**T1 Final Exam Preparation**

Name: Solutions

Date: ______

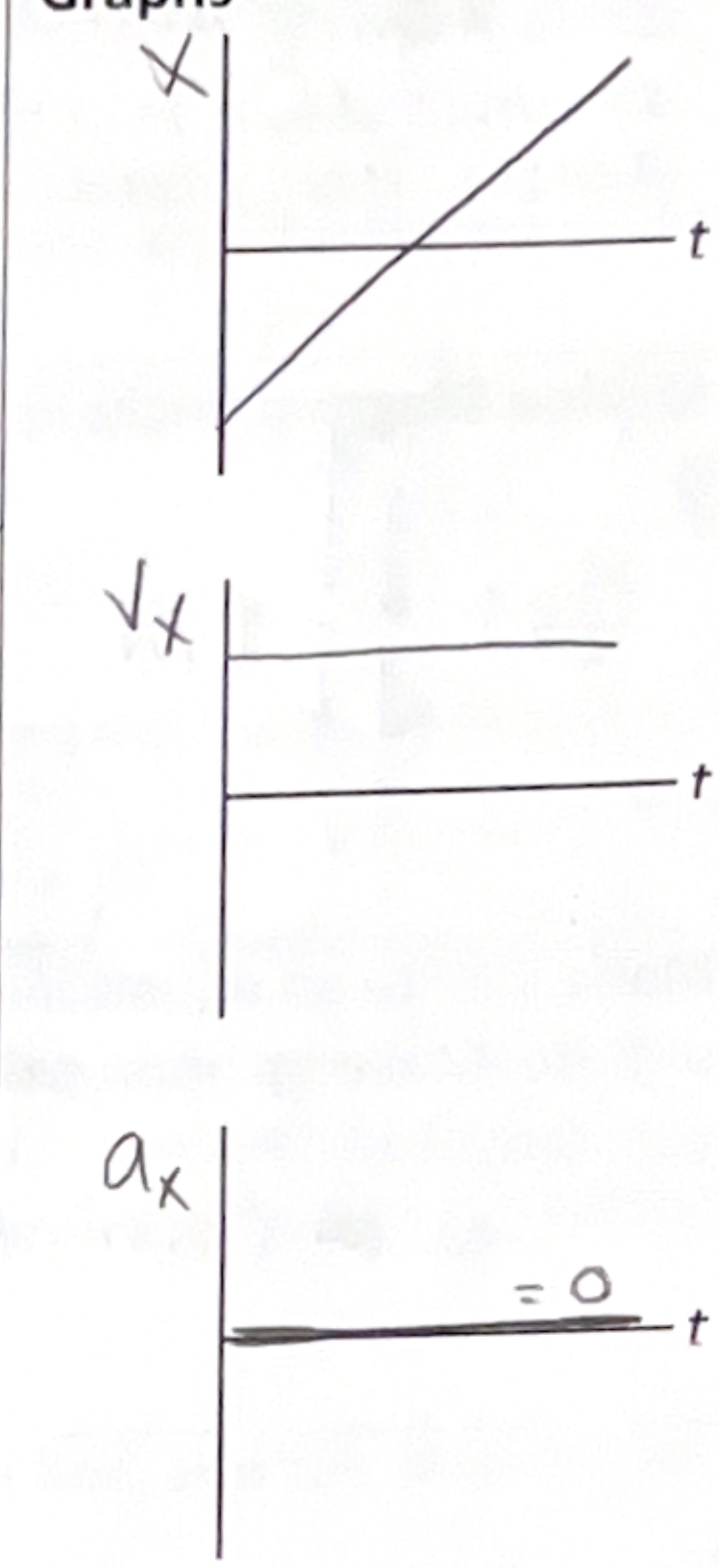
**Complete the missing representations**

1.

