Topic 1: Vectors

1) The Basics:

a) Dimensional Analysis:

- Used to evaluate the validity of a formula
- Convert all variables into dimensions of kg, s or m using the table below and then compare left to right and see if they are equal

Quantity	Variables	Dimensions
Mass	m	kg
Time	t	s
Velocity	u, v	m/s
Acceleration	a, f, g	m/s^2
Power	P	$kg\,m^2/s^3$
Force	F	$kg\,m/s^2$
Work/Energy	W, E	$kg\,m^2/s^2$

b) Magnitude and Direction of a Vector:

- Magnitude = distance from the origin i.e. measure of size of the vector
- Found using:

$$|a\vec{i} + b\vec{j}| = \sqrt{a^2 + b^2}$$

See Tables pg 17

- Direction = what way is the vector pointing
- Angle θ can be found using rule below but diagram needed to get direction correct

$$\theta = \tan^{-1}\frac{\vec{j}\ component}{\vec{i}\ component}$$

c) Dot Product of 2 Vectors:

- A measure of how much 2 vectors are pulling together or not.

$$(a\vec{i} + b\vec{j}).(c\vec{i} + d\vec{j}) = ac + bd$$

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$$If\ \vec{a}.\vec{b} = 0$$
$$=>\ \vec{a}\ \ perpendicular\ to\ \ \vec{b}$$

d) Angle Between Vectors:

- The angle between two vectors $\vec{a}$ and $\vec{b}$ can be found using:

$$\cos\theta = \frac{\vec{a}.\vec{b}}{|\vec{a}|.|\vec{b}|}$$

See Tables pg 17

2) Polar Form:

a) Polar Form:

Steps:

1. Calculate the magnitude of the vector.
2. Calculate the argument i.e. the angle the vector makes with the positive x-axis
3. Combine the two using Magnitude<Argument notation.

b) Polar Form using the Calculator:

To convert $-2\vec{i} + 3\vec{j}$ to polar form press:

SHIFT	+	−2	SHIFT	)	3	=

To convert $5 < 123°$ to rectangular form:

SHIFT	−	5	SHIFT	)	123	=

3) Distance Vs Displacement:

Some common Time Displacement graphs:

- Distance