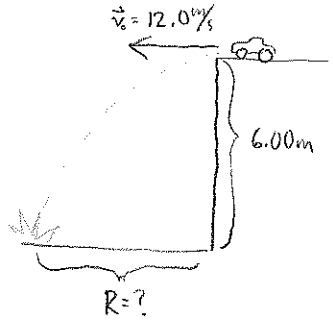
Projectiles:



$\hat{x}$:	$\hat{y}$:
$\vec{v}_x = 12.0\ m/s$	$\vec{v}_{oy} = 0\ m/s$
	$\vec{d}_y = -6.00\ m$
	$\vec{a}_y = -9.80\ m/s^2$
	$t = ?$

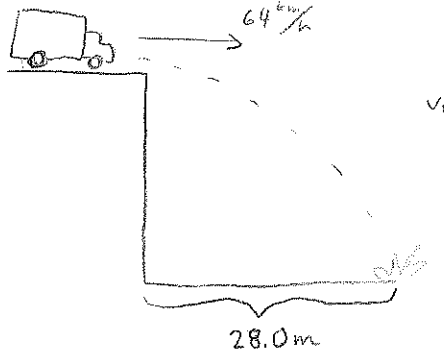
$\hat{y}$: $\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_y t^2$

$t = \sqrt{\frac{2\vec{d}_y}{\vec{a}_y}} = \sqrt{\frac{2(-6.00\ m)}{(-9.80\ m/s^2)}}$

$t = 1.10656667\ s$

$\hat{x}$: $\vec{d}_x = \vec{v}_x t =$ **13.3 m**

2.



$\hat{x}$	$\hat{y}$
$v_x = 64\frac{km}{h} \times \left(\frac{1000\ m}{km}\right) \times \left(\frac{1\ h}{3600\ s}\right)$	$\vec{v}_{oy} = 0\ m/s$
$\vec{v}_x = 17.7\ m/s$	$\vec{a}_y = -9.80\ m/s^2$
$\vec{d}_x = 28.0\ m$	
$t =$	

$\hat{x}$: $\vec{d}_x = \vec{v}_x t$

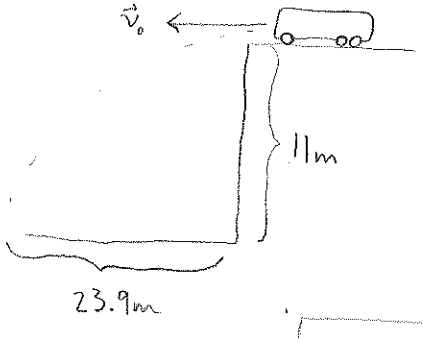
$t = \frac{\vec{d}_x}{\vec{v}_x} = \frac{28.0\ m}{17.7\ m/s} = 1.575\ s$

$\hat{y}$: $\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_y t^2$

$\vec{d}_y = -12.155\,0625\ m$

h = 12 m

3.



$\hat{x}$	$\hat{y}$
$\vec{d}_x = 23.9\ m$	$\vec{v}_{oy} = 0\ m$
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{d}_y = -11\ m$
	$t =$

$\hat{y}$: $\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_y t^2$

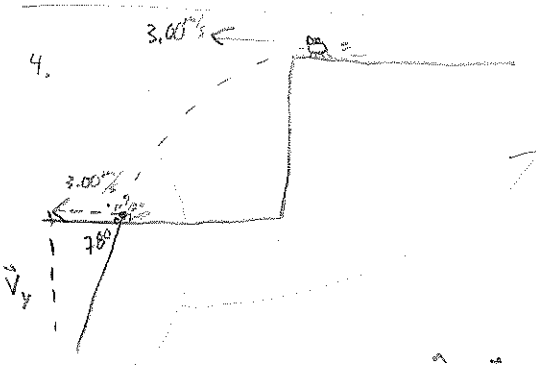
$t = \sqrt{\frac{2\vec{d}_y}{\vec{a}_y}} = 1.498\,298\,355$

$\hat{x}$: $\vec{d}_x = \vec{v}_x t$

$\vec{v}_x = \frac{\vec{d}_x}{t} = 15.9514\ldots\ m/s$

$v_o = 16\ m/s$

4.



