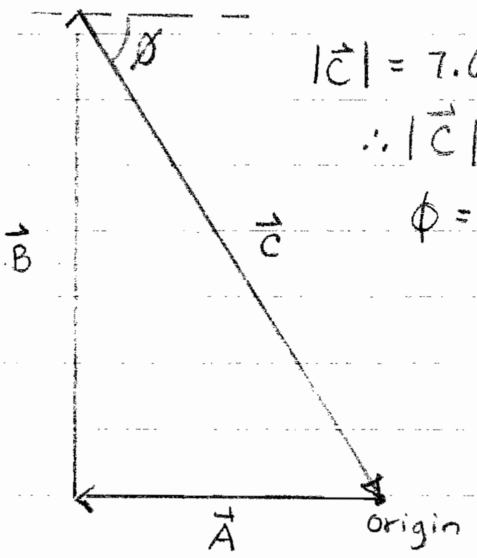
9) $\vec{A}$ = 8.00 m west $A_x = -8.00$ $A_y = 0$
$\vec{B}$ = 13.0m north $B_x = 0$ $B_y = 13.0$
$\vec{C}$ = ? to give $\vec{R} = 0$
Scale: Let 1.00cm = 2.00m



$|\vec{C}|$ = 7.65cm (measured)
$\therefore |\vec{C}|$ = 15.3 m
$\phi = 58.0°$ below x axis

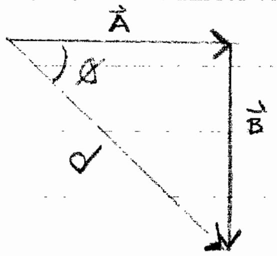
Check solution using the Component method

$R_x = A_x + B_x = -8.00m$
$R_y = A_y + B_y = 13.0\ m$

$\therefore \vec{C}$ has components
$C_x = +8.00m$ and $C_y = -13.0m$ since
$\vec{C} = -\vec{R}$

$C = \sqrt{C_x^2 + C_y^2} = 15.3m$ $\tan\phi = 13/8$ $\phi = 58.3°$ S of E

11) $\vec{A}$ = 6.00m east
$\vec{B}$ = 5.40m south



$d = \sqrt{(6.00m)^2 + (5.40m)^2} = 8.07m$

$\tan\phi = \frac{5.40}{6.00}$ $\phi = 42°$ South of East

19) See diagram on p. 77 Use the component method to find the resultant $\vec{R}$

$\vec{A} = 175\,km \quad 30.0°\ N\ of\ E$

$\vec{B} = 150\,km \quad 20.0°\ W\ of\ N$

$\vec{C} = 190\,km \quad 180°$

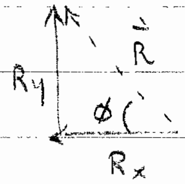
$A_x = 175\,km \cos 30.0° = 152\,km$ $\qquad$ $A_y = 175\,km \sin 30.0° = 87.5\,km$

$B_x = -150\,km \sin 20.0° = -51.3\,km$ $\qquad$ $B_y = 150\,km \cos 20.0° = 141\,km$

$C_x = -190\,km$ $\qquad$ $C_y = 0$

$R_x = A_x + B_x + C_x = (152 - 51.3 - 190)\,km = -89.3\,km$

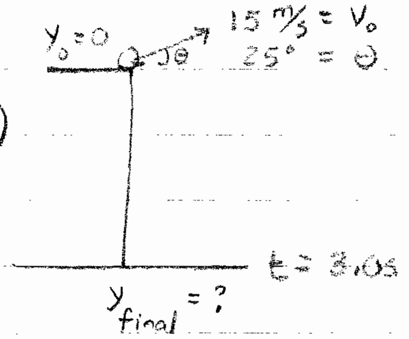
$R_y = A_y + B_y + C_y = (87.5 + 141 + 0)\,km = 228.5 \cong 229\,km$



2nd Quadrant $\quad \tan\phi = \dfrac{228.5}{89.3} \quad \therefore \phi = 68.7°\ N\ of\ W$

$|\vec{R}| = \sqrt{R_x^2 + R_y^2} = 245\,km$

29)



$V_{0y} = (15\ m/s)(\sin 25°) = 6.34\ m/s$

$y = V_{0y} t + \frac{1}{2} a_y t^2$

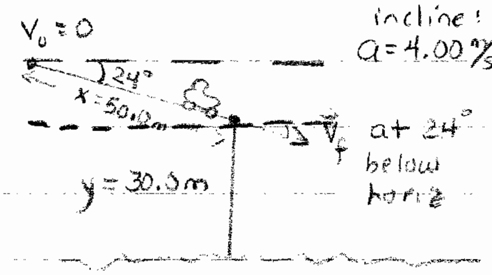
$= (6.34\ m/s)(3.0s) + \frac{1}{2}(-9.8\ m/s^2)(3.0s)^2$

$= -25.1m$

$\approx -25m$ (below top of Building)

$\therefore$ height of building = 25m

31)



a+b)

