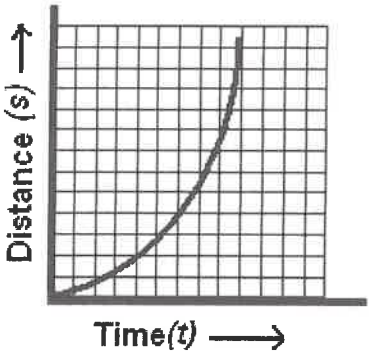
8. Representing Acceleration: Velocity - Time Graphs

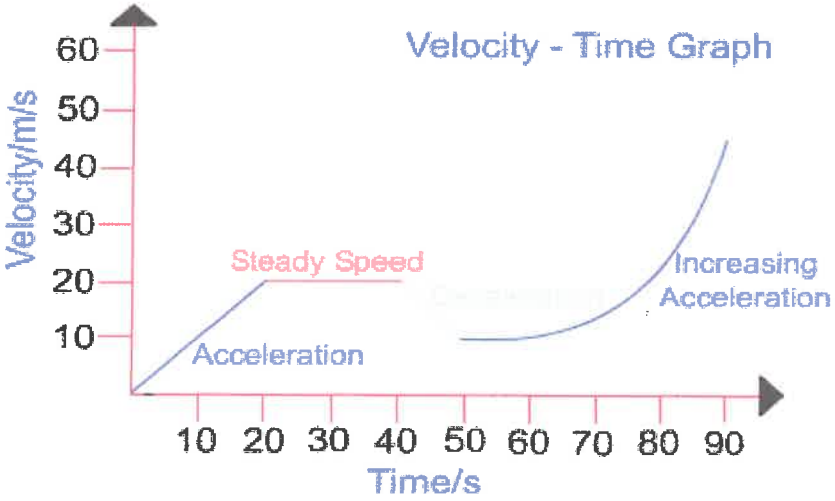
- Recall: When graphing non-uniform motion on a distance – time graph we get the resulting type of graph



Distance-time graph for a car moving with non-uniform speed

- Curved lines are much more difficult to work with (we know the car's speed is increasing, but by how much)
- To simplify analysis, we plot non-uniform motion on a Velocity-Time Graph

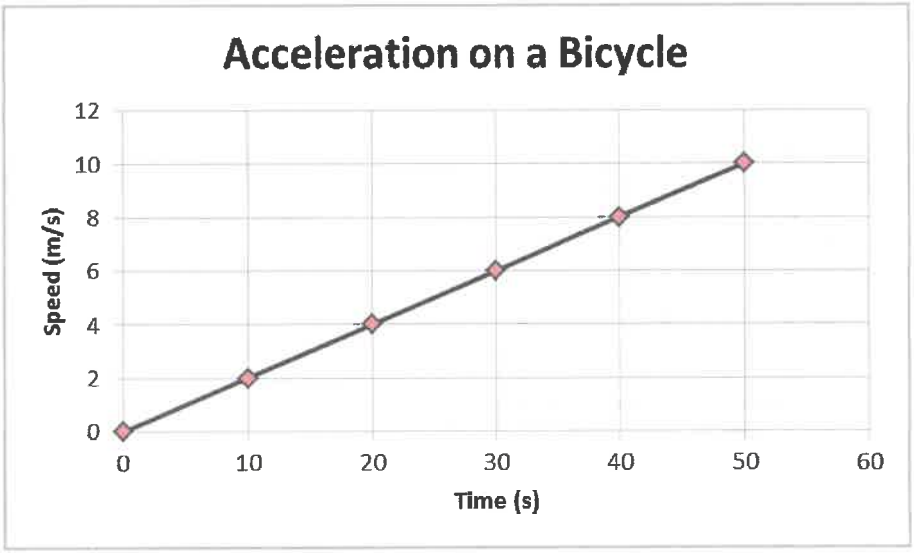
- **Velocity-Time Graph:**
  1) shows the relationship between velocity (speed) and time
     : velocity is plotted on the y-axis and time is plotted on the x-axis
     : the resulting line represents the acceleration



  2) shows the distance an object travelled
     : the area beneath the line represents the distance
     : area of a triangle = $\frac{bh}{2}$

- Example: Acceleration on a Bicycle

Time (s)	Speed (m/s)
0.0	0.0
10.0	2.0
20.0	4.0
30.0	6.0
40.0	8.0
50.0	10.0



- A velocity-time graph can be used to: calculate acceleration = slope of the line
  : calculate distance travelled = area under the line

$$\text{ave. } \vec{a} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x}$$
$$= \frac{10-0}{50-0}$$
$$= \frac{10}{50}$$
$$= 0.20\ m/s^2$$

$d = \frac{1}{2}bh$ (bcs it is a triangle)
$$= \frac{50 \times 10}{2}$$
$$= \frac{500}{2}$$
$$= 250m$$

Acceleration = 0.2m/s²

Distance = 250m