Homework due 9/27

Daniel Gameiro RUID:195000275

Ok to post

Sec. 13.3

3) $r'(t) = \langle 2, \frac{1}{t}, 2t \rangle$

$|r'(t)| = \sqrt{\frac{(2t^2+1)^2}{t^2}}$

$\int_1^4 \sqrt{\frac{(2t^2+1)^2}{t^2}} = 15 + 2\ln(2)$

9) $r'(t) = \langle 2t, 4t, 3t^2 \rangle$

$|r'(t)| = \sqrt{t^2(9t^2+20)}$

$s(t) = \int_0^t \sqrt{t^2(9t^2+20)} = \frac{(9t^2+20)^{3/2} - 8 \cdot 5^{3/2}}{27}$

11) $r'(t) = \langle 2, 4, -1 \rangle$

$s(4) = |r'(4)| = \sqrt{21}$

13) $r'(t) = \langle 1, \frac{1}{t}, \frac{2\ln(t)}{t} \rangle$

$s(1) = |r'(1)| = \sqrt{2}$

15) $r'(t) = \langle 3\cos(3t), -4\sin(4t), -5\sin(5t) \rangle$

$s(\frac{\pi}{2}) = |r'(\frac{\pi}{2})| = 5$

Sec. 13.4

1) $r'(t) = \langle 8t, 9 \rangle$

$T(t) = \langle \frac{8t}{\sqrt{64t^2+81}}, \frac{9}{\sqrt{64t^2+81}} \rangle$

$T(1) = \langle \frac{8}{\sqrt{145}}, \frac{9}{\sqrt{145}} \rangle$

5) $r'(t) = \langle -\pi\sin(\pi t), \pi\cos(\pi t), 1 \rangle$

$T(t) = \langle \frac{-\pi\sin(\pi t)}{\sqrt{\pi^2+1}}, \frac{\pi\cos(\pi t)}{\sqrt{\pi^2+1}}, \frac{1}{\sqrt{\pi^2+1}} \rangle$

$$T(1) = \left\langle 0, -\frac{\pi}{\sqrt{\pi^2+1}}, \frac{1}{\sqrt{\pi^2+1}} \right\rangle$$

7) $r'(t) = \langle 0, e^t, 1 \rangle$

$$r''(t) = \langle 0, e^t, 0 \rangle$$

$$K(t) = \frac{|r'(t) \times r''(t)|}{|r'(t)|^3} = \frac{e^t}{(e^{2t}+1)^{3/2}}$$

11) $r'(t) = \left\langle -\frac{1}{t^2}, -\frac{2}{t^3}, 2t \right\rangle$

$$r''(t) = \left\langle \frac{2}{t^3}, \frac{6}{t^4}, 2 \right\rangle$$

$$r'(-1) = \langle -1, 2, -2 \rangle$$

$$r''(-1) = \langle -2, 6, 2 \rangle$$

$$K(1) = \frac{|r'(1) \times r''(1)|}{|r'(1)|^3} = \frac{\sqrt{296}}{27}$$

17) $y' = 4t^3$ $\quad$ $y'' = 12t^2$

$$y'(2) = 32 \qquad y''(2) = 48$$

$$K(2) = \frac{|y''(2)|}{(1+y'(2)^2)^{3/2}} = \frac{48}{1025^{3/2}}$$

21) $r'(t) = \langle \tanh(t)^2, -\operatorname{sech}(t) \cdot \tanh(t) \rangle$

$$r''(t) = \left\langle \frac{2\sinh(t)}{\cosh(t)^3}, \frac{\cosh(t)^2 - 2}{\cosh(t)^3} \right\rangle$$

$$K(t) = \frac{|r'(t) \times r''(t)|}{|r'(t)|^3} = \frac{\frac{1}{\cosh(t)}}{\sqrt{\frac{\sinh(t)^2}{\cosh(t)^2}}}$$

$$K(t) = \frac{1}{\sinh(t)} = \operatorname{csch}(t)$$

Sec. 13.5

3) $v(t) = \langle 3t^2, -1, 8t \rangle \quad v(1) = \langle 3, -1, 8 \rangle$

$a(t) = \langle 6t, 0, 8 \rangle \quad a(1) = \langle 6, 0, 8 \rangle$

$s(t) = \sqrt{9t^4 + 64t^2 + 1} \quad s(1) = \sqrt{74}$

5) $v(t) = \langle \cos\theta, -\sin\theta, -3\sin(3\theta) \rangle \quad v(\frac{\pi}{3}) = \langle \frac{1}{2}, -\frac{\sqrt{3}}{2}, 0 \rangle$

$a(t) = \langle -\sin\theta, -\cos\theta, -9\cos(3\theta) \rangle \quad a(\frac{\pi}{3}) = \langle -\frac{\sqrt{3}}{2}, -\frac{1}{2}, 9 \rangle$

$s(t) = \sqrt{\cos^2\theta + \sin^2\theta + 9\sin^2(3\theta)} \quad s(\frac{\pi}{3}) = 1$

