SPH4U0-Feb. 2019 **Kinematics Review Quest-** Name:_____

Total: _____/39 marks [K/U]

Useful Equations:

$v_{av} = \frac{\Delta d}{\Delta t}$ $a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{\Delta t}$ $\Delta d = \frac{1}{2}(v_1 + v_2)\Delta t$ $\Delta d = v_2 \Delta t - \frac{1}{2} a (\Delta t)^2$

$\Delta d = v_1 \Delta t + \frac{1}{2} a (\Delta t)^2$ $\Delta d = \frac{v_2^2 - v_1^2}{2a}$

Part A: Multiple Choice Answers [8 marks]:

Write the letter representing the best answer for each question in the table below:

1	2	3	4	5	6	7	8
A	E	B	E	A	D	D	E

Part B: Short Answer and Problem Solving [30 marks] + 1 mark Sig Digs:

1. A delivery truck travels 5.0 km [North] in a time of 15.0 minutes and then 7.0 km [South] in 25.0 minutes. What is the truck's average velocity and average speed? [4]

$\vec{\Delta d_1} = 5.0\,km\,[N]$
$\vec{\Delta d_2} = 7.0\,km\,[S]$
$\Delta t_1 = 15.0\,min$
$\Delta t_2 = 25.0\,min$
$\vec{\Delta d_R} = ?$ $\vec{v}_{av} = ?$
$\Delta d_T = ?$ $v_{av} = ?$

Let S ↕

$\vec{\Delta d_R} = \vec{\Delta d_1} + \vec{\Delta d_2}$
$= -5.0\,km + 7.0\,km$
$= 2.0\,km\,[S]$

$\Delta t_T = 40.0\,min$
$= 0.667\,h$

$\vec{v}_{av} = \frac{\vec{\Delta d_R}}{\Delta t_T} = \frac{2.0\,km\,[S]}{0.667\,h} = 3.0\,km/h\,[S]$ OR $0.050\,\frac{km}{min}\,[S]$

$\Delta d_T = \Delta d_1 + \Delta d_2$
$= 12.0\,km$

$v_{av} = \frac{\Delta d_T}{\Delta t_T} = \frac{12.0\,km}{40.0\,min}$
$= 0.30\,km/min$
OR $18\,km/h$

2. A hockey puck is sliding at 12.0 m/s [Forward] when it hits a rough patch of ice. If it accelerates at a rate of 1.25 m/s^2[Backward], find the puck's velocity and displacement after 8.00 seconds. [5]

$\vec{v}_1 = 12.0\,m/s\,[F]$
$\vec{a} = 1.25\,m/s^2\,[B]$
$\Delta t = 8.00\,s$
$\vec{v}_2 = ?$
$\vec{\Delta d} = ?$

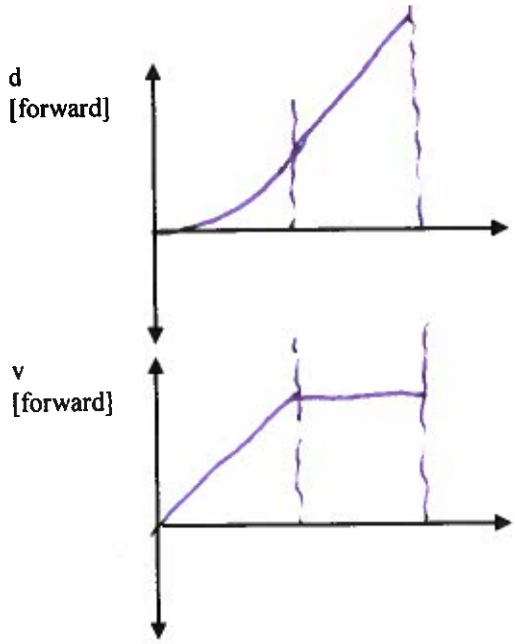
Let F ↕

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$
$= 12.0\,m/s + (-1.25\,m/s^2)(8.00\,s)$
$= 2.00\,m/s\,[F]$

$\vec{\Delta d} = \vec{v}_1 \Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$= (12.0\,m/s)(8.00\,s) - \frac{1}{2}(1.25\,m/s^2)(8.00\,s)^2$
$= 56.0\,m\,[F]$

3.

a) A sprinter competing in the Indoor Track and Field Championships accelerates from rest at 2.50 m/s^2 over the first 40.0 m of the race. He then runs the remaining 60.0 m of the race at his top speed.
Sketch position- time and velocity-time graphs for the sprinter on the axes provided. Make sure to label your graphs! [2]



b) Find the sprinter's top velocity at the end of his acceleration phase. [3]