$\tan 78 = \frac{v_y}{3.00}$

$v_y = 3.00 \tan 78°$

$v_y = 14.113\,890\,35\ m/s$

$\hat{x}$	$\hat{y}$
$v_x = 3.00\ m/s$	$\vec{v}_{oy} = 0$
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{v}_y = -14.113\,890\,35\ m/s$
	$t =$
	$\vec{d}_y =$

$\hat{y}$: $\vec{v}_y = \vec{v}_{oy} + \vec{a}_y t$

$t = \frac{\vec{v} - \vec{v}_{oy}}{\vec{a}}$

$t = 1.440\,192\,891\ s$

$\vec{v}_y^2 = \vec{v}_o^2 + 2\vec{a}_y\vec{d}_y$

$\vec{d}_y = \frac{v_y^2}{2\vec{a}}$

$\vec{d}_y = -10.163\,36\ m$

$\hat{x}$: $\vec{d}_x = \vec{v}_x t$

$\vec{d}_x = 4.320\,578\,672$

h = 1.0×10 m

R = 4.3 m

5. $\hat{x}$: $\vec{v}_x = 80.0\ km/h = 22.\overline{2}\ m/s$, $\vec{d}_x = \frac{H}{2}$

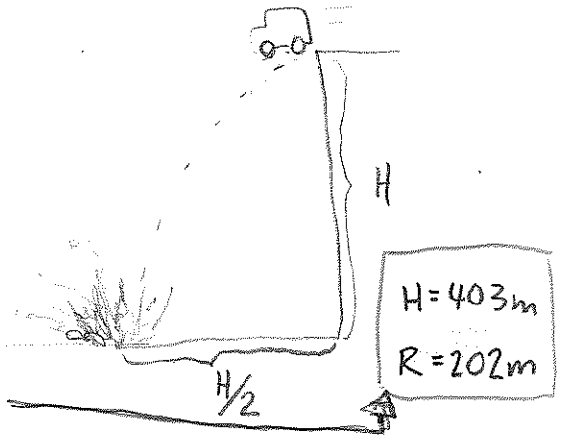
$\hat{y}$: $\vec{v}_{oy} = 0$, $\vec{a}_y = -9.80\ m/s^2$, $\vec{d}_y = -H$

$\vec{d} = \vec{v}_o t + \frac{1}{2}\vec{a}t^2$ → $t = \sqrt{\frac{2\vec{d}_y}{\vec{a}_y}}$

$t = \frac{\vec{d}_x}{\vec{v}_x} = \frac{H}{44.\overline{4}}$ $\quad t = t$ $\quad t = \sqrt{\frac{-2H}{-9.80}}$

$\frac{H}{44.\overline{4}} = \sqrt{\frac{H}{4.9}}$

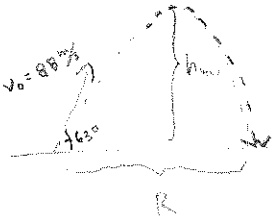
$\frac{H^2}{(44.\overline{4})^2} = \frac{H}{4.9}$ → $H = \frac{44.\overline{4}^2}{4.9} = 403.12\ m$ $\quad R = \frac{H}{2}$



$H = 403\ m$

$R = 202\ m$

6.



b.

x	y
$\vec{v}_x = 88\cos 63°$	$\vec{v}_{oy} = 88\sin 63°$
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{v}_y = 0\ m/s$ (max height)
	$\vec{d}_y = ?$