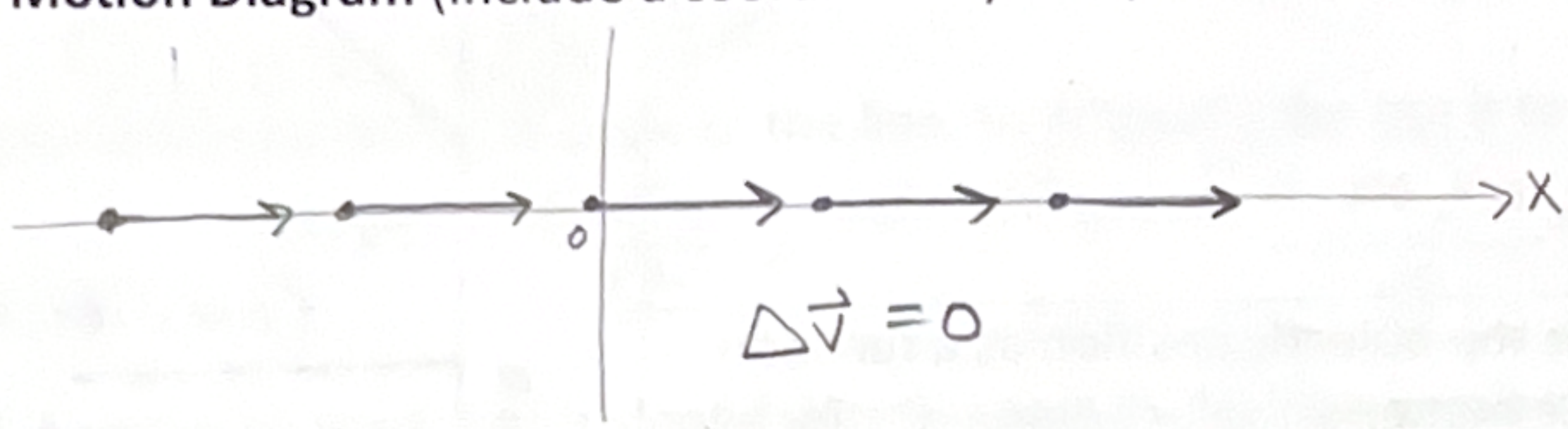
**Words** (Describe initial speed and position, the direction it is moving, and what is happening to its speed.)

***An object starts at a negative position and is initially moving in the positive direction. It continues moving in the positive direction at a constant speed.***

**Graphs**




**Motion Diagram** (Include a coordinate system)




**Math:** (Write an equation for the object's position as a function of time. Make up appropriate numerical values with units for all constants.) $x_f = x_i + v_x \Delta t$ Let $t_i = 0$, $t_f = t$ Let $x_f$ be $x$

