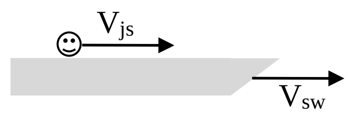
GIANCOLI HOMEWORK SOLUTIONS

Section 3-7 to 3-8, #36 - 48

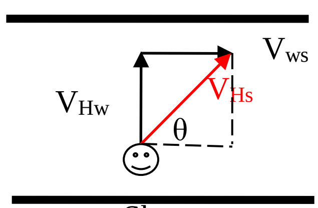
36. Jogger and ship going in the same direction, both in x-axis



$V_{j\text{-}s}$ = 2.2 m/s
$V_{s\text{-}w}$ = 7.5 m/s
$V_{j\text{-}s} + V_{s\text{-}w} = V_{j\text{-}w}$
$2.2 + 7.5 = 9.7\, m/s$

$-V_{j\text{-}s} + V_{s\text{-}w} = V_{j\text{-}w}$
$-2.2 + 7.5 = 5.3\, m/s$

37. .
V_{Hw} = 0.60 m/s
V_{ws} = 1.70 m/s



$V_{Hw} + V_{ws} = V_{Hs}$

$$V_{Hs} = \sqrt{V_{HW}^2 + V_{HW}^2}$$

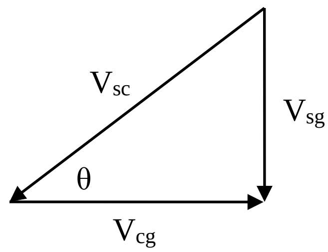
$$V_{Hs} = \sqrt{(0.6)^2 + (1.7)^2}$$

$$V_{Hs} = 1.8\, m/s$$

$$\tan\theta = \frac{V_{Hw}}{V_{ws}} = \frac{(0.6)}{(1.7)}$$

$$\theta = \tan^{-1}\frac{(0.6)}{(1.7)} = 19°$$

38.



$V_{cg} = 25\, m/s$

$\theta = 30°$

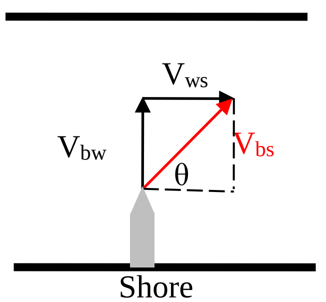
$$\cos\theta = \frac{V_{cg}}{V_{sc}}$$

$$V_{sc} = \frac{V_{cg}}{\cos\theta} = \frac{25}{\cos 30} = 28.9\, m/s$$

$$\tan\theta = \frac{V_{sg}}{V_{cg}}$$

$$V_{cg} tan\,\theta = V_{sg} = (25)\, tan\, 30 = 28.9\, m/s$$

39.



$V_{bw} = 2.30$ m/s

$V_{ws} = 1.20$ m/s

a. $V_{bw} + V_{ws} = V_{bs}$

$$V_{bs} = \sqrt{V_{bw}^2 + V_{bs}^2}$$

$$V_{bs} = \sqrt{(2.3)^2 + (1.2)^2}$$

$$V_{bs} = 2.59\, m/s$$

$$\tan\theta = \frac{V_{bs}}{V_{ws}} = \frac{(2.3)}{(1.2)}$$

$$\theta = \tan^{-1}\frac{(2.3)}{(1.2)} = 62.4°$$

b. $d_{bw} = (V_{bw})(t) = (2.30)(3) = 6.90m$ across the river

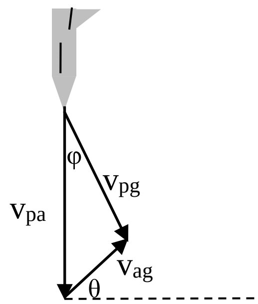
$d_{ws} = (V_{ws})(t) = (1.20)(3) = 3.60m$ down stream

40. Since the planes are flying toward each other, the time it takes to cover the distance is based on the sum of the velocities.