$\hat{y}$: $\vec{v}_y^{\,2} = \vec{v}_o^{\,2} + 2\vec{a}\vec{d}$

$\vec{d}_y = \frac{-\vec{v}_o^{\,2}}{2\vec{a}} = \frac{-(88\sin 63°)^2}{2(-9.80)} = 313.6685968\ m$

$h_{max} = 310\ m$

c.

x	y
$\vec{v}_x = 88\cos 63°$	$\vec{v}_{oy} = 88\sin 63°$
$t =$	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{d}_y = 0$

$\hat{y}$: $\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}t^2$

$0 = t(\vec{v}_{oy} + \frac{1}{2}\vec{a}t)$

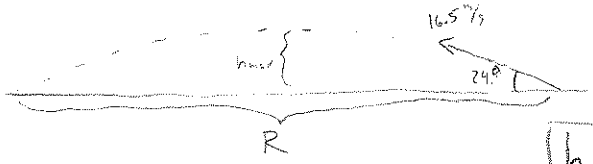
$\Rightarrow t = 0s$ or $\vec{v}_{oy} + \frac{1}{2}\vec{a}t = 0$

trivial case $\quad t = \frac{-2\vec{v}_{oy}}{\vec{a}} = 16.00174982\ s$

$\hat{x}$: $\vec{d}_x = \vec{v}_x t = 639.2885311\ m$

$R = 640\ m$

7.



b.

$\hat{x}$:	$\hat{y}$:
	$\vec{v}_{oy} = 16.5\sin 24°$
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{v} = 0$
	$\vec{d}_y = ?$

$\vec{v}_y^{\,2} = \vec{v}_{oy}^{\,2} + 2\vec{a}_y\vec{d}_y$

$\vec{d}_y = \frac{-\vec{v}_{oy}^{\,2}}{2\vec{a}_y} = \frac{-(16.5\sin 24)^2}{2(-9.8)} = 2.297938582\ m$

$h_{max} = 2.3\ m$

c.

x	y
$v_x = 16.5\cos 24$	$\vec{v}_{oy} = 16.5\sin 24$
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{v}_y = -16.5\sin 24$
	$t = ?$

$\hat{y}$: $\vec{v} = \vec{v}_o + \vec{a}t$

$t = \frac{\vec{v} - \vec{v}_o}{\vec{a}} = \frac{-16.5\sin 24 - 16.5\sin 24}{-9.80} = 1.36962339$

$\hat{x}$: $\vec{d}_x = \vec{v}_x t$

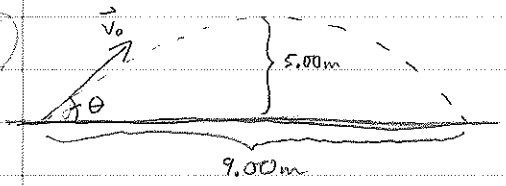
$\vec{d}_x = 20.64501824$

$R = 21\ m$

*NOTE: Could have solved this the same way as #5c. Just thought I'd change things up a wee bit.

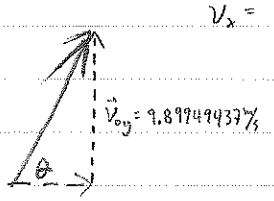
Projectiles

8.



$\hat{x}$	$\hat{y}$
$\vec{d}_x = 9.00\text{m}$	$\vec{d}_y = 5.00\text{m}$
	$\vec{a}_y = -9.80\text{m/s}^2$
	$\vec{v} = 0\text{m/s}$ (max height)
	$\vec{v}_{0y} = ?$
	$t =$

$$\vec{v}_x = \frac{\vec{d}_x}{t_T} = 4.454772\ldots$$



$$\vec{v}_y^{\,2} = \vec{v}_{0y}^{\,2} + 2\vec{a}_y\vec{d}_y$$
$$\vec{v}_{0y} = \sqrt{-2\vec{a}_y\vec{d}_y}$$
$$\vec{v}_{0y} = \sqrt{-2(-9.80)(5.00}$$
$$\vec{v}_{0y} = 9.8994437\ \text{m/s}$$

