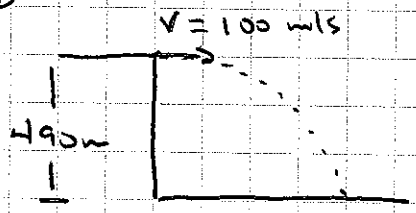
Projectiles 2

① 

V

$v_i = 0$
$a = -9.8\ m/s^2$
$d = -490\ m$
$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$-490 = (0)t + \frac{1}{2}(-9.8)t^2$

$-490 = -4.9t^2$

$t = \boxed{10\ s}$

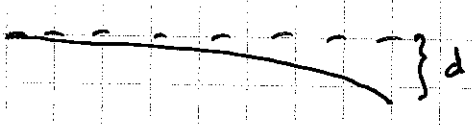
H

$v = 100\ m/s$
$t = 10\ s$
$d = ?$

$d = vt$

$= (100)(10)$

$d = \boxed{1000\ m}$

② 

H

$d = 500\ m$
$v = 1000\ m/s$
$t = ?$

$t = \frac{d}{v} = \frac{500}{1000}$

$t = 0.5s$

V

$v_i = 0$
$a = -9.8\ m/s^2$
$t = 0.5\ s$
$d = ?$

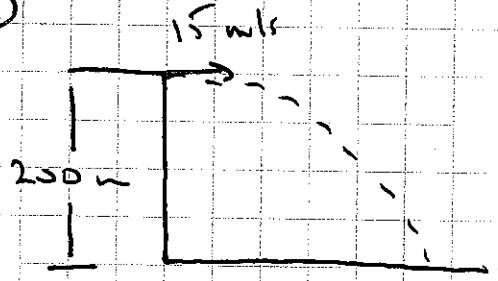
$d = v_i t + \frac{1}{2} a t^2$

$= (0)(0.5) + \frac{1}{2}(-9.8)(0.5)^2$

$d = 0 - 1.225$

$d = -\boxed{1.225\ m}$

③



V

a) $v_i = 0$
$a = -9.8\ m/s^2$
$d = -200\ m$
$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$-200 = (0)t + \frac{1}{2}(-9.8)t^2$

$-200 = -4.9t^2$

$t = \boxed{6.389\ s}$

H

b) $v = 15\ m/s$
$t = 6.389\ s$
$d = ?$

$d = vt$

$= (15)(6.389)$

$d = \boxed{95.8\ m}$

④

Vertical

$v_i = 0$
$a = -9.8\ m/s^2$
$t = 10\ s$
$d = ?$

$d = v_i t + \frac{1}{2} a t^2$

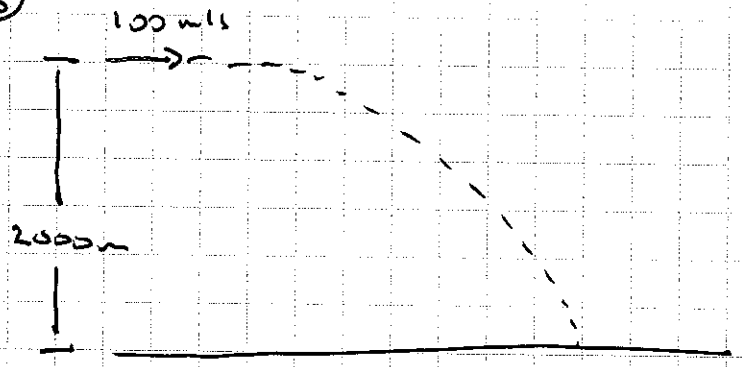
$= (0)(10) + \frac{1}{2}(-9.8)(10)^2$

$d = 0 - 490$

$d = -490\ m$

The building is $\boxed{490\ m}$ tall.

