1. Consider the curve $\mathbf{r}(t) = \langle \sin(2t), -\cos(2t), 4t \rangle$.

   (a) Find the Frenet frame for $\mathbf{r}(t)$ at the point $(0, 1, 2\pi)$.

   (b) Find the curvature $\kappa(t)$ of $\mathbf{r}(t)$.

   (c) The normal plane to a curve at a point P is the plane formed by the normal and binormal vectors at the point P. Find an equation for the normal plane to the curve $\mathbf{r}(t)$ at the points $(0, 1, 2\pi)$.

2. A particle has acceleration function $\mathbf{a}(t) = \langle 6t, 12t^2, \cos(2t) \rangle$, with initial velocity $\mathbf{v}(0) = \langle 2, 0, 1 \rangle$, and initial position $\mathbf{r}(0) = \langle 0, 2, 0 \rangle$. Find the position of the particle at $t = 2$.

3. Show that the following limit does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{y^2 \sin^2 x}{x^4 + y^4}$$

4. Match each function with its contour plot (level curves) below.

(a) $f(x,y) = \sin(y)$ ____________

(b) $f(x,y) = (x^2 - y^2)^2$ ____________

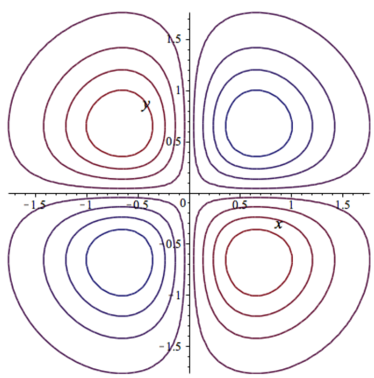
(c) $f(x,y) = 3 - x^2 - y^2$ ____________

(d) $f(x,y) = \sin(x)\sin(y)e^{-x^2-y^2}$ ____________

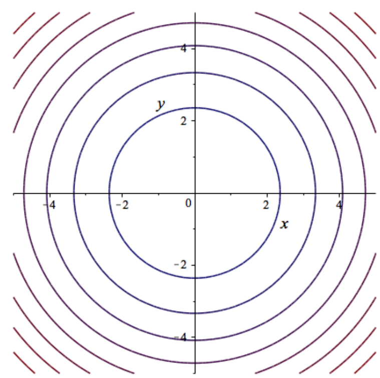
(e) $f(x,y) = (x-y)^2$ ____________

(f) $f(x,y) = \dfrac{1}{1+x^2+y^2}$ ____________

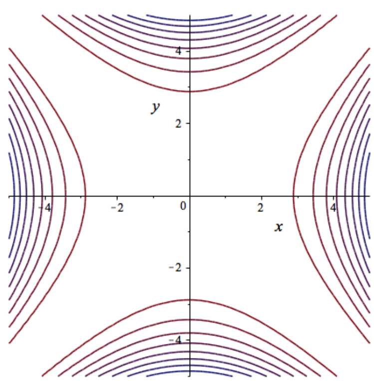
(i)



(ii)



(iii)



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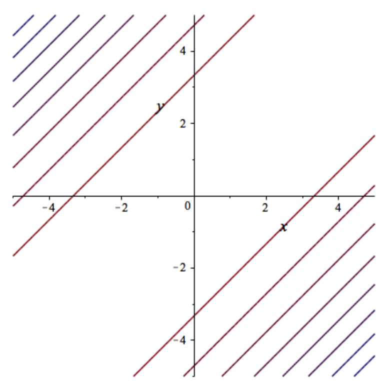
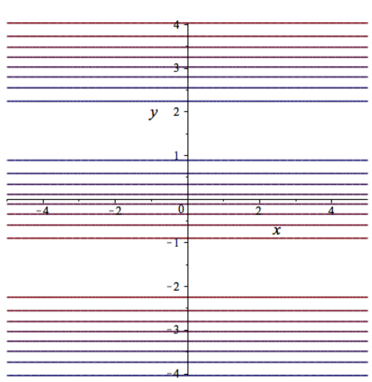


(v)



(vi)