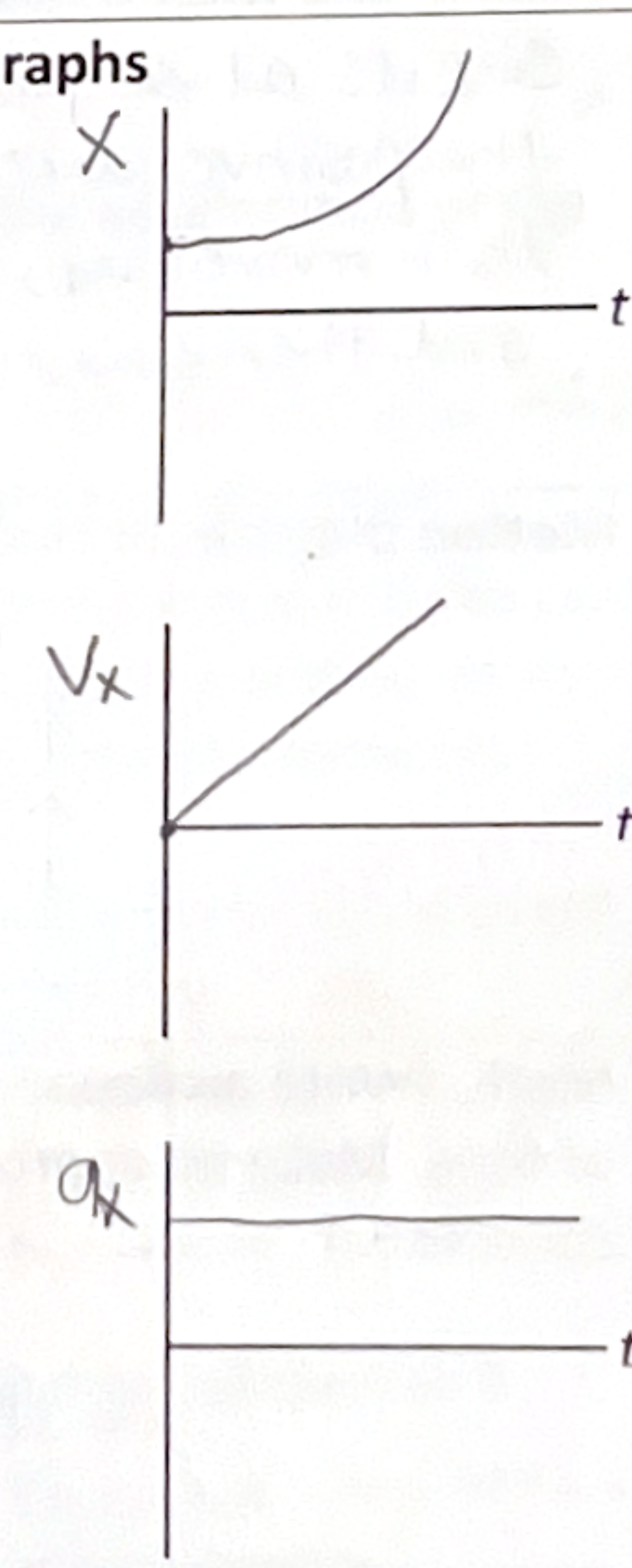
$$\boxed{x = (-3m) + (6\,m/s)t}$$

2.

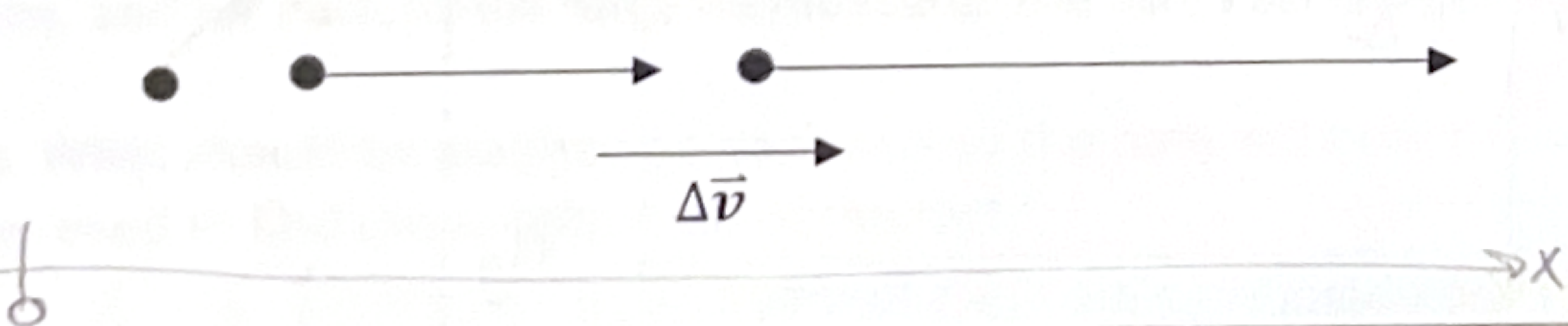
**Words** (Describe initial speed and position, the direction it is moving, and what is happening to its speed.)

