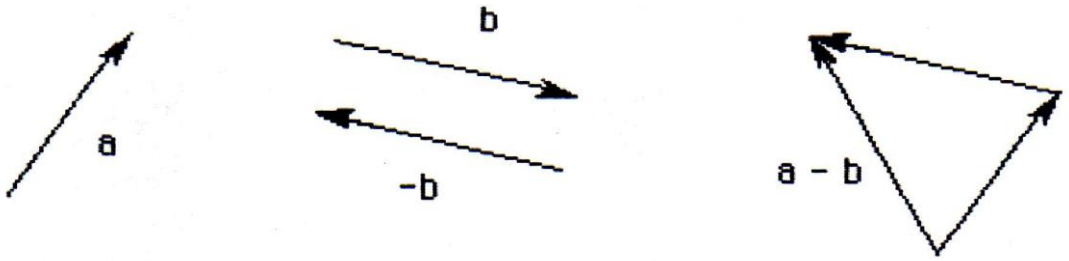
Physics with Synno – Motion-2 – Lesson 3

M.1.2.2 Subtraction of Vectors

Vector subtraction is easiest to do if you think of it in terms of addition.
Consider a - b which can be expressed as a + (-b).
-b means the same magnitude, but opposite direction.

Example. Find a -b



Typically in physics we subtract vectors when there has been a change in a vector quantity.

Change in position $\Delta x = x_{final} - x_{initial} = x_{final} + (-x_{initial})$

Change in velocity $\Delta v = v_{final} - v_{initial} = v_{final} + (-v_{initial})$

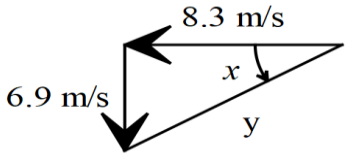
Note: the symbol Δ indicates a 'change in' a quantity.

Example A ball is thrown at a wall with a velocity of 5 m/s East it rebounds with a velocity of 3.5 m/s West. Find its change in velocity.

$\Delta v = v_{final} + (-v_{initial})$ Use East as the +ve direction
$v_{final} = -3.5$ $v_{initial} = 5$
$\Delta v = -3.5 + (-5) = -8.5 = 8.5$ m/s West

Example Freddie is riding his bike at 6.9 m/s in a Northerly direction. He turns a corner and is now heading in a Westerly direction at 8.3 m/s. Find his change in velocity.

$\Delta v = v_{final} + (-v_{initial})$
$v_{initial} = 6.9$ m/s North → $-v_{initial} = 6.9$ m/s South
$v_{final} = 8.3$ m/s West



$y^2 = 8.3^2 + 6.9^2$
$y^2 = 68.89 + 47.61$
$y = \sqrt{116.5}$
$y = 10.79$ m/s
$x = \tan^{-1}\left(\frac{6.9}{8.3}\right)$
$x = 39.7°$
Change in velocity is 10.79 m/s W 39.7° S

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