Vector Functions and Curves

One variable functions

Question

A particle is moving around a circle at constant speed. Given that the equation of the circle is $x^2 + y^2 = 25$ and that the particle makes one revolution every two seconds, find its acceleration at the point $(3, 4)$.

Answer

The position of the particle is given by

$$\underline{r} = 5\cos(\omega t)\underline{i} + 5\sin(\omega t)\underline{j},$$

where $\omega = pi$ ensures that $\underline{r}$ has period $2\pi/\omega = 2s$.

Thus

$$\underline{a} = \frac{d^2\underline{r}}{dt^2} = -\omega^2\underline{r} = -\pi^2\underline{r}.$$

The acceleration at $(3, 4)$ is $-3\pi^2\underline{i} - 4\pi^2\underline{j}$.