Starts at rest at a positive position
It moves in the positive direction with increasing speed.

**Graphs**




**Motion Diagram** (Include a coordinate system)




**Math:** (Write an equation for the object's position as a function of time. Make up appropriate numerical values with units for all constants.) $x_f = x_i + v_{ix}\Delta t + \frac{1}{2}a_x \Delta t^2$

Let $t_i = 0$
$t_f = t$
$x_f = x$

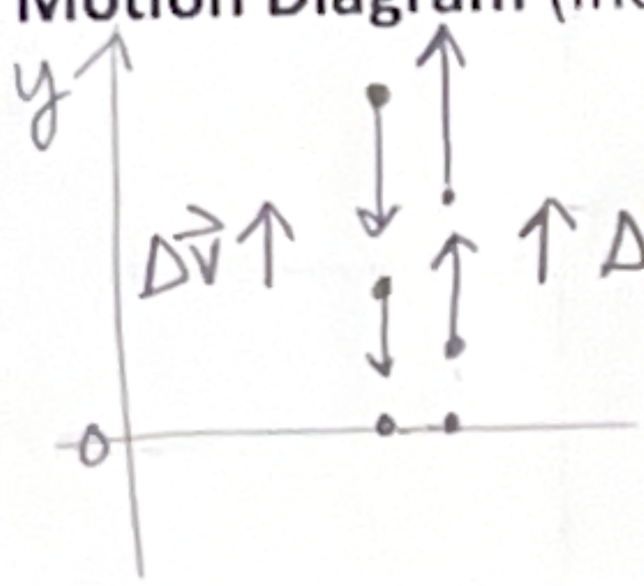
$$\boxed{x = (3m) + (0)t + \tfrac{1}{2}(2\,m/s^2)t^2}$$

3.

**Words** (Describe initial speed and position, the direction it is moving, and what is happening to its speed.)

Initial position could be anything.
It is moving initially in the − direction.
It slows down in neg. direction, then stops instantaneously, then speeds up in the + direction

