Revision 1

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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

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

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

Question 2

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

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

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

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

$$y = 12t - 5t^2$$
$$y = 12\frac{x}{9} - 5\frac{x}{9}^2$$
$$y = \frac{4}{3}x - \frac{5}{81}x^2$$

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) Nospin
- 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

$$\frac{dy}{dt} = 12 - 10t$$
$$v_y = 19.3 - 9.8t$$
$$= 19.3 - 9.8 * 1.48$$
$$= 4.78\ \text{ms}^{-1}$$
$$v = \sqrt{23^2 + 4.78^2}$$
$$= 23.5\ \text{ms}^{-1}$$

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

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

Question 5

a

$$v^2 = u^2 + 2as$$
$$0^2 = (u\sin\alpha)^2 - 2 * 0.3 * g$$
??? $u^2 = \frac{3g}{5\sin\alpha}$

b

??? Passes through (12, 0.9)

v_x const, so $x = 12 = u\cos\alpha\, t$, $t = \frac{12}{u\cos\alpha}$

$0.9 - 2.5 = -1.6$

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

then expand + sub to get ans

c) find α from $\tan\alpha$ and sub in.

c

Yes - it is only 12m away. X Use $s = ut + \frac{1}{2}at^2$

de

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