$V_f^2 = \cancel{V_0^2}^{\,0} + 2ax$

$= 2(4.00\ m/s^2)(50.0m)$

$\Rightarrow V_f = 20.0\ m/s$

$V_{y_0} = (-20.0\ m/s)\sin 24° = -8.13\ m/s$

$V_{x_0} = (20.0\ m/s)\cos 24° = 18.3\ m/s$

$y = V_{0y} t - \frac{1}{2} g t^2$

$-30.0m = (-8.13\ m/s)t - (4.9\ m/s^2)t^2$

$\therefore\ 4.9t^2 + 8.13t - 30 = 0$

Use Quadratic formula:

$$t = \frac{-8.13 \pm \sqrt{(8.13)^2 - 4(4.9)(-30.0)}}{2(4.9)}$$

$$= \frac{-8.13 \pm \sqrt{654}}{9.8}$$

$\therefore\ t = 1.78\ s$

Choose positive root since $t > 0$

$X = V_{0x} t$

$= (18.3\ m/s)(1.78s)$

$= 32.5m$

36) $V_{bw} = 10\,m/s$ Downstream
$V_{ws} = 1.5\,m/s$

$\longrightarrow V_{bw}$
$\longrightarrow V_{ws}$

$\therefore \quad |\vec{V}_{bs}| = 10\,m/s + 1.5\,m/s = 11.5\,m/s$

Let $\longrightarrow$ be the + direction

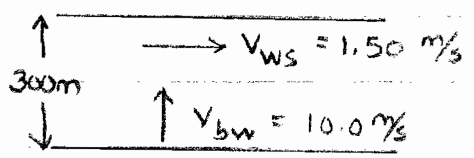
$t_D = \dfrac{300\,m}{11.5\,m/s} = 26.1\,s$

Upstream $\longrightarrow V_{ws}$
$\longleftarrow V_{bw}$

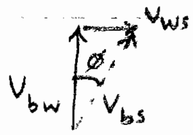
$V_{bs} = 1.5\,m/s - 10\,m/s = -8.5\,m/s$

$t_{up} = \dfrac{-300\,m}{-8.5\,m/s} = 35.3\,s$

Total time $= t_D + t_{up} = 61.4\,s \approx 61\,s$

38) 

a) $\vec{V}_{bw} + \vec{V}_{ws} = \vec{V}_{bs}$



$V_{bs} = \sqrt{(10.0)^2 + (1.50)^2}\ m/s$
$= 10.1\,m/s$

$\tan\phi = \dfrac{1.50}{10.0} \quad \therefore \phi = 8.53^\circ$ E of N

b) $t = \dfrac{300\,m}{10.0\,m/s} = 30.0\,s \quad \therefore d = V_x t = (1.50\,m/s)(30.0\,s)$
$= 45.0\,m$ downstream

41) a) $V_{WG} = 0.500\,m/s \quad V_{SW} = 1.20\,m/s$

against current $V_{SG} = -1.20\,m/s + .500\,m/s = -.700\,m/s$
$d = 1.00\,km = 1000\,m \quad \therefore \quad t = {}^{-1000}/_{-.700\,m/s} = 1429\,s$

with current $V_{SG} = 1.20\,m/s + .500\,m/s = 1.70\,m/s$
$t = {}^{1000\,m}/_{1.70\,m/s} = 588\,s \quad \therefore$ total time $= 2.02 \times 10^3\,s$

b) If there is no current, the V_{SG} is the same for both displacements. $t = {}^{2000\,m}/_{1.20\,m/s} = 1.67 \times 10^3\,s$

c) The Δt to swim against the current is always longer than the saved time downstream for the same distance.

55) $\Theta = 35°$

$\left.\begin{array}{l} x = 130\,m \\ y_f = 21\,m \end{array}\right\}$ at same time t

$y_0 = 1\,m \quad \therefore \Delta y = 20\,m$

$$x = V_{0_x} t \quad \therefore \quad t = \frac{x}{V_0 \cos 35°} \quad ①$$

$$y = V_{0_y} t - \frac{1}{2} g t^2$$

$$20\,m = \left(\frac{V_0 \sin 35°}{V_0 \cos 35°}\right) x - 4.9 \left(\frac{x^2}{V_0^2 \cos^2 35}\right)$$

$$20\,m = \tan 35° (130\,m) - \frac{4.9\,(130\,m)^2}{V_0^2\,(.67)}$$

$$20\,m = 91\,m - \frac{1.24 \times 10^5}{V_0^2}$$

$$\frac{1.24 \times 10^5}{V_0^2} = 71\,m \quad \Rightarrow V_0 = 41.7\,m/s \approx 42\,m/s$$

b) $$t = \frac{130\,m}{(42\,m/s) \cos 35°} = 3.78\,s \approx 3.8\,s$$

c) $$V_{f_x} = V_{0_x} = V_0 \cos 35° = (42\,m/s)(.819) = 34.4\,m/s$$
$$\approx 34\,m/s$$

$$V_{f_y} = V_{0_y} - g t = V_0 \sin 35° - (9.8)(3.8\,s)$$
$$= 42\,m/s\,(.57) - 37.2$$
$$V_{f_y} = +24 - 37.2 = -13.2\,m/s \approx -13\,m/s$$

$$V = \sqrt{V_{f_x}^2 + V_{f_y}^2} = 37\,m/s$$

62) $y = ax^2 + bx + c$ where a, b and c are constants

① $x = v_{0x} t$ and ② $y = v_{0y} t - \frac{1}{2} g t^2$

solve ① for t and substitute it into equation ②:

$$t = \frac{x}{v_{0x}} \quad \therefore \quad y = v_{0y}\left(\frac{x}{v_{0x}}\right) - \frac{1}{2} g \left(\frac{x}{v_{0x}}\right)^2$$

$$y = \left(\frac{v_{0y}}{v_{0x}}\right) x - \left(\frac{g}{2 v_{0x}^2}\right) x^2$$

or

$$y = -\left(\frac{g}{2 v_{0x}^2}\right) x^2 + \left(\frac{v_{0y}}{v_{0x}}\right) x + 0$$

$$y = a \quad x^2 + bx + c$$

$$\therefore \quad a = -\frac{g}{2 v_{0x}^2} \qquad b = \frac{v_{0y}}{v_{0x}} \qquad c = 0$$