$\vec{V}_1 = 0.0\,m/s$

$\Delta\vec{d} = 40.0\,m\ [F]$

$\vec{V}_2 = ?$

$\vec{a} = 2.50\,m/s^2\ [F]$

$\Delta\vec{d} = \dfrac{\vec{V}_2^{\,2} - \vec{V}_1^{\,2}}{2\vec{a}}$

$V_2^2 = 2a\Delta d$

$V_2 = \sqrt{2a\Delta d} = \sqrt{2(2.50\,m/s^2)(40.0\,m)} = 14.1\,m/s\ [F]$

c) Find the total time for him to run the race! [3]

$\Delta d_2 = 60.0\,m \quad V_2 = 14.1\,m/s\ [F]$

$\Delta t_2 = ?$

$\Delta t_1 = ?$

$\Delta t_T = ?$

$V = \dfrac{\Delta d_2}{\Delta t_2} \rightarrow \Delta t_2 = \dfrac{\Delta d}{V}$

$= \dfrac{60.0\,m}{14.1\,m/s}$

$= 4.243\,s$

$\Delta d_1 = \frac{1}{2} a \Delta t_1^2$

$\Delta t_1 = \sqrt{\dfrac{2\Delta d_1}{a}} = \sqrt{\dfrac{2(40.0\,m)}{(2.50\,m/s^2)}} = 5.657\,s$

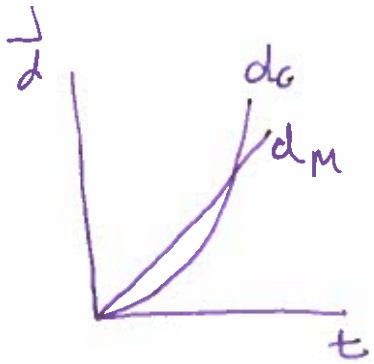
$\therefore \Delta t_T = \Delta t_1 + \Delta t_2 = 5.657\,s + 4.243\,s$

$= 9.90\,s$

ners, Mickey and Goofy are playing a game of tag. Goofy is standing still when
ns past him at a constant speed of 4.00 m/s. As soon as Mickey passes Goofy,
celerates from rest at a rate of 1.75 m/s^2. Find the time it takes Goofy to catch Mickey
ar he has to run to catch Mickey. [5]

(S CP)

$/s^2$ CP)



$\Delta d_M = V_M \cdot \Delta t$ $\Delta d_G = \frac{1}{2} a_G \Delta t^2$

Let $\Delta d_M = \Delta d_G$

$V_M \Delta t = \frac{1}{2} a_G \Delta t^2$

$4.00 \Delta t = 0.875 \Delta t^2$

$0 = 0.875 \Delta t^2 - 4.00 \Delta t$

$\therefore 0 = \Delta t (0.875 \Delta t - 4.00)$

$\therefore \Delta t = 0$ OR $0.875 \Delta t - 4.00 = 0$

$\Delta t = \frac{4.00}{0.875} = 4.57\text{s}$

point:

$d_M = V_M \Delta t$

$= (4.00 \text{ m/s})(4.57\text{s})$

$= 18.3 \text{ m}$

$\therefore$ Goofy catches Mickey in 4.57s after running 18.3m

rk Sig Digs

4. Two run
Mickey ru
Goofy acc
and how f

$V_{IG} = 0.0 m/s$

$\vec{V}_M = 4.00 m$

$\vec{a}_G = 1.75 m$

$\Delta d = ?$

$\Delta t = ?$

meeting

Δ

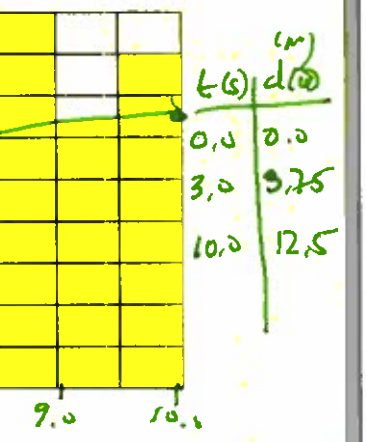
____/ 1 ma

shown on the

[3]

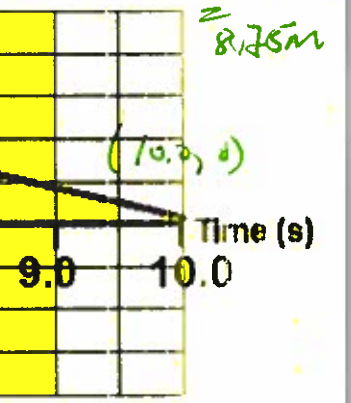
sponding

[5]