⑤



V

a) $v_i = 0$

$a = -9.8\ m/s^2$

$d = -2000\ m$

$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$-2000 = (0)t + \frac{1}{2}(-9.8)t^2$

$-2000 = -4.9t^2$

$t = \boxed{20.203\ s}$

H

b) $v = 100\ m/s$

$t = 20.203\ s$

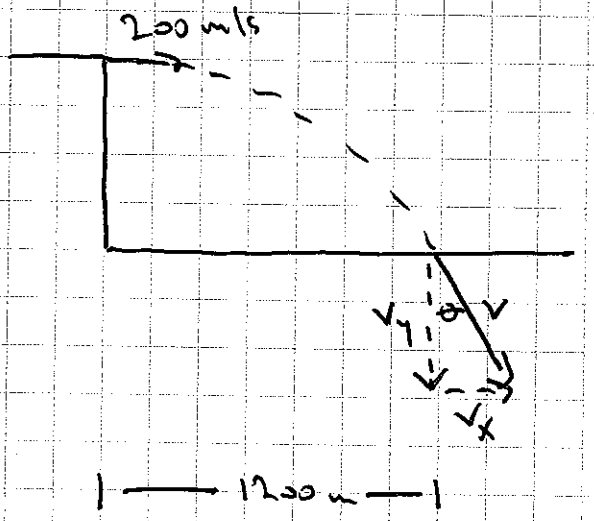
$d = ?$

$d = vt$

$= (100)(20.203)$

$d = \boxed{2020\ m}$

(6)



Horizontal

$v_x = 200$ m/s

$d = 1200$ m

$t = \frac{d}{v} = \frac{1200}{200} = 6$ s

Vertical

$v_i = 0$

$a = -9.8$ m/s^2

$t = 6$ s

$d = ?$

$d = v_i t + \frac{1}{2} a t^2$

$= (0)(6) + \frac{1}{2}(-9.8)(6)^2$

$d = 0 - 176.4$

$d = -176.4$ m

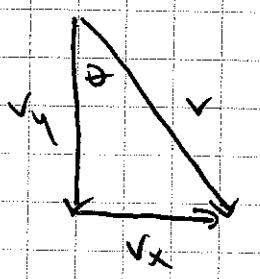
The cliff is $\boxed{176.4 \text{ m}}$ high.

$v_f = ?$

$v_f = v_i + at$

$= 0 - 9.8(6)$

$v_y = v_f = -58.8$ m/s.



$v^2 = v_x^2 + v_y^2$

$= (200)^2 + (58.8)^2$

$v = 208.464$

$\theta = \tan^{-1}\left(\frac{200}{58.8}\right)$

$\theta = 73.617$

$v = \boxed{208.5 \text{ m/s } [16.4° \text{ BTH}]}$

⑦

V	H

a) $v_i = 0$
$a = -9.8 \text{ m/s}^2$
$d = -200 \text{ m}$
$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$-200 = (0)t + \frac{1}{2}(-9.8)t^2$

