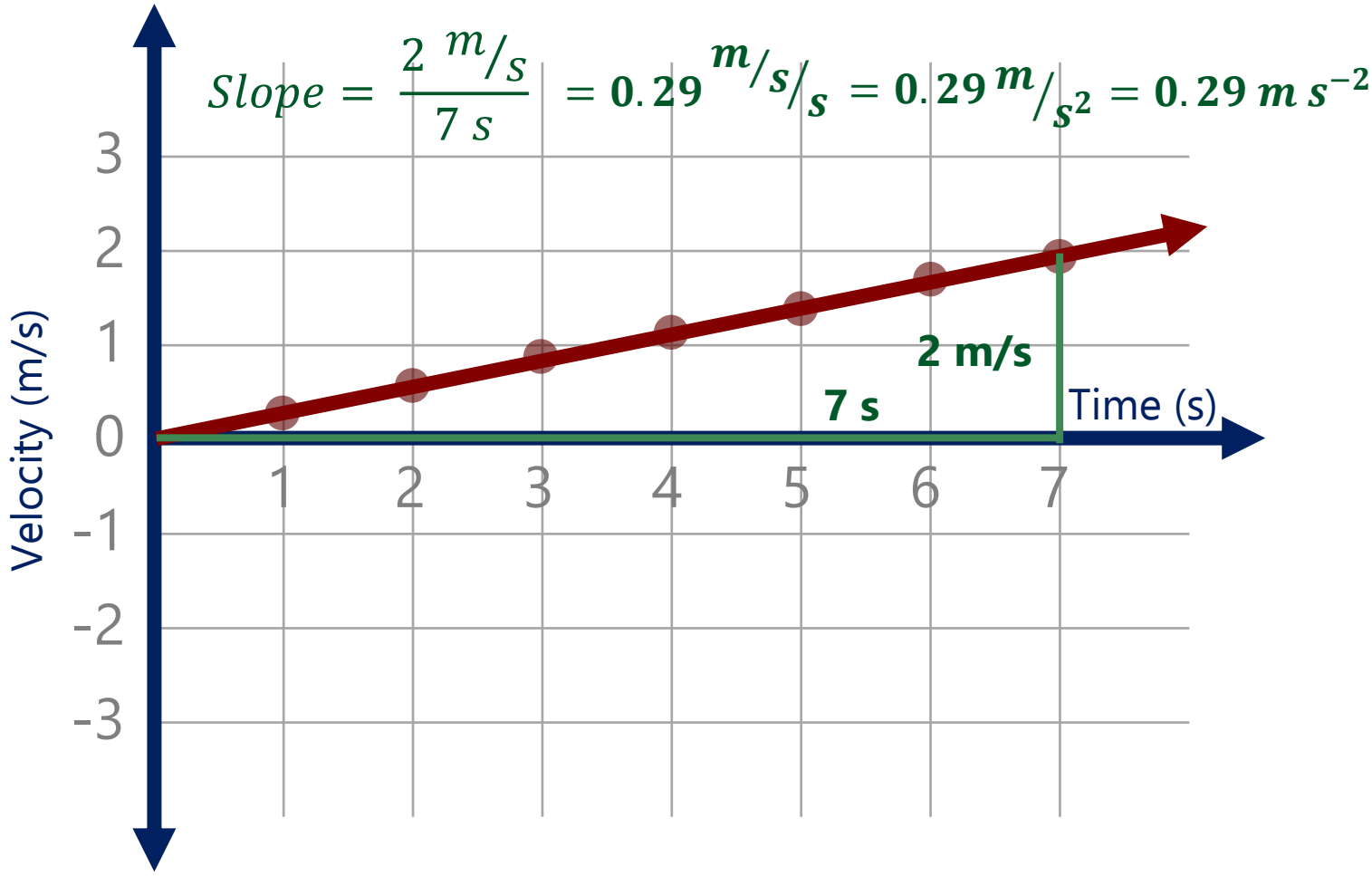
$$v = \frac{d}{t} = \frac{26.2}{1.99} =$$

