PQ2

(13) $T(t) = \frac{1}{\sqrt{10+4t^2}} \langle 3, -1, 2t \rangle$

$T'(t) = \langle -\frac{3}{2}(10+4t^2)^{-3/2}(8t), \frac{1}{2}(10+4t^2)^{-3/2}(8t), 2(10+4t^2)^{-\frac{1}{2}} + 2t(-\frac{1}{2})(10+4t^2)^{-3/2}(8t) \rangle$

$= \frac{4}{(\sqrt{10+4t^2})^3} \langle -3t, t, \frac{1}{2}(10+4t^2) - 2t^2 \rangle = \frac{4}{(10+4t^2)^{3/2}} \langle -3t, t, 5 \rangle$ (b)

02 $= \frac{2^2}{(2(5+2t^2))^{3/2}} \langle -3t, t, 5 \rangle = \frac{2^2}{2^{3/2}(5+2t^2)^{3/2}} \langle -3t, t, 5 \rangle = \frac{\sqrt{2}}{(5+2t^2)^{3/2}} \langle -3t, t, 5 \rangle$

(get the common factor out of r)

(14) $r(t) = \sqrt{t}\, i + t\, j$; $t = 4$

$r'(t) = \frac{1}{2}t^{-1/2} i + j$

$r'(4) = \frac{1}{2\sqrt{4}} i + j$, $\|r'(4)\| = \sqrt{\frac{1}{16}+1} = \frac{\sqrt{17}}{4}$

$T(4) = \frac{r'(4)}{\|r'(4)\|} = \frac{\langle \frac{1}{4}, 1 \rangle}{\sqrt{17}/4} = \frac{1}{\sqrt{17}} \langle 1, 4 \rangle$

(15) find K at $t=1$ for $r(t) = t^2 i + t j + k$

$r'(t) = \langle 2t, 1, 0 \rangle$; $r'(1) = \langle 2, 1, 0 \rangle$

$r''(t) = \langle 2, 0, 0 \rangle$; $r''(1) = \langle 2, 0, 0 \rangle$

when $t=1$: $K = \frac{\|r'(t) \times r''(t)\|}{\|r'(t)\|^3} = \frac{\|\langle 2,1,0 \rangle \times \langle 2,0,0 \rangle\|}{\|\langle 2,1,0 \rangle\|^3}$

$= \frac{\|\langle 0,0,-2 \rangle\|}{\|\langle 2,1,0 \rangle\|^3} = \frac{2}{(\sqrt{5})^3} = \frac{2}{5^{3/2}}$

(16) find K in 2-space when $y = \frac{1}{x}$ at $(-1,-1)$

use $K = \frac{|y''|}{[1+(y')^2]^{3/2}}$ $\quad y' = -\frac{1}{x^2}$, $y'' = \frac{2}{x^3}$

$K = \frac{|\frac{2}{x^3}|}{[1+(-\frac{1}{x^2})^2]^{3/2}}$ at $(-1,-1)$ $= \frac{|\frac{2}{-1}|}{[1+(-\frac{1}{1})^2]^{3/2}} = \frac{2}{2^{3/2}} = \frac{1}{\sqrt{2}}$

(17) find K in 2-space for $r(t) = 3\cos t\, i + 3\sin t\, j$ at $(\sqrt{2}, \sqrt{7})$

use $K = \frac{a(t) \cdot N(t)}{\|v(t)\|^2}$

$v = r'(t) = \langle -3\sin t, 3\cos t \rangle$; $\|r'(t)\| = 3$

$T = \frac{\langle -3\sin t, 3\cos t \rangle}{3} = \langle -\sin t, \cos t \rangle$ $\quad N = \langle -\cos t, -\sin t \rangle$

$a = \langle -3\cos t, -3\sin t \rangle$ $\quad K = \frac{\langle -3\cos t, -3\sin t \rangle \cdot \langle -\cos t, -\sin t \rangle}{9}$

$K = \frac{3\cos^2 t + 3\sin^2 t}{9} = \frac{1}{3}$

(18) $16 \geq 4x^2 + y^2$

$\frac{x^2}{2^2} + \frac{y^2}{4^2} \leq 1$

(19) $f(x,y) = x^3 + y^2 - 3xy + 5$

$f(-1,2) = -1 + 4 + 6 + 5 = 14$

(20) $c = \sqrt{1 + x^2 - y}$

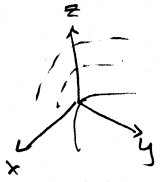
$c^2 = 1 + x^2 - y$

$y = x^2 + 1 - c^2$

vertex $(0, 1-c^2)$

Parabolas

(d)



(21) $f(x,y) = e^{xy}(\cos x \sin y)$

$f_y = xe^{xy}(\cos x \sin y) + e^{xy}(\cos x \cos y)$

$= e^{xy}\cos x (x \sin y + \cos y)$