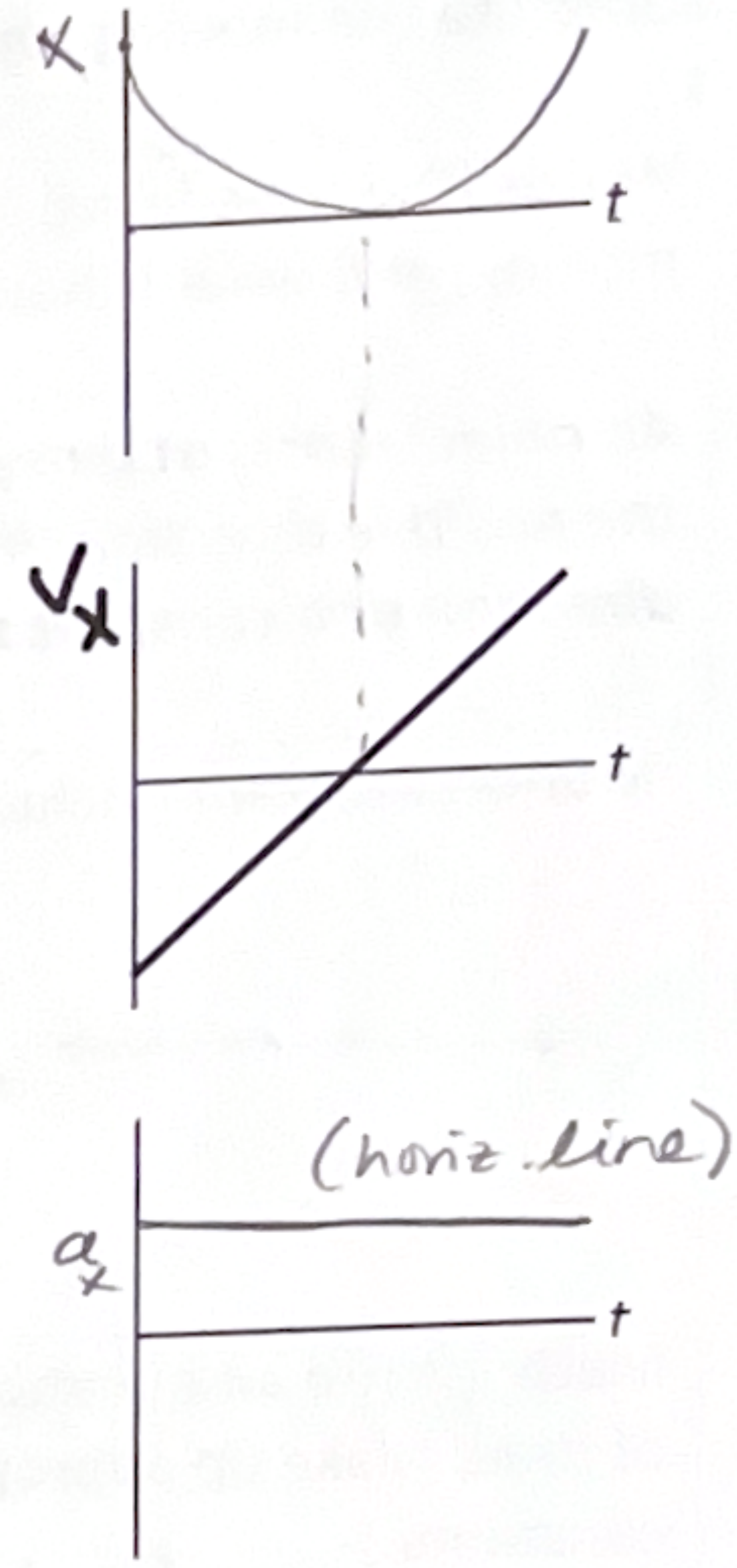
**Motion Diagram** (Include a coordinate system)




**Math**: (Write an equation for the object's position as a function of time. Make up appropriate numerical values with units for all constants.)

$$y = (10\ m) + (-20\ m/s)t + \tfrac{1}{2}(+5\ m/s^2)t^2$$

**Graphs**

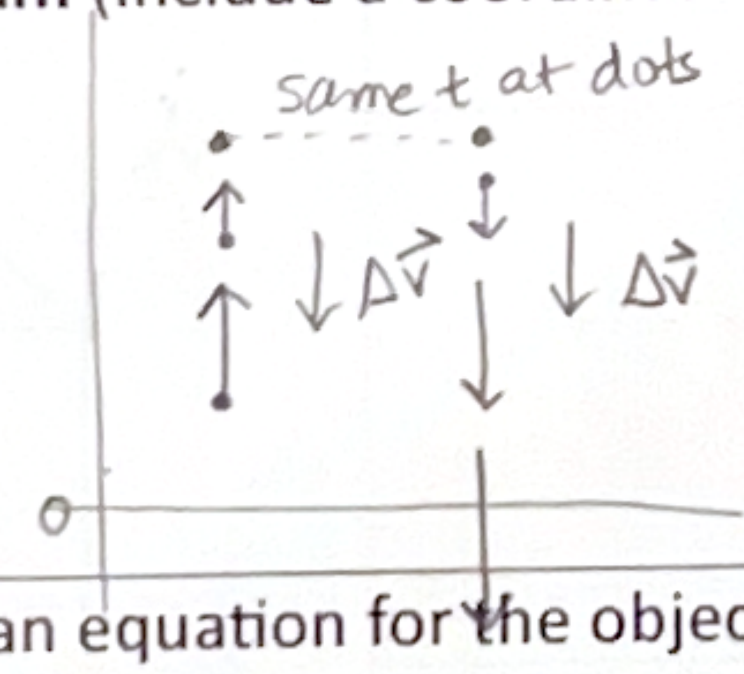



4.

