

Linear Motion Calculations

Activity 1a

- A car starts from rest and accelerates at a constant rate. It takes 8 seconds to accelerate from 20 ms^{-1} to 25 ms^{-1} .
 - calculate the distance travelled to increase its speed from 20 ms^{-1} to 25 ms^{-1} .
 - Calculate the total time it took to reach 25 ms^{-1} .
- A girl throws a ball vertically upwards at 6 ms^{-1} from a platform which is descending at a steady 2 ms^{-1} . The girl then catches the ball after the lift has dropped for a time t .
 - Equate expressions for the displacement of the platform and the displacement of the ball after a time t .
 - Calculate the time t
 - Calculate the distance the platform has moved
 - Calculate how far the platform would have moved if it had been travelling upwards and the girl had thrown and caught the ball.
- A Ferrari can accelerate from 0 - 60 mph (27 ms^{-1}) in 6 seconds.
 - Calculate the car's acceleration and how long it would take to reach light speed if the car obeyed Newtonian instead of relativistic mechanics. Express your answer in years!
 - How far would the car have travelled in this time?
- An object moves with acceleration of -7 ms^{-2} . At time $t = 0$ the object was at displacement 0 m, travelling with velocity 36 ms^{-1} . Use two definite integrals to calculate.
 - The velocity change after 5s
 - The displacement at $t = 5 \text{ s}$.

5. The displacement of an object is given by the equation

$$s = 2t^2 - 3t + 1$$

By differentiation if necessary calculate the:

- displacement of the object at $t = 4 \text{ s}$.
 - speed of the object at $t = 2 \text{ s}$.
 - the acceleration of the object at $t = 3 \text{ s}$.
6. The acceleration of a rocket is given by the equation:

$$a = 2.5t + 0.7 \text{ while the fuel burns for the first 3 s}$$

If the rocket is launched from rest at time $t = 0$. Calculate the

- Acceleration at $t = 3 \text{ s}$
- Velocity at $t = 3 \text{ s}$
- Displacement at $t = 3 \text{ s}$.