Lecture 3. 1D motion. Freefall. Vectors.

Note Title 9/9/2011

$a = \text{const}$

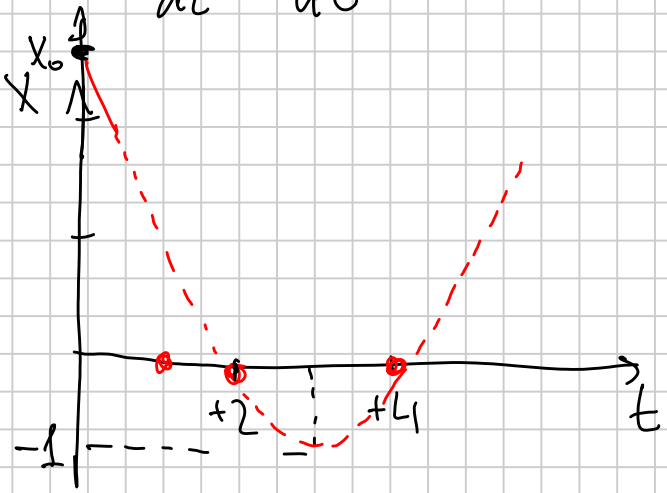
$v = v_0 + at$

$x = x_0 + v_0 t + \frac{1}{2} a t^2$

EX. $x = 8 - 6t + t^2$ (m)

$v = \frac{dx}{dt} = -6 + 2t$ (m/s)

$a = \frac{d^2x}{dt^2} = \frac{dv}{dt} = +2$ (m/s^2)



$t = 0$ $x = 8$ $(x_0 = 8)$

$v_0 = -6$

$x = 0$ | $0 = 8 - 6t + t^2$

$t = +2, +4$

$v = 0$ $0 = -6 + 2t$

$t = 3$ $x = -1$

+ Free fall

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

$$v = v_0 - gt$$

$$x = x_0 + v_0 t - \frac{1}{2} g t^2$$

$t = 0 \quad x = x_0 = h_0$

$t \quad x = 0$

$$0 = h_0 + v_0 t - \frac{1}{2} g t^2$$

$v_0 = 0$

$$0 = h_0 - \frac{1}{2} g t^2$$

$$\frac{1}{2} g t^2 = h_0$$

$$g t^2 = 2 h_0$$

$$t^2 = \frac{2 h_0}{g}$$

$$\boxed{t = \sqrt{\frac{2 h_0}{g}}}$$

$h_0 = 1\ m \quad g = 9.8\ m/s^2$

$$t = \sqrt{\frac{2}{9.8}} = 0.45\ s$$

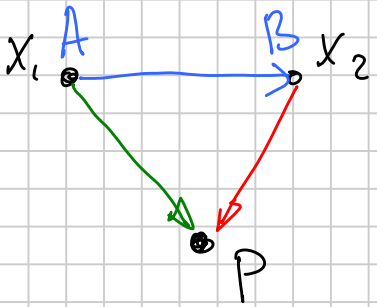
Vectors

$+v$

$-v$

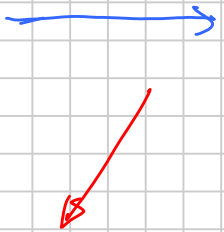
Vector addition

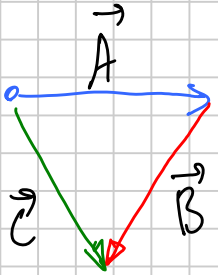
$$\vec{AB} + \vec{BP} = \vec{AP}$$



length, mass, time — scalars

(I)

