

# Revision 1

## Jack Maguire

### Question 1

a

$$\begin{aligned}v^2 &= u^2 + 2as \\0 &= (25 \sin 35)^2 - 2 * 9.8 * s \\s &= \frac{14.3^2}{19.6} \\&= 10.5 \text{ m}\end{aligned}$$

b

$$\begin{aligned}s &= ut + at^2 \\0 &= 25t \sin 35 - 9.8t^2 \\t &= 0, 2.551 \\s &= ut - \frac{at^2}{2} \\&= 25 * 2.551 * \cos 35 - 0 \\&= 52.2 \text{ m}\end{aligned}$$

### Question 2

$$\begin{aligned}s &= ut - \frac{at^2}{2} \\-28 &= 0 - 4.9t^2 \\t &= \sqrt{\frac{28}{4.9}} \\&= 2.39 \dots\end{aligned}$$

$$\begin{aligned}s &= ut - \frac{at^2}{2} \\45 &= 2.39u - 0 \\u &= \frac{45}{2.39} \\&= 18.8 \text{ m s}^{-1}\end{aligned}$$

### Question 3

a

$R(x)$

$$\begin{aligned}s &= ut - \frac{at^2}{2} \\&= 15 * 0.6t - 0 \\&= 9t \\x &= 9t\end{aligned}$$

$R(y)$

$$\begin{aligned}s &= ut - \frac{at^2}{2} \\&= 15 * 0.8t - \frac{10 * t^2}{2} \\&= 12t - 5t^2 \\y &= 12t - 5t^2\end{aligned}$$

b

$$x = 9t$$

$$t = \frac{x}{9}$$

$$y = 12t - 5t^2$$

$$y = 12\frac{x}{9} - 5\frac{x^2}{9}$$

$$y = \frac{4}{3}x - \frac{5}{81}x^2$$

c

$$0 = \frac{4}{3}x - \frac{5}{81}x^2$$

$$x = 0, 21.6$$

$$x = 21.6 \text{ m}$$

#### Question 4

a

- No air resistance (no horizontal acceleration)
- No external factors (eg. child hitting the ball midway through)
- Constant gravity value, irregardless of location or height

b

$$R(x)$$

$$s = ut - \frac{at^2}{2}$$

$$= 30 * \cos 40t - 0$$

$$= 23.0t$$

$$x = 23.0t$$

$$R(y)$$

$$s = ut - \frac{at^2}{2}$$

$$= 30 * \sin 40t - \frac{9.8 * t^2}{2}$$

$$= 19.3t - 4.9t^2$$

$$y = 19.3 - 4.9t^2$$

c

$$s = ut - \frac{at^2}{2}$$

$$34 = 23.0t - 0$$

$$t = \frac{34}{23.0}$$

$$= 1.48 \text{ s}$$

d

$$\frac{dy}{dt} = 12 - 10t$$

$$\begin{aligned}v_y &= 19.3 - 9.8t \\&= 19.3 - 9.8 * 1.48 \\&= 4.78 \text{ ms}^{-1}\end{aligned}$$

$$\begin{aligned}v &= \sqrt{23^2 + 4.78^2} \\&= 23.5 \text{ ms}^{-1}\end{aligned}$$

$$\begin{aligned}\tan \theta &= \frac{O}{A} \\ \theta &= \arctan \frac{4.78}{23.0} \\ &= 11.8^\circ\end{aligned}$$

The ball is still rising at  $23.5 \text{ ms}^{-1}$  at an angle of  $11.8^\circ$  from the horizontal.

#### Question 5

a

$$\begin{aligned}v^2 &= u^2 + 2as \\ 0^2 &= (u \sin \alpha)^2 - 2 * 0.3 * g \\ ???\end{aligned}$$

b

???

c

Yes - it is only 12m away.

d

- Doesn't account for squashing/stretching of ball in air.
- Doesn't account for air resistance
- Doesn't account for weather.