**Words** (Describe initial speed and position, the direction it is moving, and what is happening to its speed.)

Starts at a positive position and moving in the positive direction.
As it moves up, it slows down, stops instantaneously, and then speeds up in the negative direction.

**Motion Diagram** (Include a coordinate system)



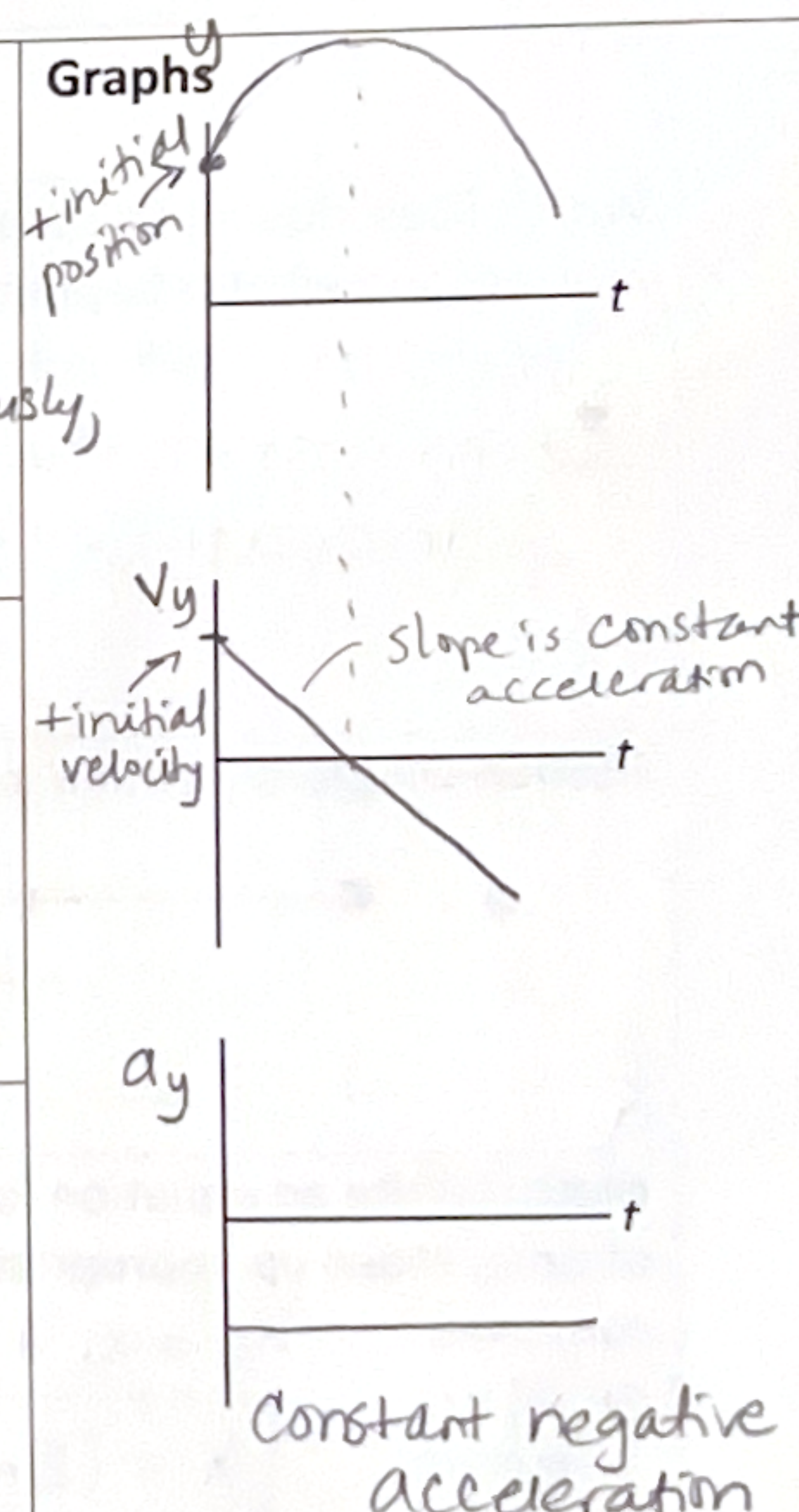

**Math**: (Write an equation for the object's position as a function of time. Make up appropriate numerical values with units for all constants.)