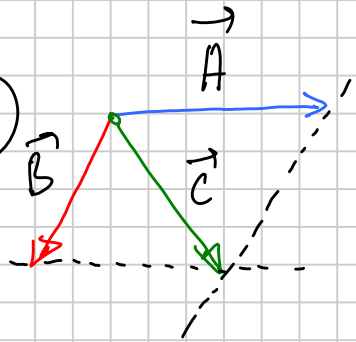




$$\vec{C} = \vec{A} + \vec{B}$$

head-to-tail

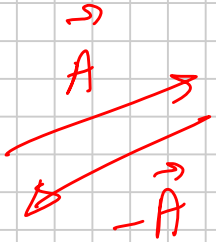
(II)



$$\vec{C} = \vec{A} + \vec{B}$$

parallelogram

Subtraction

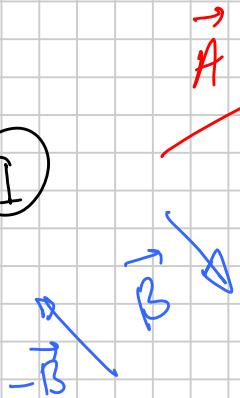


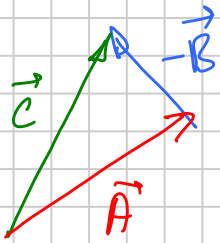
$$\vec{A} + \vec{B} = \vec{C}$$

$$\vec{A} = \vec{C} - \vec{B}$$

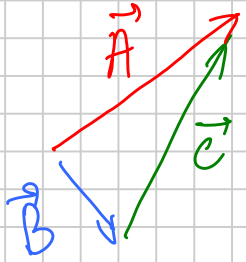
$$\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$$

(I)





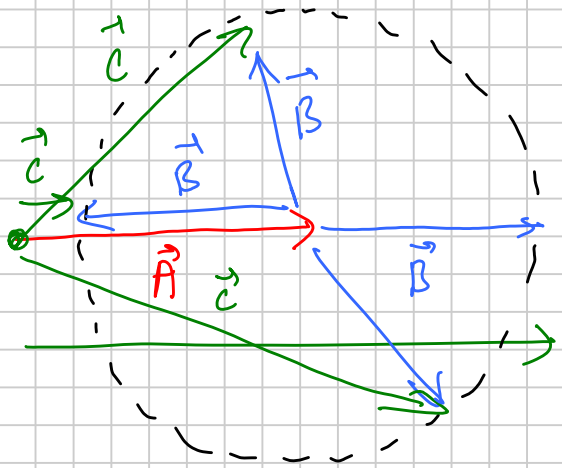
(II)

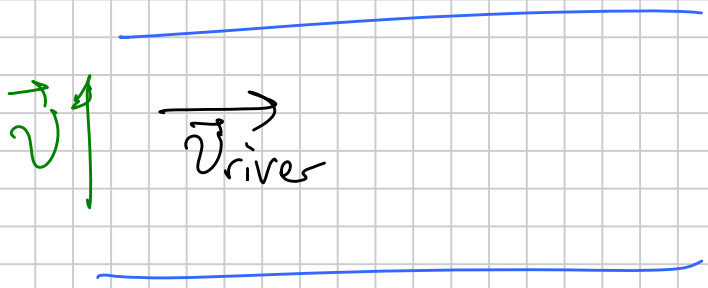


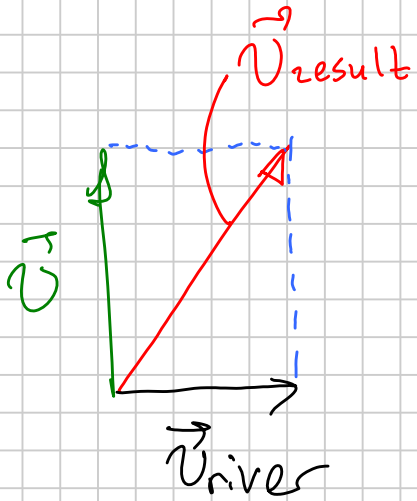
$$|\vec{A}| = 5$$

$$|\vec{B}| = 4$$

$$\vec{A} + \vec{B} = \vec{C}$$







$$\vec{v}_{result} = \vec{v}_{river} + \vec{v}$$