***Vectors

Velocity, speed, acceleration, and direction of motion in Vector form

- position vector is $r(t) = \langle x(t), y(t) \rangle$

- velocity vector is $v(t) = \left\langle \dfrac{dx}{dt}, \dfrac{dy}{dt} \right\rangle$

- speed is the magnitude of velocity because $speed = |v(t)| = \sqrt{\left(\dfrac{dx}{dx}\right)^2 + \left(\dfrac{dy}{dt}\right)^2}$

- acceleration vector is $a(t) = \left\langle \dfrac{d^2x}{dt^2}, \dfrac{d^2y}{dt^2} \right\rangle$

- the direction of motion is based on the velocity vector and the signs on its components

Displacement and distance travelled in vector form

- Displacement in vector form $\left\langle \displaystyle\int_a^b v_1(t)\,dt, \int_a^b v_2(t)\,dt \right\rangle$

- Final position in vector form $\left(x_1 + \displaystyle\int_a^b v_1(t)\,dt, x_2 + \int_a^b v_2(t)\,dt \right)$

- Distance travelled from

  $t = a$ to $t = b$ is given by $\displaystyle\int_a^b |v(t)|\,dt = \int_a^b \sqrt{\left(v_1(t)\right)^2 + \left(v_2(t)\right)^2}\,dt$