Vectors - Doing basic physics with vectors

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Vectors - Scalar times vector - Basics

The basic concept is simple:
Suppose you had a Velocity of
$v = 2.1\ m/s\ x + 3.2\ m/s\ y$
for 2.0 seconds, your displacement would be simply $v = s/t$, $s = vt$:

$(2.1\ m/s\ x + 3.2\ m/s\ y)(2.0s) =$
$s = 4.2\ m\ x + 6.4\ m\ y$

So you just multiply the scalar by each component (distributed)

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Vectors - Example #2

Suppose initial vel (u) is u = 12 m/s x + 17 m/s y
and acceleration is a = 0 m/s/s x + -9.8 m/s/s y
What is your displacement and velocity at 3.0 sec

x dir	y dir
s = ?	s = ?
u = 12 m/s	u = 17 m/s
v = ?	v = ?
a = 0	a = -9.8 m/s/s
t = 3.0 s	t = 3.0 s

Solve using suvat

$v = u + at$

$s = ut + {}^{1}/_{2}at^{2}$

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Whiteboards:

Scalar times vector

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What is your velocity if your displacement is 4.6 m x + -6.8 m y in 3.17 seconds?

$$v = s/t$$

$$v = (4.6\ m\ x + -6.8\ m\ y)/(3.17\ s)$$

$$v = (1.5\ ms^{-1}\ x + -2.1\ ms^{-1}\ y)$$

1.5 ms^{-1} x + -2.1 ms^{-1} y

W

What is your change in velocity if your acceleration is -1.50 ms^{-2} x + -9.80 ms^{-2} y for 2.50 seconds?

$a = \Delta v/t,\ \Delta v = at$

$\Delta v = (-1.5\ ms^{-2}\ x + -9.8\ ms^{-2}\ y)(2.5\ s)$

$\Delta v = (-3.75\ ms^{-1}\ x + -24.5\ ms^{-1}\ y)$

-3.75 m/s x + -24.5 m/s y

W

What is your final velocity if your initial velocity is 15.2 ms^{-1} x + 35.2 ms^{-1} y, and you accelerate at 5.50 ms^{-2} x + -3.80 ms^{-2} y for 1.75 seconds?

$v = u + at$

$v = (15.2\ ms^{-1}\ x + 35.2\ ms^{-1}\ y) + (5.50\ ms^{-2}\ x + -3.80\ ms^{-2}\ y)(1.75\ s)$

$v = (15.2\ ms^{-1}\ x + 35.2\ ms^{-1}\ y) + (9.625\ ms^{-1}\ x + -6.65\ ms^{-1}\ y)$

$v = (24.8\ ms^{-1}\ x + 28.6\ ms^{-1}\ y)$

$24.8\ ms^{-1}\ x + 28.6\ ms^{-1}\ y$

W

What is your displacement if your initial velocity is 5.2 ms^{-1} x + 3.2 ms^{-1} y, and your final velocity is 2.3 ms^{-1} x + 4.8 ms^{-1} y after 12 seconds?

$s = (u+v)t/2$

$s = \{(5.2\ ms^{-1}\ x + 3.2\ ms^{-1}\ y)+(2.3\ ms^{-1}\ x + 4.8\ ms^{-1}\ y)\}(12\ s)/2$

$s = \{7.5\ ms^{-1}\ x + 8.0\ ms^{-1}\ y\}(12\ s)/2$

$s = \{90\ m\ x + 96\ m\ y\}/2$

$s = 45\ m\ x + 48\ m\ y$

45 m x + 48 m y

W