$$y = 32\,m + \left(6\frac{m}{s}\right)t - \left(3\frac{m}{s^2}\right)t^2$$

$$+\tfrac{1}{2}(-3\ m/s^2)t^2$$

$V_{iy} = +6\ m/s$ $\quad a_y = -3\ m/s^2$

**Graphs**



## Plan the analysis of experimental data to find a constant quantity

5. Penny is on the surface of Earth. She knows the radius of Earth is rE, and she wants to find the mass of Earth. She hangs an object of known mass $m_O$ on a spring scale, which allows her to find the force exerted by Earth on the object, $F_{E\ on\ O}$. She collects force and mass data for six different objects.

a. What should she graph on each axis so the data will be a straight line, and the slope could be used to find the mass of Earth?

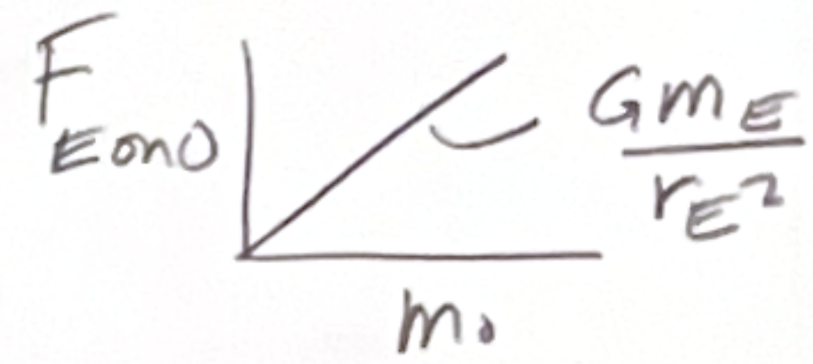
$F_{E\,on\,O} = \frac{G m_E m_o}{r_E^2}$

constant

$F_{E\,on\,O} = \left(\frac{G m_E}{r_E^2}\right) m_o$

x-axis: $m_o$

y-axis: $F_{E\,on\,O}$

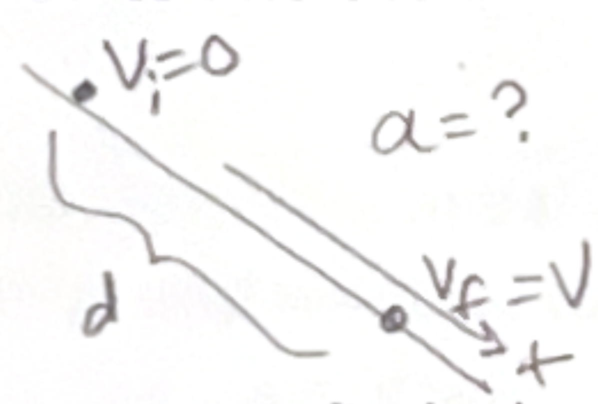



b. Once Penny finds the slope of the line, how should she use it to find the radius of Planet X?

slope $= \frac{G m_E}{r_E^2}$, so $m_E = \frac{(\text{slope})(r_E)^2}{G}$. She should do this calculation.

6. A cart is on track that is sloped. James wants to find the acceleration of a cart on this ramp experimentally. He releases a cart from rest and measures the speed of the cart *v* using a photogate after it has traveled a distance *d*. He then repeats the experiment using five different distances, measuring the speed of the cart at each distance.

a. What should be graphed on each axis so the data will be a straight line, and the slope could be used to find the acceleration of the cart?