V_1=785km/h V_2=785km/h

$d = 11.0km$
$v_1 = v_2 = 785\ km/h$
$v_R = v_1 + v_2 = 1570\ km/h$
$(d) = (v_R)(t)$
$\frac{(d)}{(v_R)} = (t) = \frac{(11)}{(1570)} = 0.007hx\frac{60m}{1h}x\frac{60s}{1m} = 25.2s$

41. “from the southwest” means going from southwest to northeast at a 45° angle



$v_{pa} = 600\ km/h$
$v_{pa-x} = 0$
$v_{pa-y} = -600$

$v_{ag} = 100\ km/h$
$v_{ag-x} = 100(\cos 45) = 70.7$
$v_{ag-y} = 100(\sin 45) = 70.7$

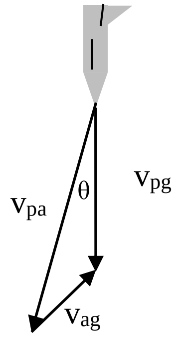
$v_{R-x} = 0 + 70.7 = 70.7$

$v_{R-y} = -600 + 70.7 = -529$

$V_R = \sqrt{V_{R-x}^2 + V_{R-x}^2}$
$V_R = \sqrt{(70.7)^2 + (-529)^2}$
$V_R = -529\ m/s$

$\tan \emptyset = \frac{v_{R-x}}{v_{R-y}} = \frac{(70.7)}{(529)}$
$\emptyset = \tan^{-1}\frac{(70.7)}{(529)} = 7.61°$ east of south

42. .



$V_{pa} + V_{ag} = V_{pg}$

$v_{pa} = 600\, km/h$

$v_{pa-x} = 600(\sin\theta)$

$v_{pa-y} = 600(\cos\theta)$

$v_{ag} = 100\, km/h$

$v_{ag-x} = 100(\cos 45) = 70.7$

$v_{ag-y} = 100(\sin 45) = 70.7$

In order for the plane to fly due South, the x-component of v_{pa} must equal the x-component of v_{ag}

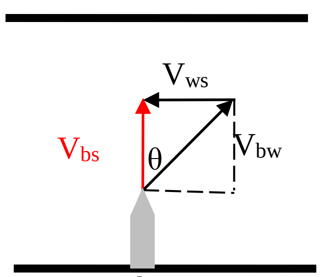
$$v_{pa-x} = v_{ag-x}$$

$$600(\sin\theta) = 70.7$$

$$(\sin\theta) = \frac{70.7}{600}$$

$$\theta = \sin^{-1}\frac{70.7}{600} = 6.77°$$

43. .



