MATH 53 4 Feb 08
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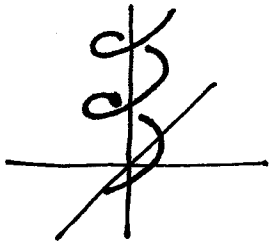
① Consider the helix

$$x = \cos t$$
$$y = \sin t$$
$$z = t$$



(a) What is the velocity (vector) at time t?

(b) What is the speed (scalar) at time t?

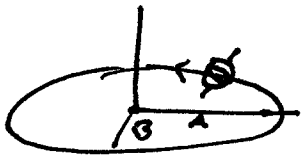
(c) What is the length of the curve traced as t ranges from 0 to T?

② A planet rotates on its axis, and a person stands on the surface. Then for some constants R, S, L and φ, the person's coordinates are

$$x = R\cos\varphi\cos\tfrac{t}{L} + S\sin\varphi$$
$$y = R\sin\tfrac{t}{L}$$
$$z = -R\sin\varphi\cos\tfrac{t}{L} + S\cos\varphi$$

A planet orbiting in an ellipse in the xy-plane follows

$$x = A\cos\tfrac{t}{M}$$
$$y = B\sin\tfrac{t}{M}$$



for constants A, B, M.

(a) What is the (total) position of the person at time t?

(b) What is their speed?