

EOM Examples

Year 11 Term 2

Worked Example Q1

A car accelerates from the lights, 0 to 60 km/h in 4.0 seconds

Find the distance covered in that time.

$$u = 0 \text{ m/s}$$

$$v = \frac{60 \text{ km/h}}{3.6} = 17 \text{ m/s}$$

$$t = 4.0 \text{ s}$$

$$= \frac{1}{2}(u+v)t$$

$$= \frac{1}{2}(0 + 17 \text{ m/s}) \times 4 \text{ s}$$

$$= 34 \text{ m}$$

(This is an average speed of 8.5 m/s over the 4 seconds.)

Worked Example Q2

The brakes & tyres of a car can provide a maximum deceleration of around 6 m/s^2 . If a car is traveling at 100 km/h , what is the minimum distance in which it could stop?

$$u = \frac{100 \text{ km/h}}{3.6} = 28 \text{ m/s}$$

$$a = -6 \text{ m/s}^2$$

$$v = 0 \text{ m/s}$$

$$= \frac{v^2 - u^2}{2a}$$

$$= \frac{(0 \text{ m/s})^2 - (28 \text{ m/s})^2}{2 \times -6 \text{ m/s}^2}$$

$$= 65 \text{ m}$$

(Stopping distance varies with the square of speed.
 $2 \times \text{speed} = 4 \times \text{stopping distance.}$)

Worked Example Q3

A tennis ball is hit upwards at a speed of 15 m/s.

How high does the ball go? How long does it take to hit the ground?

$$u = 15 \text{ m/s}$$

$$a = -10 \text{ m/s}^2$$

Acceleration due to gravity
 $g \approx 10 \text{ m/s}^2$

$$a = \frac{v-u}{t} \quad t = \frac{v-u}{a}$$

$$t = \frac{-15 \text{ m/s} - 15 \text{ m/s}}{-10 \text{ m/s}^2}$$

$$t = 3 \text{ s}$$

If the ball lands at the height
that it was hit from:

$$v = -15 \text{ m/s}$$

Worked Example Q3 continued

Maximum height at 1.5 s, $v = 0$

$$\begin{aligned} &= \frac{1}{2}(u+v)t \\ &= \frac{1}{2}(15 \text{ m/s} + 0 \text{ m/s})(1.5 \text{ s}) \\ &= 11.25 \text{ m} \end{aligned}$$

Worked Example Q4

Objects falling (or rising up) experience an acceleration due to the force of gravity.

$$g \text{ (on Earth)} = 9.81 \text{ m/s}^2 \approx 10 \text{ m/s}^2$$

Time (s)	Speed	Distance
0	0 m/s	0 m
1	10 m/s	5 m
2	20 m/s	20 m
3	30 m/s	45 m
4	40 m/s	80 m
5	50 m/s	125 m

0 m
5 m

20 m

45 m

80 m

125 m

Worked Example 5

- A ball is dropped from the leaning tower of Pisa, at a height of 50m from the ground. The ball is dropped from rest and falls freely under gravity.
- How long will it be before the ball hits the ground?
- $s = 50$, $a = 9.8$, $u = 0$ and we want to find t
- The equation connecting these four is $s = ut + \frac{1}{2} at^2$

Worked Example 5 continued

- So $50 = 0 + \frac{1}{2} \times 9.8 \times t^2$
Rearranging: $t^2 = 10.20408$
 $t = 3.19\dots$
the time taken is 3.19s (3sf)