Differentiating Vectors

We use calculus with 2-d (and 3-d) vectors by differentiating and integrating each function of time separately:

If $\mathbf{r} = x\mathbf{i} + y\mathbf{j}$, then

Example

A particle P of mass 0.8kg is acted on by a single force $\mathbf{F}$ N. Relative to a fixed origin O, the position vector of P at time t seconds is $\mathbf{r}$ metres, where

$$\mathbf{r} = 2t^3\mathbf{i} + 50t^{-\frac{1}{2}}\mathbf{j}, \quad t \geq 0$$

Find:

a) the speed of P when $t = 4$
b) the acceleration of P as a vector when $t = 2$
c) $\mathbf{F}$ when $t = 2$.