

1. **Displacement, s** , is the change of position of a particle with respect to the fixed point O at an instant. It has both **magnitude** (distance from the initial position to the final position) and **direction** (direction from the initial position to the final position). It can be positive, zero or negative.

- If $s > 0$, the particle is in the positive s -axis
- If $s = 0$, the particle is at the fixed point O
- If $s < 0$, the particle is in the negative s -axis

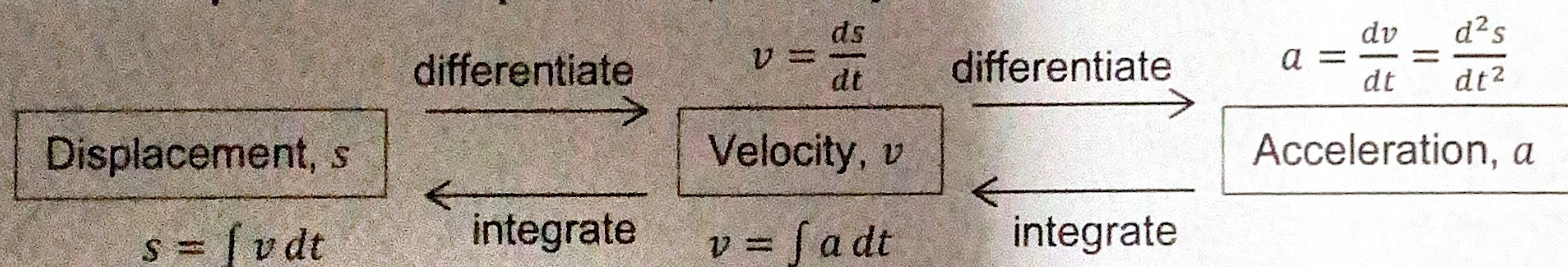
2. **Velocity, v** , is the rate of change of displacement with respect to time. It is given by $\frac{ds}{dt}$ and can be seen as speed with direction. It can be positive, zero or negative.

- If $v > 0$, the particle is moving in the direction of positive displacement (positive s -axis)
- If $v = 0$, the particle is **instantaneously at rest**
- If $v < 0$, the particle is moving in the direction of negative displacement (negative s -axis)

3. **Acceleration, a** , is the rate of change of velocity with respect to time. It is given by $\frac{dv}{dt}$ and its direction is dependent on the velocity of the particle (increases/ decreases) and the direction of the moving particle (positive/ negative displacement).

- If $a > 0$, the velocity increases with respect to time, and the particle is accelerating
- If $a < 0$, the velocity decreases with respect to time, and the particle is decelerating

4. Relationship between Displacement, Velocity and Acceleration



5. Common Terms in Kinematics

- Initial: Time, $t = 0$
- At rest/ stationary: Velocity, $v = 0$
- Particle at fixed point: Displacement, $s = 0$
- Maximum/ minimum displacement: Velocity, $v = 0$
- Maximum/ minimum velocity: Acceleration, $a = 0$

6. **Average Speed** = $\frac{\text{Total Distance travelled}}{\text{Total time taken}}$

7. **Distance travelled** is different from **displacement** as it does not have direction.

To find distance travelled in the first n seconds,

- **Step 1:** Find the value(s) of t when $v = 0$.
- **Step 2:** Use each of the value(s) of t found in Step 1 to find s .
- **Step 3:** Find the value of s when $t = 0$ and $t = n$.
- **Step 4:** Draw the path of the particle to visualise the movements of the particle using the displacements found to find the total distance travelled by the particle.