$V_{bw} = 1.85$ m/s

$V_{ws} = 1.20$ m/s

$\theta = 40.4°$

$\tan\theta = \frac{V_{ws}}{V_{bs}}$

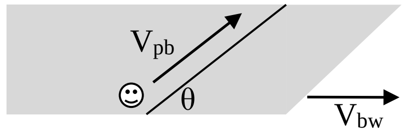
$V_{bs} = \frac{V_{ws}}{\tan\theta}$

$V_{bs} = \frac{1.20}{\tan(40.4)} = 1.41\, m/s$

$\cos\theta = \frac{V_{bs}}{V_{bw}}$

$V_{bw}\cos\theta = V_{bs}$

$(1.85)\cos(40.4) = V_{bs} = 1.41\, m/s$



44. $\theta = 45°$

$v_{pb} = 0.50\,m/s$

$v_{pb-x} = v_{pb}\cos 45 = 0.354$

$v_{pb-y} = v_{pb}\sin 45 = 0.354$

$v_{bw} = 1.50\,m/s$

$v_{bw-x} = 1.50$

$v_{bw-y} = 0$

$v_{R-x} = 0.354 + 1.50 = 1.85$

$v_{R-y} = 0.354 + 0 = 0.354$

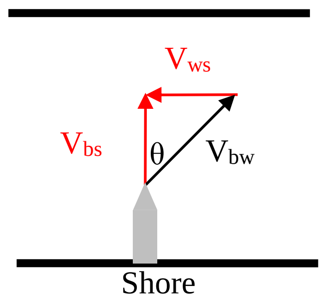
$V_R = \sqrt{V_{R-x}^2 + V_{R-x}^2}$

$V_R = \sqrt{(1.85)^2 + (0.354)^2}$

$V_R = 1.88\,m/s$

$\tan\theta = \frac{v_{R-y}}{v_{R-x}} = \frac{(0.354)}{(1.85)}$

$\theta = \tan^{-1}\frac{(0.354)}{(1.85)} = 10.8°$ up the stairs



45. $\theta = 28.5°$

$v_{bw} = 2.60\,m/s$

a. $\sin\theta = \frac{v_{ws}}{v_{bw}}$

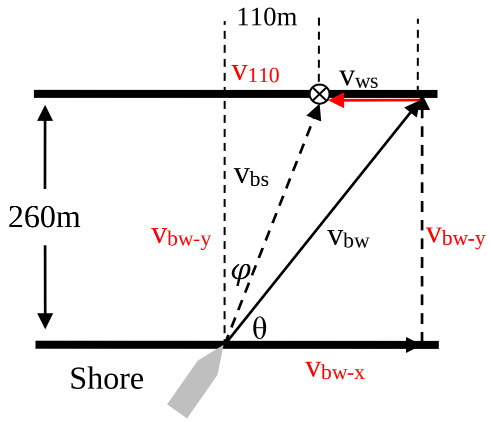
$v_{bw}\sin\theta = v_{ws}$

$(2.60)\sin(28.5) = v_{ws} = 1.24\,m/s$

b. $\cos\theta = \frac{v_{bs}}{v_{bw}}$

$v_{bw}\cos\theta = v_{bs}$

$(2.60)\cos(28.5) = v_{bs} = 2.28\,m/s$



46. $v_{bw} = 1.70\, m/s$

$v_{bw-x} = v_{ws} + v_{110}$

$v_{ws} = v_{bw-x} - v_{110}$

$\cos\theta = \frac{v_{bw-x}}{v_{bw}}$

$v_{bw-x} = (v_{bw})\cos\theta$

$\sin\varphi = \frac{v_{110}}{v_{bw-y}}$

$v_{110} = (v_{bw-y})\sin\varphi$

$\sin\theta = \frac{v_{bw-y}}{v_{bw}}$

$v_{bw-y} = (v_{bw})\sin\theta$

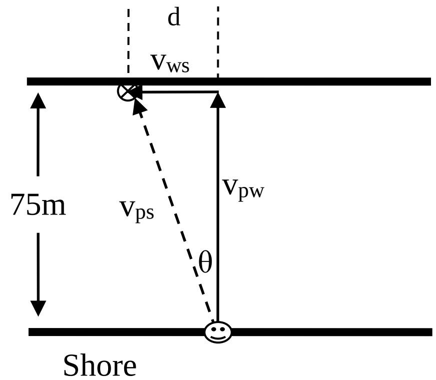
$\sin\varphi = \left(\frac{110m}{260m}\right)$

$v_{110} = \left((v_{bw})\sin\theta\right)\left(\frac{110m}{260m}\right)$

$v_{ws} = v_{bw-x} - v_{110}$

$v_{ws} = (v_{bw})\cos\theta - \left((v_{bw})\sin\theta\right)\left(\frac{110m}{260m}\right)$

$v_{ws} = (1.70)\cos(45) - \left((1.70)\sin(45)\right)\left(\frac{110m}{260m}\right) = 0.69$