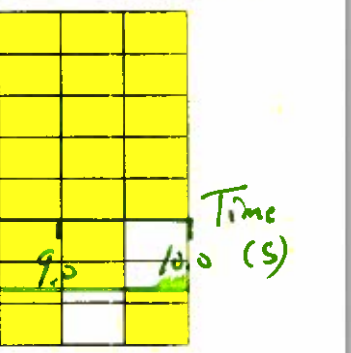


$\Delta d_2 = \frac{1}{2}(7.0)(2.5)$

$= 8.75\text{m}$



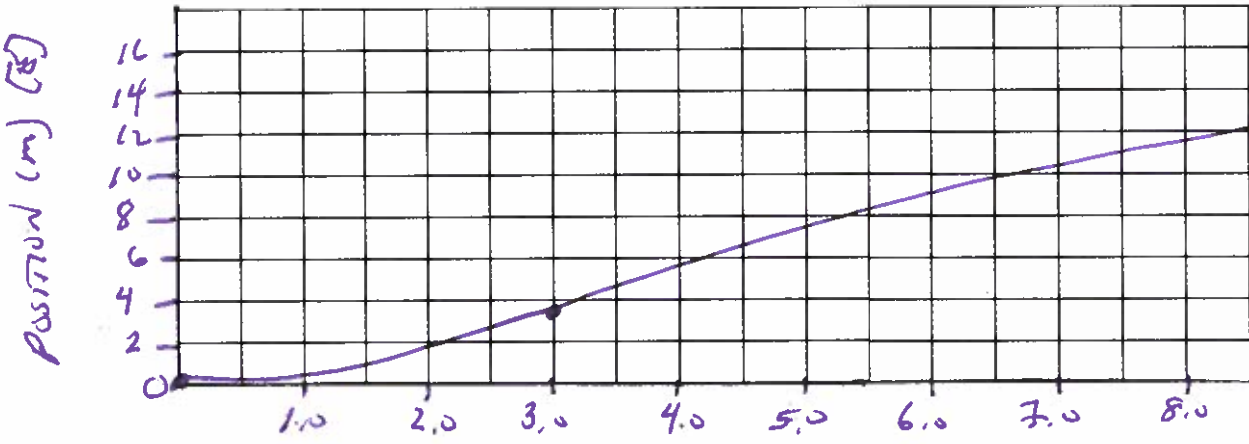
$\frac{-2.5}{+7.0} = -0.357\ m/s^2$



Part C: Graph Analysis [8 marks]

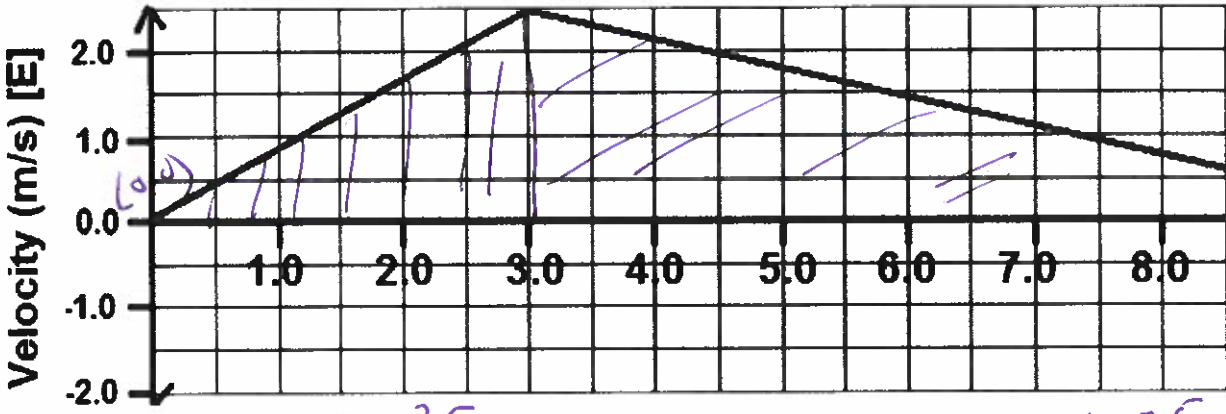
1. The motion of a train engine moving along a straight track in a railyard is velocity-time graph below.
   i) Draw the corresponding acceleration-tine graph for the train.
   ii) **Assuming that the train starts at the station (origin)**, draw the corre position-time graph.

Position-Time Graph:



Velocity-Time Graph: (3.0, 2.5)

$\Delta d_1 = \frac{1}{2}(3.0)(2.5) = 3.7$



$a_1 = \frac{2.5-0}{3.0-0} = 0.833\ m/s^2$

$a_2 = \frac{0.0-2.5}{10.0-3.0} =$

Acceleration-Time Graph: