1   Acceleration

> **Definition 1.0.1**
> **Acceleration**, $\vec{a}_{av}$, refers to the rate of change of velocity, or in other words the ratio of the change of velocity to the time elapsed. (**Units:** m/s^2)
> $$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}$$

First we note that acceleration is a vector quantity because $\Delta \vec{v}$ is a vector quantity. Acceleration is experienced any time an object is increasing or decreasing its velocity, *any* change in velocity results in acceleration. For example, you must initially accelerate your vehicle in order for it to reach the desired velocity, similarly you must first *accelerate* your vehicle in order to come to a stop and change your velocity to $(+0\,\text{m}/\text{s})$.

Remark : It is common to hear the term *de-accelerate*, however this term is rather redundant because the term acceleration refers to any change in velocity, regardless of weather you would like to increase your velocity or bring yourself to a holt $(\vec{v} = +0\,\text{m}/\text{s})$.

> **Definition 1.0.2**
> A **velocity-time graph** is a plot describing the motion of an object, with velocity on the vertical axis and time on the horizontal axes.

Similar to the analogy of how a Pos V. Time plot helps us understand velocity better, a Velocity V. Time plot will help us understand acceleration better. Again we mention some basic properties, again we take the reference point to be $(0,0)$. Also we take the positive direction of motion to be above the vertical axes.
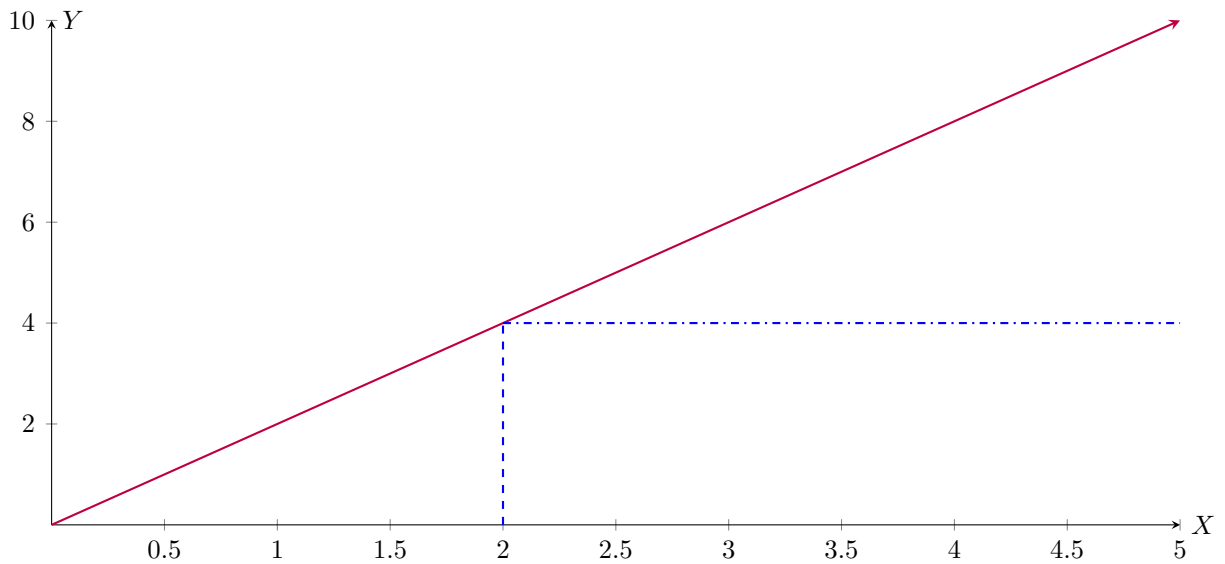
(a)
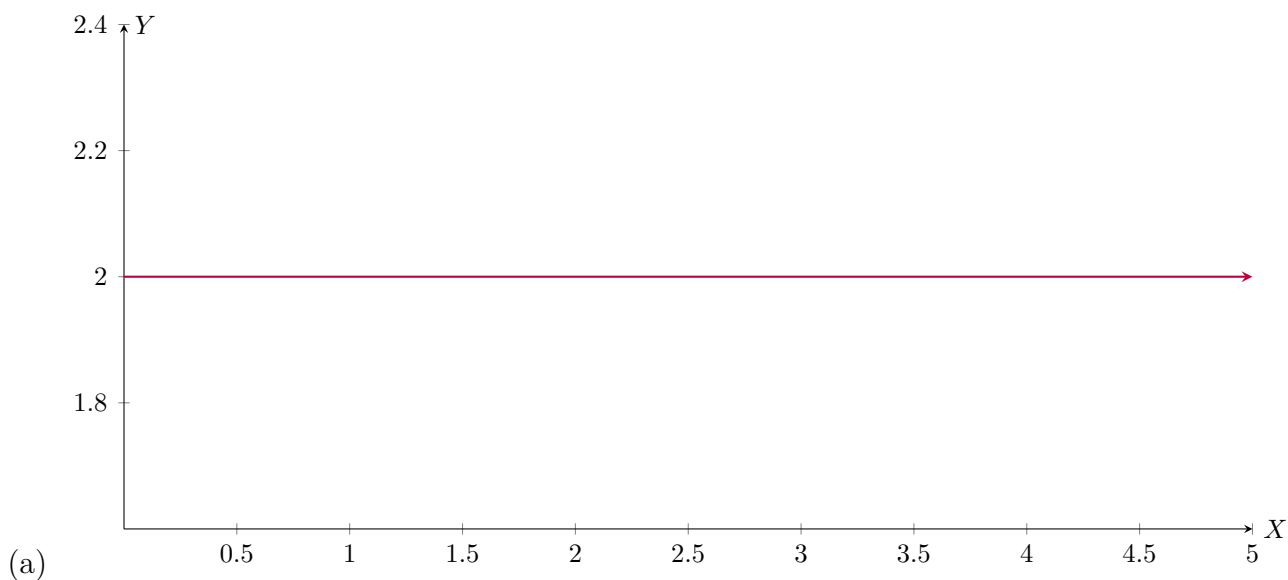
Properties of type (a):

