Homework 4 Solutions
Math 212
Feb. 11, 2009

Section 2.3

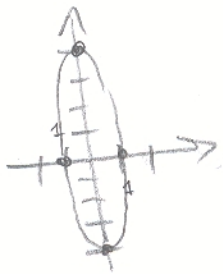
17. Let $f(x,y,z) = x^2+y^2-z^2$. Calculate $\nabla f(0,0,1)$.

$$\nabla f(x,y,z) = (2x, 2y, -2z).$$

$$\nabla f(0,0,1) = (0, 0, -2).$$

Section 2.4

1. Sketch the curve traced out by $x=\sin t$, $y=4\cos t$, where $0 \le t \le 2\pi$.



5. Determine the velocity vector of the given path.

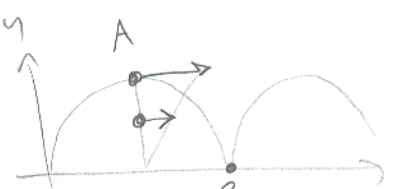
$$c(t) = 6t\,i + 3t^2\,j + t^3\,k$$

$$c'(t) = 6\,i + 6t\,j + 3t^2\,k$$

6. Again. $c(t) = (\sin 3t)\,i + (\cos 3t)\,j + 2t^{3/2}\,k$.

$$c'(t) = (3\cos 3t)\,i - (3\sin 3t\,j) + 3t^{1/2}\,k,$$

13. When is the velocity vector of a point on the rim of a rolling wheel horizontal? What is its speed then?



At position A, the velocity is horizontal & the speed is twice the speed of the bike.

At position B, the speed is zero, so that is also "horizontal".