$-200 = -4.9 t^2$

$t = 6.389 \text{ s}$

$v = 15 \text{ m/s}$
$t = 6.389 \text{ s}$

$d = vt$
$= (15)(6.389)$
$d = \boxed{95.835 \text{ m}}$

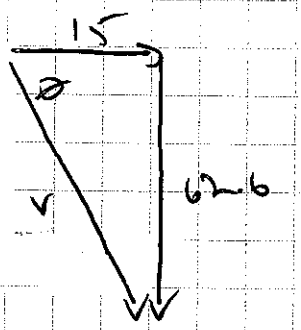
b) $v_f = ?$

$v_f = v_i + at$

$= (0) - 9.8(6.389)$

$v_f = -62.612 \text{ m/s}$

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



$v = \sqrt{15^2 + 62.612^2}$

$v = 64.384 \text{ m/s}$

$\theta = \tan^{-1}\left(\frac{62.6}{15}\right)$

$\theta = 76.528$

$v = \boxed{64.4 \text{ m/s } [76.5° \text{ BTH}]}$

⑦

c) V

$d = v_i t + \frac{1}{2} a t^2$

$= (0)(4) + \frac{1}{2}(-9.8)(4)^2$

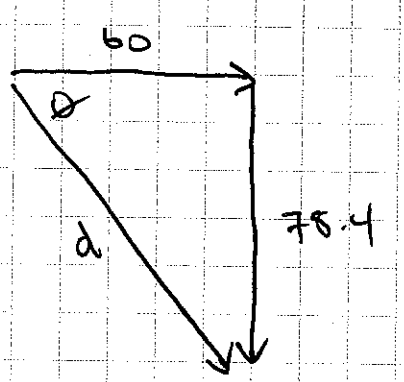
$d = -78.4 \text{ m}$

H

$d = vt$

$= (15)(4)$

$d = 60 \text{ m}$



$d = \sqrt{60^2 + 78.4^2}$

$d = 98.7 \text{ m}$

$\theta = \tan^{-1}\left(\frac{78.4}{60}\right)$

$\theta = 52.6°$

$d = \boxed{98.7 \text{ m } [52.6° \text{ STH}]}$

⑧

V H

a) $v_i = 0$
$a = -9.8 \text{ m/s}^2$
$d = -122.5 \text{ m}$
$t = ?$

$d = v_i t + \frac{1}{2} a t^2$

$-122.5 = (0)t + \frac{1}{2}(-9.8)t^2$

$-122.5 = -4.9 t^2$

$t = \boxed{5 \text{ s}}$

b) → $v = 20 \text{ m/s}$
$t = 5 \text{ s}$

$d = vt$
$= (20)(5)$
$d = \boxed{100 \text{ m}}$

c) $v_f = v_i + at$
$= (0) - 9.8(5)$

$v_y = v_f = -49 \text{ m/s}$

$v_x = 20 \text{ m/s}$

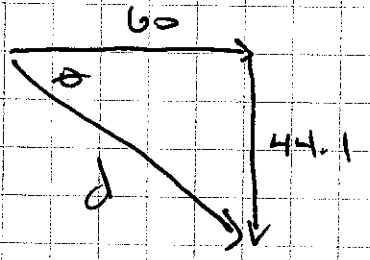
$v = \sqrt{20^2 + 49^2}$ $\theta = \tan^{-1}\left(\frac{49}{20}\right)$

$v = 52.924 \text{ m/s}$ $\theta = 67.797°$

$v = \boxed{52.9 \text{ m/s} \ [67.8° \text{ BTH}]}$

⑧

	V	H
d)	$d = v_i t + \frac{1}{2} a t^2$	$d = vt$
	$= (0)(3) + \frac{1}{2}(-9.8)(3)^2$	$= (20)(3)$
	$d = -44.1$ m	$d = 60$ m.



$d = \sqrt{60^2 + 44.1^2}$

$d = 74.463$ m

$\theta = \tan^{-1}\left(\frac{44.1}{60}\right)$

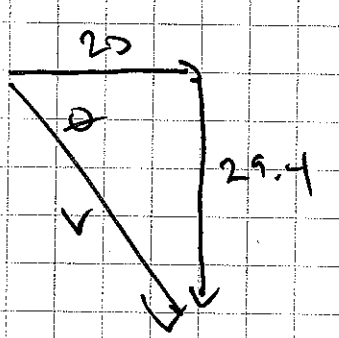
$\theta = 36.316°$

$d = \boxed{74.5 \text{ m } [36.3° \text{ BTH}]}$

e) $v_f = v_i + at$ $\qquad v = 20$ m/s.

$= (0) - 9.8(3)$

$v_f = -29.4$ m/s



$v = \sqrt{20^2 + 29.4^2}$

$v = 35.558$ m/s.

$\theta = \tan^{-1}\left(\frac{29.4}{20}\right)$

$\theta = 55.774°$

$v = \boxed{35.6 \text{ m/s } [55.8° \text{ BTH}]}$