47. $v_{pw} = 0.45\,m/s$

$v_{ws} = 0.40\,m/s$

a. $\tan\theta = \frac{v_{ws}}{v_{pw}}$

$\theta = \tan^{-1}\frac{v_{ws}}{v_{pw}}$

$\theta = \tan^{-1}\frac{0.40}{0.45} = 41.6°$

$\tan\theta = \frac{d}{75m}$

$(75m)\tan(41.6°) = d = 66.7m$

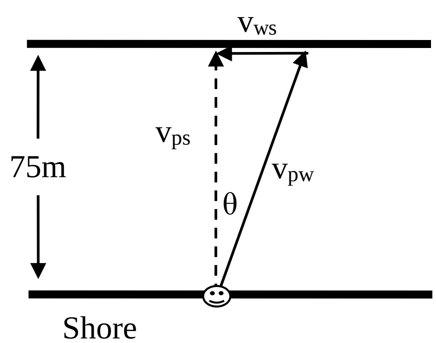
Or, you can use ratios

$\frac{v_{ws}}{v_{pw}} = \frac{d}{75m}$

$(75m)\frac{0.40}{0.45} = d = 66.7m$

b. $(d_y) = (v_{pw})(t)$

$\frac{(d_y)}{(v_{pw})} = t = \frac{(75)}{(0.45)} = 167s = 2m\ 47s$



48. $v_{pw} = 0.45\,m/s$

$v_{ws} = 0.40\,m/s$

a. $\sin\theta = \frac{v_{ws}}{v_{pw}}$

$\theta = \sin^{-1}\frac{v_{ws}}{v_{pw}}$

$\theta = \sin^{-1}\frac{0.40}{0.45} = 62.7°$

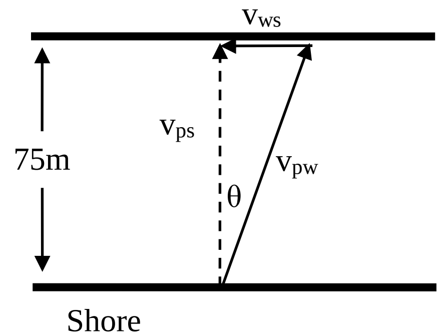
b. $(d_y) = (v_{ps})(t)$

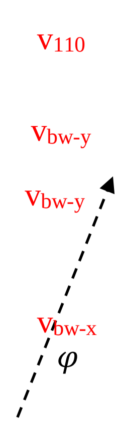
$\cos\theta = \frac{v_{ps}}{v_{pw}}$

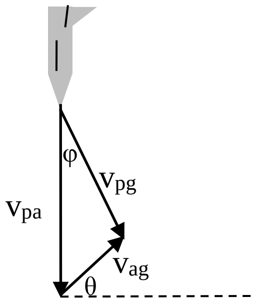
$v_{pw}\cos\theta = v_{ps} = (0.45)\cos(62.7) = 0.206$

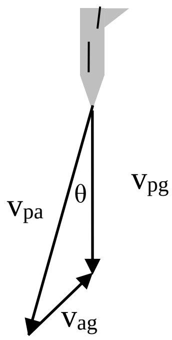
$\frac{(d_y)}{(v_{ps})} = t = \frac{(75)}{(0.206)} = 363s = 6m\ 3s$

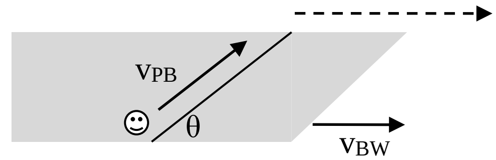

d

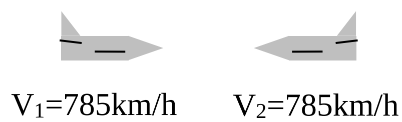

vws
75m
vps
vpw
θ
Shore

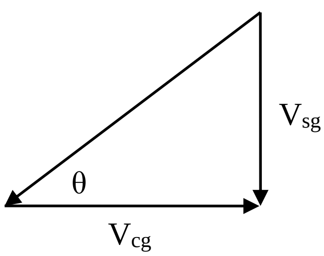

v110
Vbw-y
Vbw-y
Vbw-x
φ

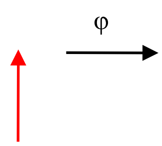

φ
vpg
vpa
vag
θ

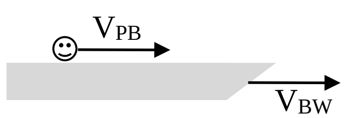

vpa
θ
vpg
vag

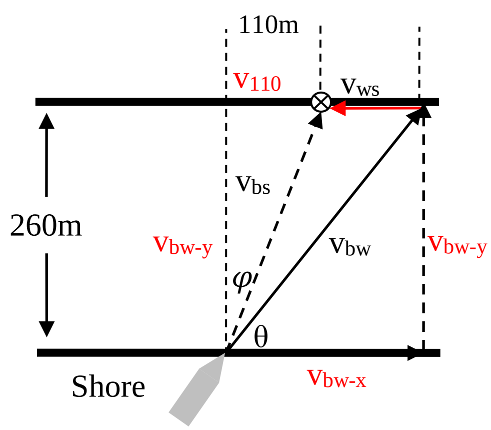

vPB
θ
vBW


V1=785km/h
V2=785km/h


Vsg
θ
Vcg


φ


VPB
VBW


110m
v110
vws
260m
vbs
vbw-y
vbw
vbw-y
φ
θ
Shore
vbw-x