

Homework questions for section 14.3

Math 114, Spring 2008

Below are three questions about a helix. They will be graded as if they were multiple choice questions. This means that there will be no partial credit! Clearly place the result of your final calculation in a box, so that the grader can see which answer you would have picked if this was a multiple choice test. However, answers without supporting work receive no credit.

A circular helix is the graph of the vector valued function

$$\mathbf{r}(t) = (r \cos t, r \sin t, ct)$$

where r, c are constants (r is positive).

1. Derive a general formula for the curvature of the helix in terms of r and c .
2. Derive a formula for the *sine* of the angle ϕ between the binormal vector $\mathbf{B}(t)$ and the vertical vector $\mathbf{k} = (0, 0, 1)$ in terms of r, c . (Hint: first calculate \mathbf{B} , then $\cos \phi$, and then use $\cos^2 \phi + \sin^2 \phi = 1$.)
3. Derive a formula for the torsion of the helix in terms of r, c . (The general torsion formula is found on page 906 in the book, as part (d) of exercise 51.)