15) $v(t) = \langle \frac{t^2}{2} + C_x, 4t + C_y \rangle$

$\frac{0}{2} + C_x = 3$ $\quad\quad$ $0 + C_y = -2$

$C_x = 3$ $\quad\quad$ $C_y = -2$

$v(t) = \langle \frac{t^2}{2} + 3, 4t - 2 \rangle$

$r(t) = \langle \frac{t^3}{6} + 3t + C_x, 2t^2 - 2t + C_y \rangle$

$0 - 0 + C_x = 0$ $\quad\quad$ $0 + C_y = 0$

$C_x = 0$ $\quad\quad$ $C_y = 0$

$r(t) = \langle \frac{t^3}{6} + 3t, 2t^2 - 2t \rangle$

17) $v(t) = \frac{t^2}{2} \cdot k + C$ $\quad\quad$ $C = i$

$v(t) = \frac{t^2}{2} \cdot k + i$

$r(t) = \frac{t^3}{6} \cdot k + t \cdot i + C$ $\quad\quad$ $C = j$

$r(t) = \frac{t^3}{6} \cdot k + t \cdot i + j$

31) $2\langle 2,1,-3\rangle \cdot \langle 12,20,20\rangle = -32$

Particle is slowing down

33) $v(t) = \langle 1, -\sin(t), \cos(t)\rangle$

$a(t) = \langle 0, -\cos(t), -\sin(t)\rangle$

$a_T(t) = 0 \qquad a_N(t) = 1$

Sec. 14.1

1) $f(2,2) = 2 + 2\cdot 2^3 = 18$

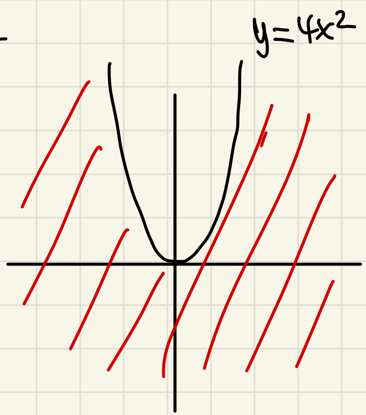
$f(-1,4) = -1 + 4(-1)^3 = -5$

3) $f(3,8,2) = \dfrac{3\cdot 8}{4} = 6$

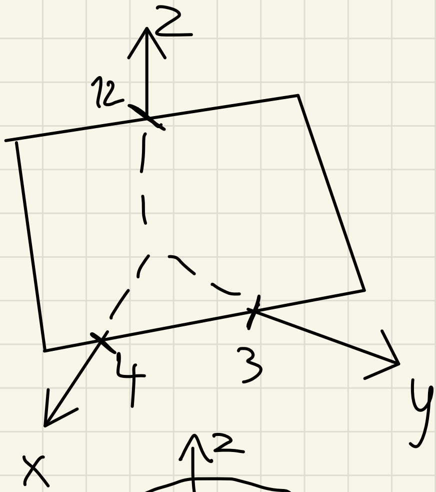
$f(3,-2,-6) = \dfrac{3(-2)}{(-6)^2} = -\dfrac{1}{6}$

7) The domain is $4x^2 - y > 0$

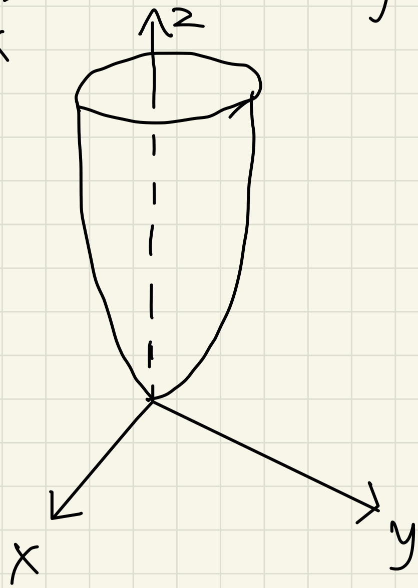
The domain is the red region



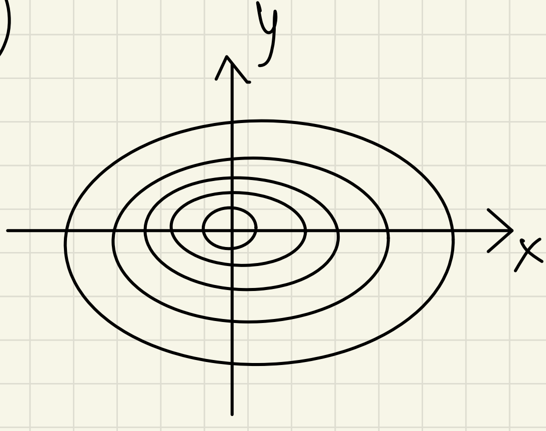
21)



23)



33)



35)

37) For $m=6$, we have $f(x,y)=2x+6y+6$

For $m=3$, $f(x,y)=x+3y+3$

Sec. 14.2

5) This problem is missing in the scan

15) $\lim_{x\to 0} \frac{x^3+(mx)^3}{x\,(mx)^2} = \lim_{x\to 0} \frac{x^3(1+m)}{m^3x^3}$

$= \lim_{x\to 0} \frac{1+m}{m^3} = \frac{1+m}{m^3}$

The limit depends on m, therefore it doesn't exist.

21) $\lim_{x\to 0} \frac{x(mx)}{3x^2+2(mx)^2} = \lim_{x\to 0} \frac{mx^2}{x^2(3+2m^2)}$

$= \lim_{x\to 0} \frac{m}{3+2m^2} = \frac{m}{3+2m^2}$ Limit doesn't exist

23) Along the x-axis we know $y=0$, $z=0$

$\lim_{x\to 0} \frac{x}{x^2} = \lim_{x\to 0} \frac{1}{x} = \infty$

27) Plugging in, this limit equals $-16e$

31) Plugging in, this limit equals $\frac{1}{5}$

35) Plugging in, this limit equals -48