Rasulan, S.
+60105520080
KMSw

PS2: Kinematics

1 Basics

1.1 Definitions and statements

Define the following terms:

1. Instantaneous velocity
2. Instantaneous acceleration
3. Average velocity
4. Average acceleration
5. Uniform velocity
6. Uniform acceleration

1.2 Equations

1. Given the equations

$$v = u + at$$
$$s = ut + \frac{1}{2}at^2$$
$$v^2 = u^2 + 2as$$

   Define the variables v, u, a, t and s.

2. Write down the equation (of the 3 given above) that you can utilize in the following situation and justify your choice:
   (a) Finding the final velocity of a body moving at constant acceleration with a known time range and initial velocity.
   (b) Finding the average acceleration of a body with a known initial and final velocity in a given time.
   (c) Finding the average acceleration of a moving body of which its initial and final velocity is known but not it's time of travel.

3. Sketch out the graphs → write down the equation used to sketch out the graphs → explain what the **area under the graph** and **the gradient** of the graph represents physically, for the following graphs:
   (a) Displacement-time graph
   (b) Velocity-time graph
   (c) Acceleration-time graph

4. Sketch the path of a projectile (label your x and y axes!) and describe it in words → Write the equations for displacement, s_x and s_y , in the 2 axes.
   Helpful tips:
   - Is there a source of acceleration in the x and/or y axis?
   - Remember that $u^2 = u_x^2 + u_y^2 = u^2 sin^2(\theta) + u^2 cos^2(\theta)$

5. For the projectile path, determine the maximum height (and range) and explain the conditions for the determination of the maximum height (and range). Explain how the angle of release determines the range and maximum height.

6. Determine the time of flight for a projectile of which its initial and final height is known to be the same.

7. **Extra:** How will these projectile motion equations (in questions 4 to 6) differ in the case where air resistance is not assumed to be 0?

8. **Extra:** Show that the maximum range for a projectile is always when the angle is release, θ, is 45^o.