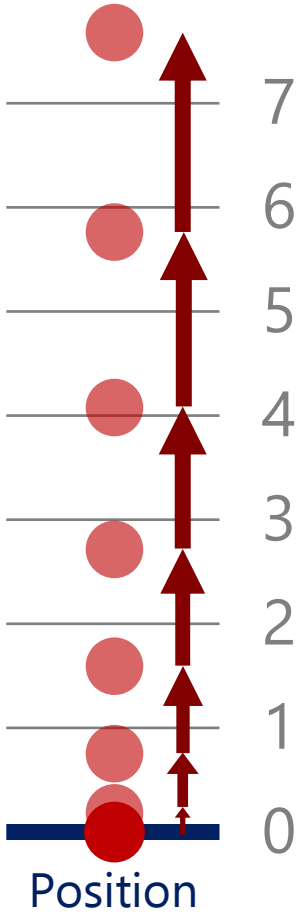
13.2 mi hr^{-1}

Average vs Instantaneous

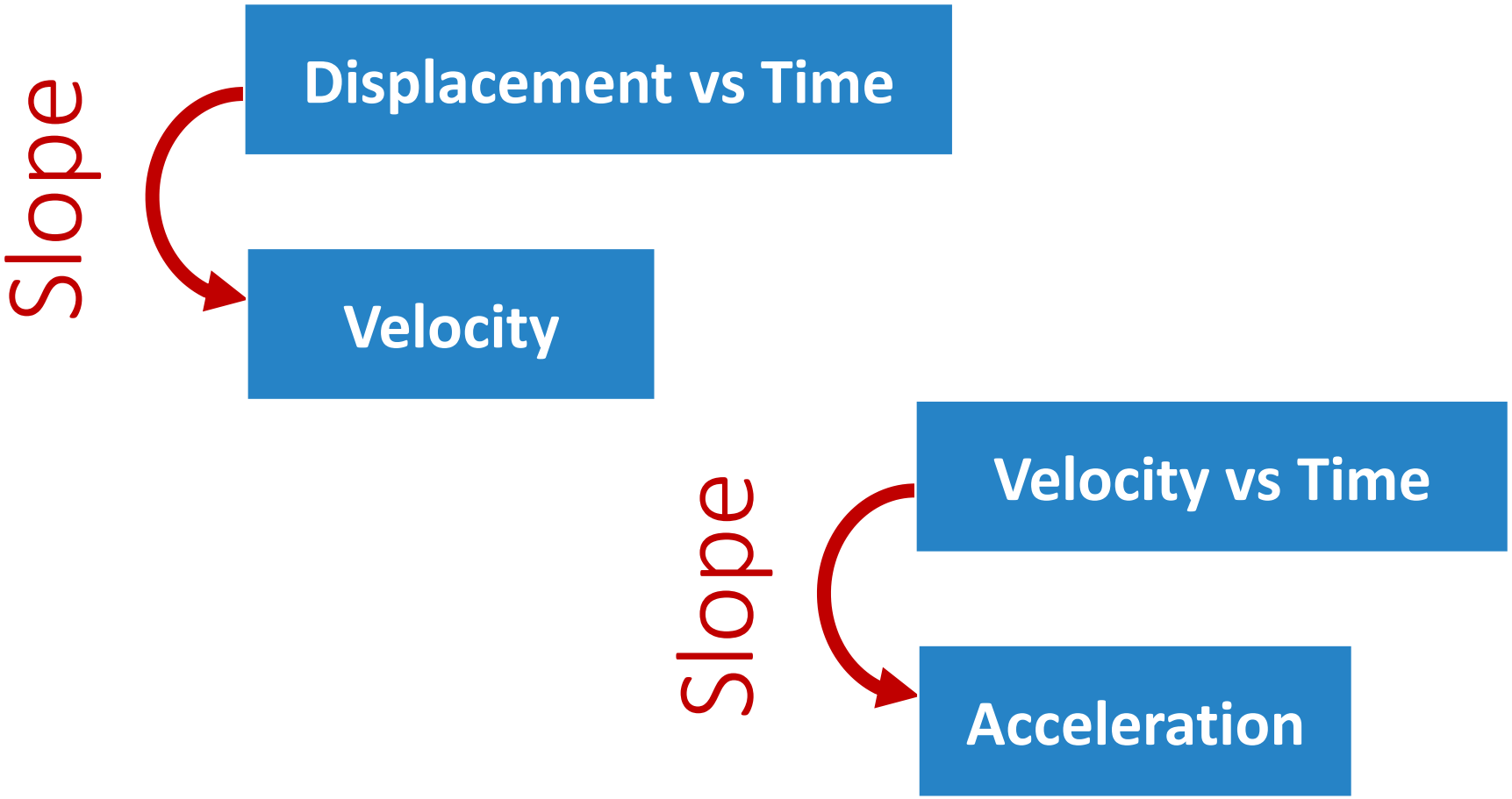


An object speeding up (positive)

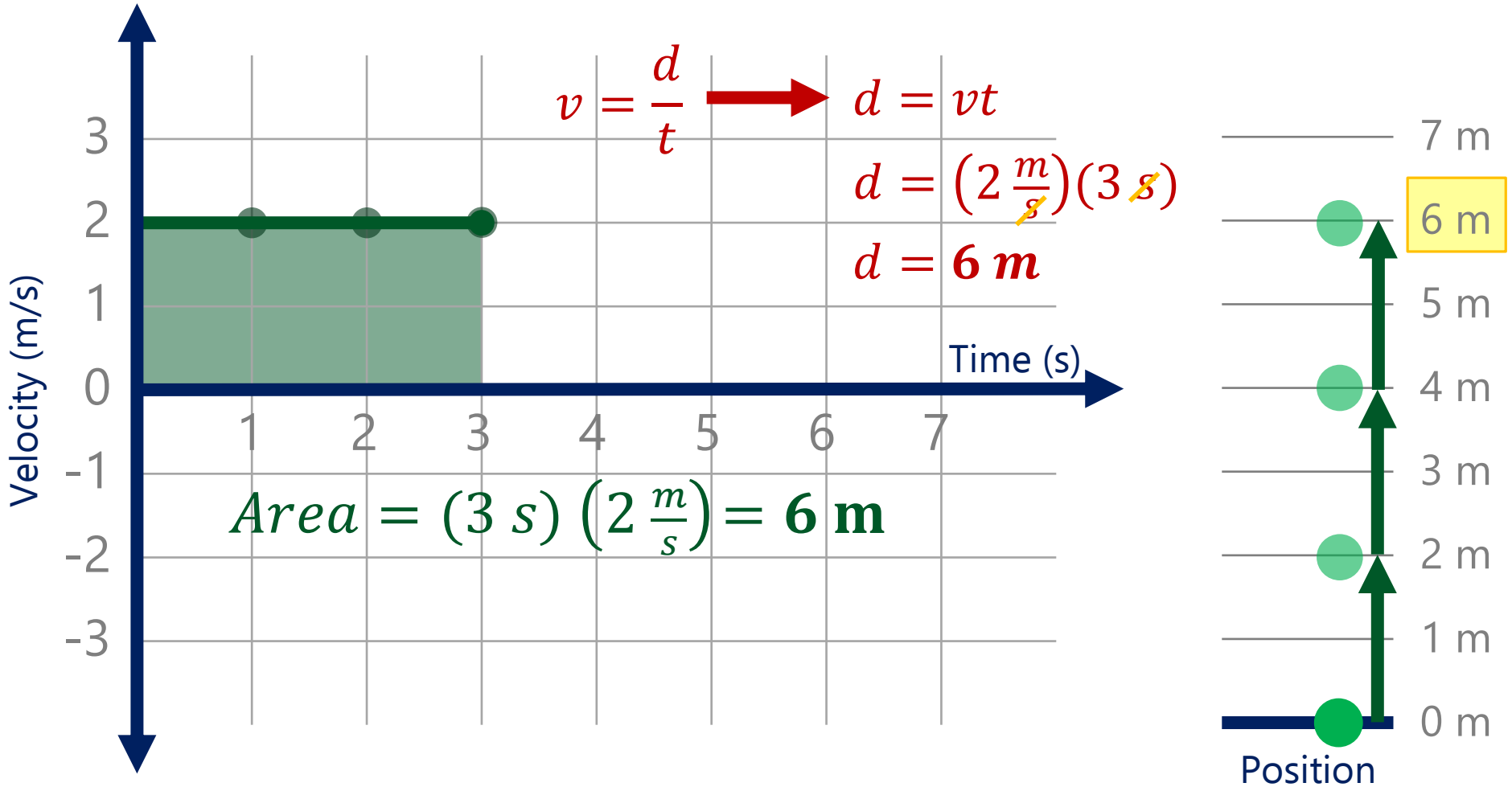




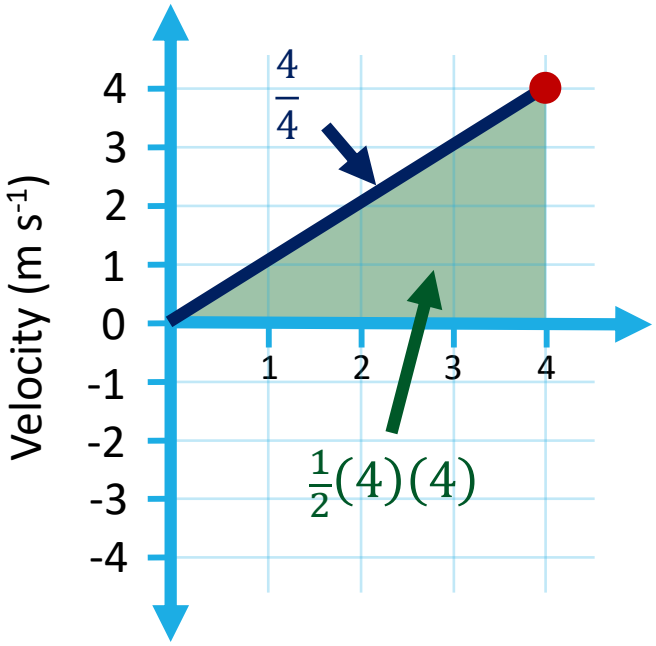
The power of the slope!



Calculating Displacement



Information from a V vs T graph



What is the velocity at 4 seconds?

$4\ m\ s^{-1}$

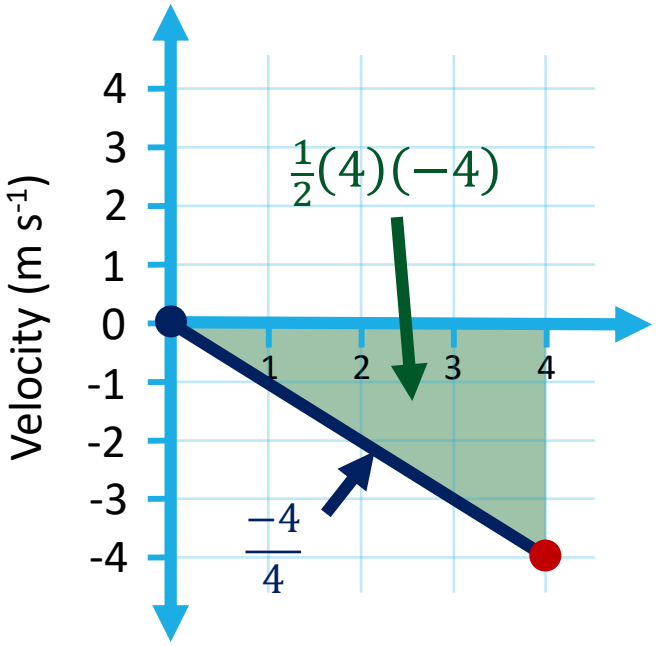
What is the acceleration from 1 s – 4 s?

Slope = $1\ m\ s^{-2}$

What is the displacement after 4 s?

Area = 8 m

Information from a V vs T graph



What is the velocity at 4 seconds?

-4 m s^{-1}

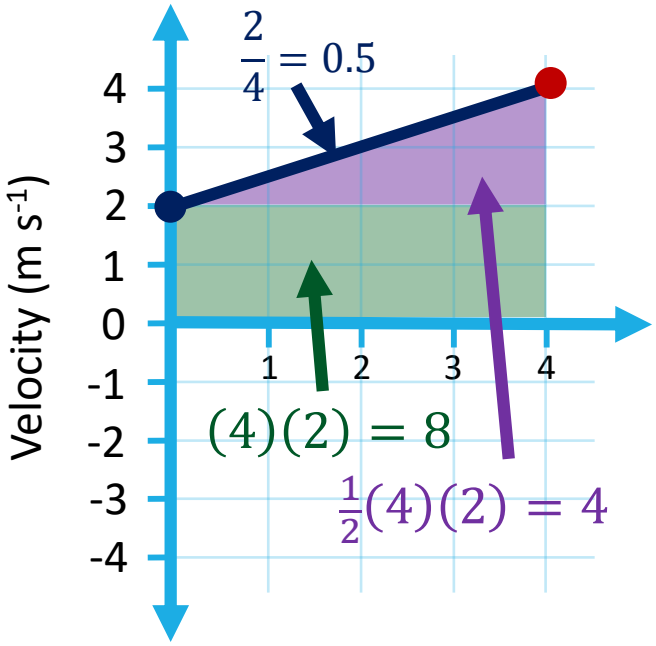
What is the acceleration from 0 s – 4 s?

Slope = -1 m s^{-2}

What is the displacement after 4 s?

Area = -8 m

Information from a V vs T graph



What is the velocity at 4 seconds?

4 m s^{-1}

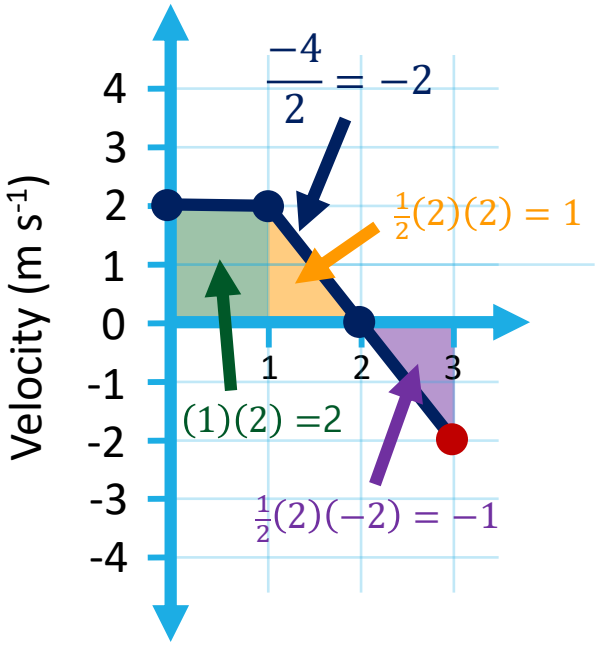
What is the acceleration from 0 s – 4 s?

Slope = 0.5 m s^{-2}

What is the displacement after 4 s?

Area = 12 m

Information from a V vs T graph



What is the velocity at 3 seconds?