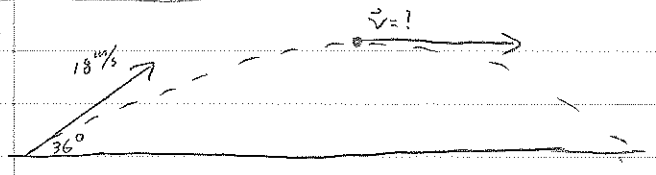
$$\vec{v}_y = \vec{v}_{0y} + \vec{a}t$$

$$t_1 = \frac{\vec{v}_y - \vec{v}_{0y}}{\vec{a}} = 1.010152545\text{s}$$

$$t_T = 2.020305089$$

$\vec{v}_0 = 10.9\text{m/s}$ [65.8° above horizontal]

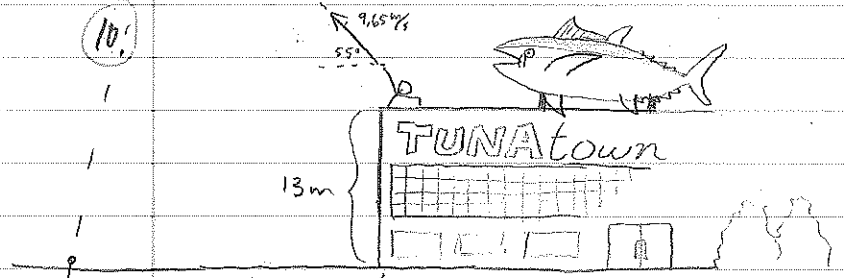
9.



At max height $\vec{v}_y = 0$ so $\vec{v} = \vec{v}_x = 18\text{m/s}\cos 36°$

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

10.



$\hat{x}$	$\hat{y}$
$\vec{v}_x = 9.65\cos 55°$	$\vec{v}_{0y} = 9.65\sin 55°$
	$\vec{a}_y = -9.80\text{m/s}^2$
	$\vec{d}_y = -13\text{m}$
	$\vec{v}_y = ?$
	$t = ?$

$$\vec{v}_y^{\,2} = \vec{v}_{0y}^{\,2} + 2\vec{a}\vec{d}$$
$$\vec{v}_y = -\sqrt{v_{0y}^2 + 2\vec{a}\vec{d}}$$
$$v_y = -17.8125748$$
$$\vec{v}_y = \vec{v}_{0y} + \vec{a}_y t$$

b. $\vec{v}_x = 9.65\cos 55° = 5.535012611\ \text{m/s}$

$\vec{v}_y = -17.8125748\ \text{m/s}$

$$t = \frac{\vec{v}_y - \vec{v}_{0y}}{a}$$

$t = 2.624218848\text{s}$

$\vec{v} = 19\text{m/s}$ [73° below horizontal]

