

**Mathematics Questions by Topic**

Motion and Force

Answer 36

Source: K10SM2Q18

**Question 36**

An object of mass  $m$  kg is projected downwards from a point  $P$ , with an initial speed of  $U$  m/s. The object falls under the influence of gravity in a medium which offers resistance proportional to the velocity. Take the initial position as  $y = 0$  and downwards as the positive direction. If  $k$  is a positive constant, which of the following most accurately reflects the situation ?

- A.  $\ddot{y} - k\dot{y} = mg$     $y(0) = 0$     $\dot{y}(0) = U$
- B.  $\ddot{y} - k\dot{y} = g$     $y(0) = 0$     $\dot{y}(0) = -U$
- C.  $\ddot{y} + k\dot{y} = mg$     $y(0) = 0$     $\dot{y}(0) = U$
- D.  $\ddot{y} + k\dot{y} = mg$     $y(0) = 0$     $\dot{y}(0) = -U$
- E.  $\ddot{y} + k\dot{y} = g$     $y(0) = 0$     $\dot{y}(0) = U$

**ANSWER E**

motion is downwards, positive direction

$$m\ddot{y} = mg - R \quad \text{where} \quad R = Kv = K\dot{y}$$

$$m\ddot{y} = mg - K\dot{y}$$

$$m\ddot{y} = mg - K\dot{y}$$

$$m\ddot{y} + K\dot{y} = mg \quad \text{let} \quad k = \frac{K}{m}$$

$$\ddot{y} + k\dot{y} = g \quad y(0) = 0 \quad \dot{y}(0) = U$$