- The slope of the graph is zero, hence $\vec{a}_{av} = +0\,\mathrm{m/s}$.
- The item is at **rest**.
- The object is [East] relative to the reference point (0,0).
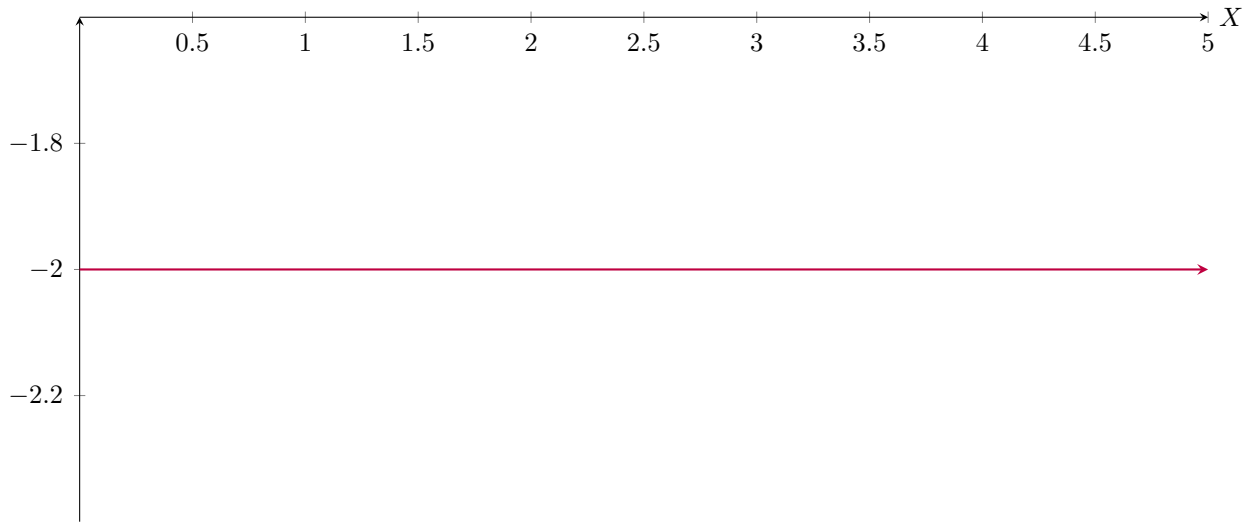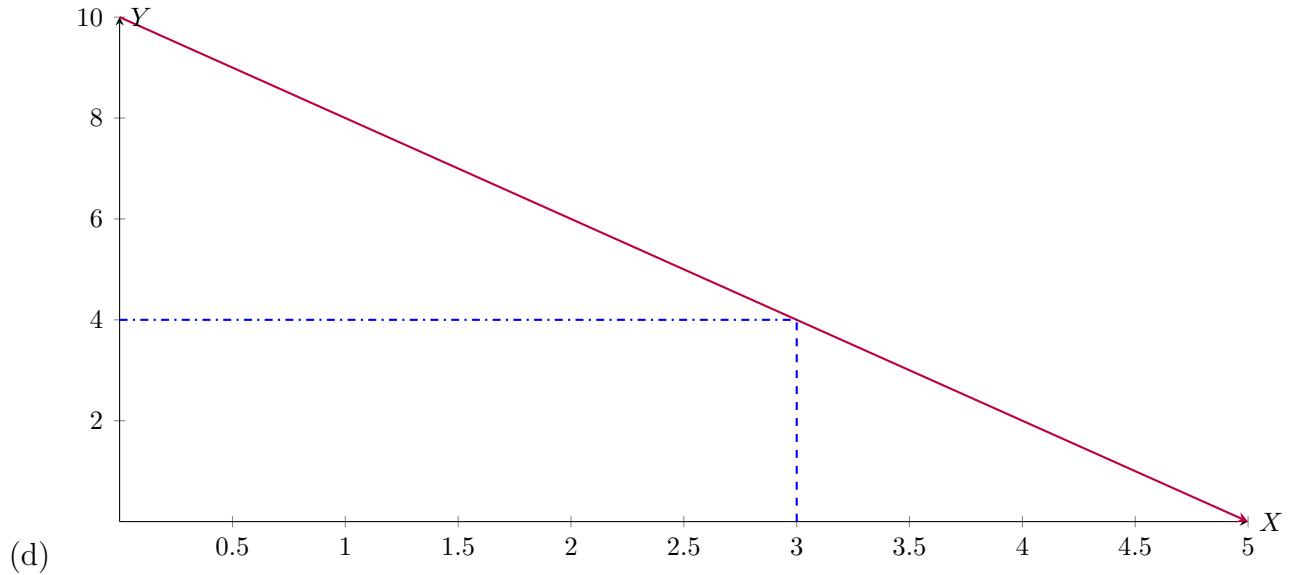
(b)

Properties of type (b):

- The slope of the graph is zero, hence $\vec{v}_{av} = +0\,\mathrm{m/s}$.
- The item is at **rest**.
- The object is [West] relative to the reference point (0,0).

(c)

Properties of type (c):

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- The slope of the graph is $m = +2$, hence $\vec{v}_{av} = +2\,\mathrm{m/s}$.

- The item experiencing **uniform motion** or **constant velocity**.

- The object is traveling in the [East] direction.

(d)

Properties of type (c):

- The slope of the graph is $m = -2$, hence $\vec{v}_{av} = -2\,\mathrm{m/s}$.

- The item experiencing **uniform motion** or **constant velocity**.

- The object is traveling in the [West] direction.