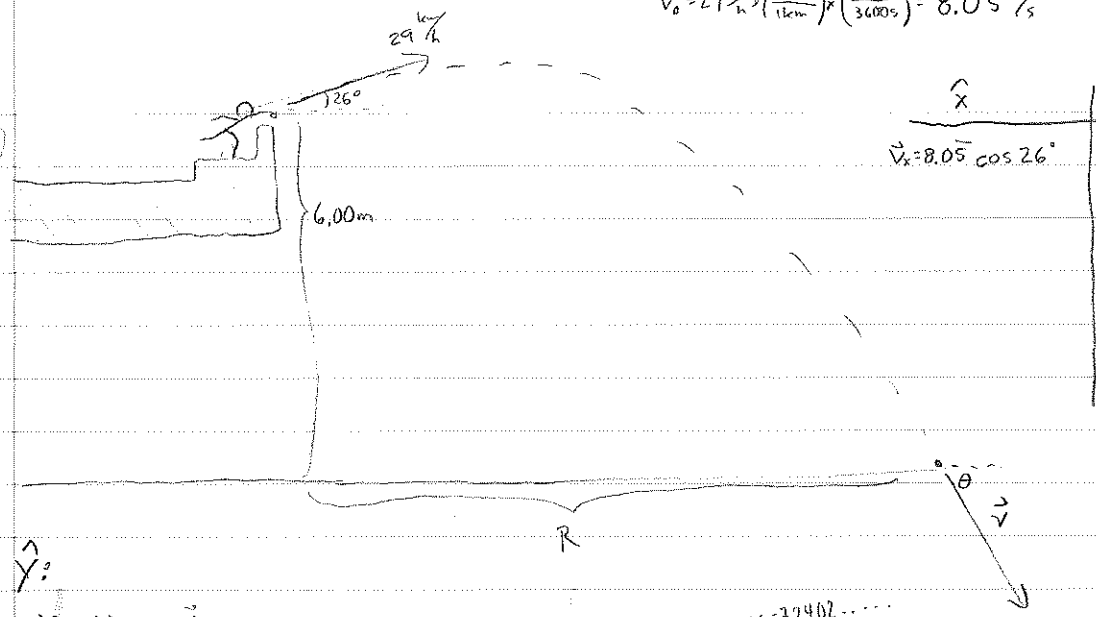
c. $t = 2.6\text{s}$

d. $\vec{d}_x = \vec{v}_x t = 14.52508442\text{m}$

$\vec{d}_x = 15\text{m}$

$V_0 = 29\ \frac{km}{h} \times \left(\frac{1000m}{1km}\right) \times \left(\frac{1h}{3600s}\right) = 8.05\ m/s$

11.



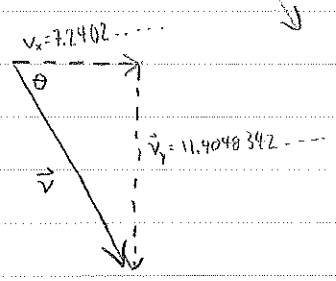
$\hat{x}$	$\hat{y}$
$\vec{v}_x = 8.05 \cos 26$	$\vec{v}_{oy} = (8.05 \sin 26°)$ m/s
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{d}_y = -6.00m$
	$\vec{v}_y = ?$
	$t = ?$

$\hat{y}$:

b. $\vec{v}_y^2 = \vec{v}_{oy}^2 + 2\vec{a}_y\vec{d}_y$

$\vec{v}_y = -\sqrt{(8.05 \sin 26)^2 + 2(-9.80)(-6.00)}$

$\vec{v}_y = -11.4048342\ m/s$



$\vec{v} = 14\ m/s\ [58°\ \text{below horizontal}]$

$\hat{y}$:

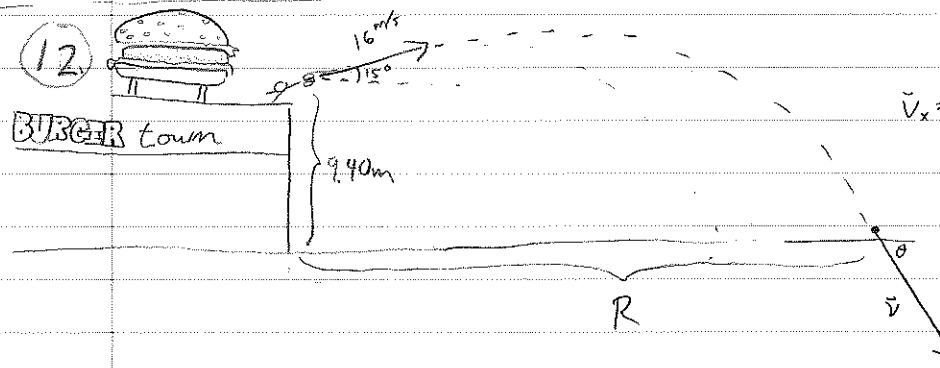
c. $\vec{v}_y = \vec{v}_{oy} + \vec{a}_y t \Rightarrow t = \frac{\vec{v}_y - \vec{v}_{oy}}{\vec{a}_y} = 1.5240976865$

$t = 1.5s$

d. $\hat{x}$: $\vec{d}_x = \vec{v}_x t = 11.034902199\ m$

$R = 11m$

12.