$-2\ m\ s^{-1}$

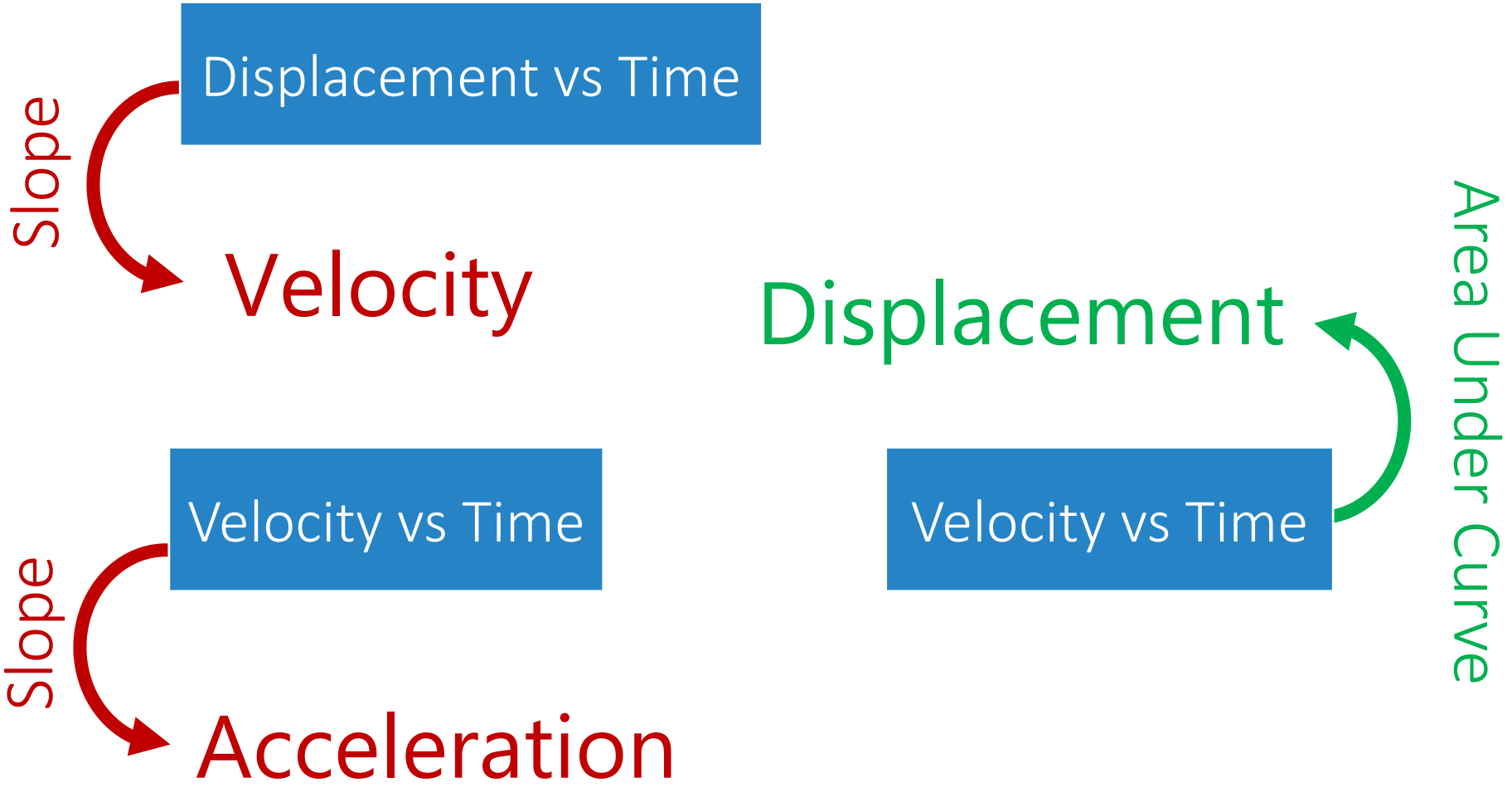
What is the acceleration from 1 s – 3 s?

Slope = $-2\ m\ s^{-2}$

What is the displacement after 3 s?

(2) + (1) + (-1) = Area = 2 m

Use the graphs to tell you MORE!



Lesson Takeaways

- ❑ I can use an equation to calculate average speed/velocity
- ❑ I can calculate instantaneous velocity using the slope of a displacement vs time graph
- ❑ I can calculate instantaneous acceleration using the slope of a velocity vs time graph
- ❑ I can calculate overall displacement using the area of a velocity vs time graph