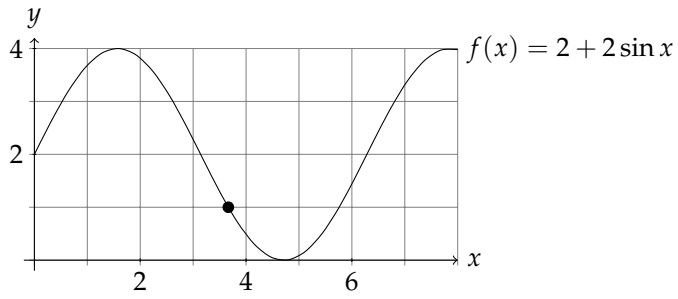
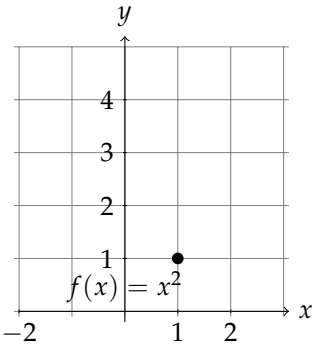
Math 101C Ch. 11 Sample Test (from Spring 2009)

1. If $\mathbf{a}(t) = 3\mathbf{i} + e^{-t}\mathbf{j}$, $\mathbf{v}(0) = 3\mathbf{i} + 2\mathbf{j}$, and $\mathbf{r}(0) = 2\mathbf{i} + \mathbf{i}$, find $\mathbf{r}(t)$.
2. Find the curvature of the circle $x^2 + y^2 = 9$.
3. Find the parametric equations that describe the intersection of the surfaces $x^2 + y^2 + z^2 = 18$ and $z = x^2 + y^2$.
4. The graph of $f(x) = 2 + 2\sin x$ is shown below, including the point $\left(\frac{7\pi}{6}, 1\right)$. Draw $\mathbf{T}\left(\frac{7\pi}{6}\right)$ and $\mathbf{N}\left(\frac{7\pi}{6}\right)$. The graph must be accurate and to the appropriate scale to receive full credit. Be sure to label each vector. Each marking on the graph is 1 unit.



5. For the vector $\mathbf{r}(t) = t\mathbf{i} + t^2\mathbf{j}$,
   (a) Find $\mathbf{a}(1)$.
   (b) Find the vector projection of $\mathbf{a}(t)$ onto $\mathbf{T}(t)$ at $t = 1$.
   (c) Find the vector projection of $\mathbf{a}(t)$ onto $\mathbf{N}(t)$ at $t = 1$.
   (d) Sketch an accurate picture of these three vectors on the following graph. Again, label each vector and draw everything accurately and to scale.



6. Sketch the graphs of the following surfaces.
   (a) $x^2 + y = 4$
   (b) $x + 4y + 3z = 12$
   (c) $z = \sin y$
   (d) $z = 4 - \sqrt{x^2 + y^2}$
7. Sketch the graphs of the following 3-dimensional curves.
   (a) $\mathbf{r}(t) = 0\mathbf{i} + t\mathbf{j} + 2\mathbf{k}, \quad t \in [-2, 2]$
   (b) $\mathbf{r}(t) = t\mathbf{i} + \cos(4t)\mathbf{j} + \sin(4t)\mathbf{k}, \quad t \in [0, \pi]$
   (c) $\mathbf{r}(t) = t\mathbf{i} + \cos(4t)\mathbf{j} + \sin(4t)\mathbf{k}, \quad t \in [0, \pi]$
   (d) $\mathbf{r}(t) = t\cos(8t)\mathbf{i} + t\cos(8t)\mathbf{k}, \quad t \in [0, \pi]$