$V_{fx}^2 = V_{ix}^2 + 2a\Delta x$

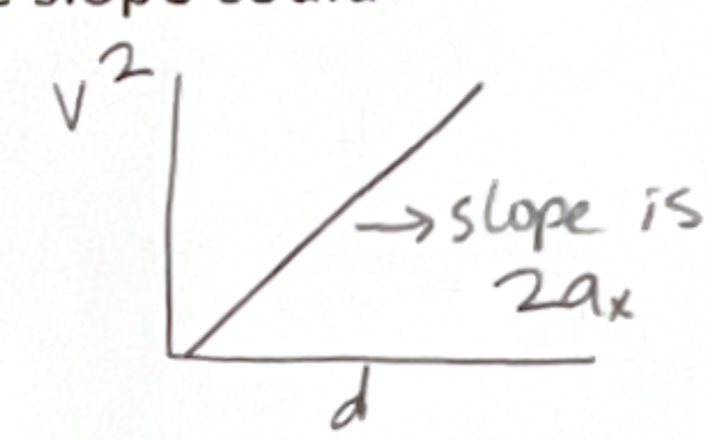
$V^2 = (2a_x)d$ ← x-axis

↑ y-axis

constant slope

x-axis: d

y-axis: $V^2$




b. Once James finds the slope of the line, how should he use it to find the acceleration of the cart?

The slope is $2a_x$, so slope $= 2a_x$.

$a_x = \frac{2}{\text{slope}}$ ← He needs to do this calculation

7. Jude wants to use a fan cart on a horizontal track to experimentally find the mass of the cart. He measures and applies five different thrust forces to the cart by changing the setting on the fan, and for each thrust force he measures the cart's acceleration using a motion detector.

a. What should be graphed on each axis so the data will be a straight line, and the slope could be used to find the acceleration of the cart?

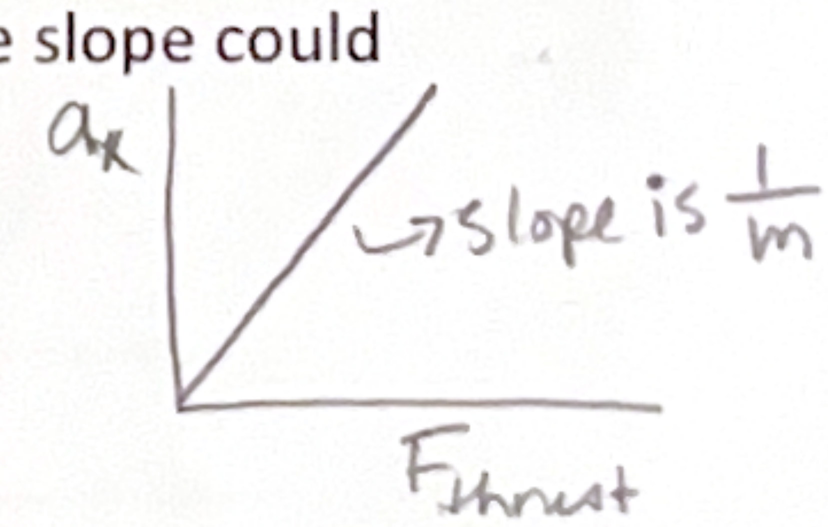
If no friction, $\Sigma F_{on\,c\,x} = F_{thrust}$

$a_x = \frac{\Sigma F_{on\,c\,x}}{m_c} \Rightarrow a_x = \frac{1}{m} F_{thrust}$

constant

x-axis: $F_{thrust}$

y-axis: $a_x$




b. Once Jude finds the slope of the line, how should he use it to find the mass of the cart?

slope $= \frac{1}{m}$, so $m = \frac{1}{\text{slope}}$ ← He should do this calculation.