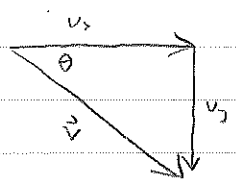
$\hat{x}$	y
$\vec{v}_x = 16\ m/s\ (\cos 15°)$	$\vec{v}_{oy} = 16\ m/s \sin 15°$
	$\vec{a}_y = -9.80\ m/s^2$
	$\vec{d}_y = -9.40m$

b. $\hat{y}$: $\vec{v}_y^2 = \vec{v}_{oy}^2 + 2\vec{a}_y\vec{d}_y$

$\vec{v}_y = -\sqrt{(16 \sin 15)^2 + 2(-9.80)(-9.40)}$

$\vec{v}_y = -14.191150355\ m/s$

$\hat{x}$: $v_x = 16 \cos 15 = 15.454813227\ m/s$



$\vec{v} = 21\ m/s\ [43°\ \text{below horizontal}]$

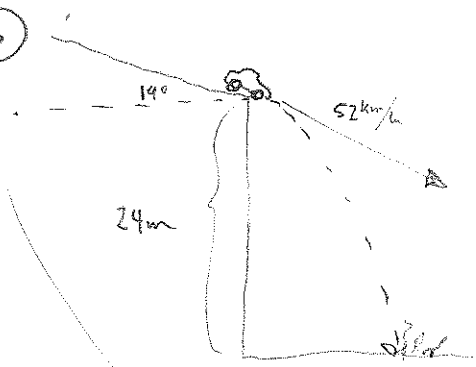
c. $\vec{v}_y = \vec{v}_{oy} + \vec{a}_y t \Rightarrow t = \frac{\vec{v}_y - \vec{v}_{oy}}{\vec{a}_y} = 1.8706\ldots$

$t = 1.9s$

d. $\vec{d}_x = \vec{v}_x t = 16\ m/s \cos 15° (1.8706\ldots s) = 28.910\ldots$

$R = 29m$

(13)



$\hat{x}$: $v_x = 14.4\ m/s \cos 19°$

$\hat{y}$: $\vec{v}_{oy} = -14.4\ m/s \sin 19°$

$\vec{a}_y = -9.80\ m/s^2$

$\vec{d}_y = -24.0\ m$

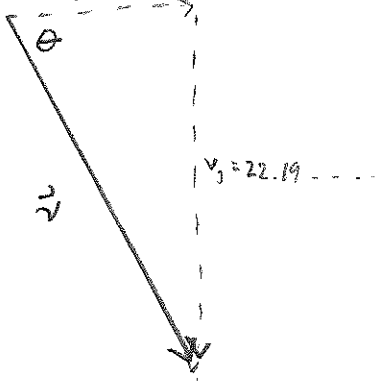
$t = ?$

$\vec{v}_y = ?$

$v_y = \pm\sqrt{\vec{v}_{oy}^2 + 2\vec{a}_y\vec{d}_y}$

$\vec{v}_y = -22.192677349\ m/s$

b. $v_x = 13.657490554$



$\vec{v} = 26\ m/s\ [58°\text{ below horizontal}]$

c. $t = \dfrac{\Delta\vec{v}_y}{\vec{a}_y} = \dfrac{-22.192\ldots - (-14.4\sin 19)°}{-9.80\ m/s^2} = 1.78469\ldots$ $= 1.8\ s$

d. $d_x = v_x t = 24\ m$