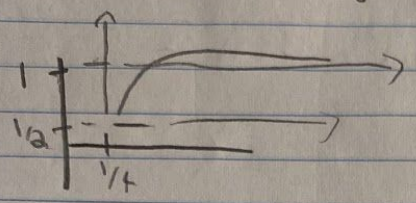
2)

$$D=\{(x,y)\mid 0\le y\le\sqrt{x},\ \tfrac{1}{4}\le x\le 1\}$$



$$D=\ \tfrac{1}{2}\le y\le 1\ ,\ y^2\le x\le 1$$

3) $2\cos(\pi/3)+4\cos(\pi/3)+8\cos(\pi/3)=7$

$F_x=-2\sin(x+y)-4\sin(x+z)\Rightarrow -2\sin(\pi/3)-4\sin(\pi/3)$

$F_y=-2\sin(x+y)-8\sin(y+z)\to -2\sin(\pi/3)-8\sin(\pi/3)$

$F_z=-4\sin(x+z)-8\sin(y+z)\to -4\sin(\pi/3)-8\sin(\pi/3)$

$z=-3\sqrt{3}(x-\pi/3)+-5\sqrt{3}(y-\pi/3)+-6\sqrt{3}(z-\pi/3)$

4) $0-\langle 1,1,-1\rangle+\langle a,1,2\rangle+2\langle -1,-1,1\rangle-0+3\langle 1,-1,1\rangle+2\langle -2,-1,2\rangle$

$-\langle -1,1,-1\rangle$

$i=-1+2-2+3-4+1=1$

$j=1+1-2-3-2-1=-6$ $\Big\}\ \langle -1,-6,6\rangle$

$k=-1+2+2+3-4+1=6$

5)

$AB = \langle 1,0,1 \rangle$

$AC = \langle 1,1,0 \rangle$

$BC = \langle 0,1,-1 \rangle$

$\langle 0,-1,1 \rangle \cdot \langle -1,-1,0 \rangle$

$\theta_A = \cos^{-1}\left(\frac{1}{2}\right)$

$\theta_B = \cos^{-1}\left(\frac{1}{2}\right)$

$\theta_C = \cos^{-1}\left(\frac{1}{2}\right)$

6) $\nabla f = (3x^2+yz, 3y^2+xz, 3z^2+xy)$

$\nabla f_P = (4,4,4)$

$QP = (-1-1, -1-1, -1-1) = (-2,-2,-2)$

$\left(\frac{2}{\sqrt{2^2+2^2+2^2}}, \ldots, \ldots\right) = \left(\frac{-2}{\sqrt{12}}, \frac{-2}{\sqrt{12}}, \frac{-2}{\sqrt{12}}\right)$

$\nabla f \cdot u = (4,4,4) \cdot \left(\frac{-2}{\sqrt{12}}, \frac{-2}{\sqrt{12}}, \frac{-2}{\sqrt{12}}\right) = \frac{-12}{\sqrt{3}}$

$-4\sqrt{3}$

7) $\frac{dg}{dx} = 6x \cdot \frac{dy}{dy} = -6y$

$\frac{\partial x}{dv} = e^v \cos v \quad \frac{\partial v}{\partial v} = e^v \sin v$

$\frac{dg}{\partial v} = 6e^{2v} \cdot \cos^2(v) - 6e^{2v} \sin^2(v)$

$\frac{dg}{\partial v}\Big|_{v,1} = 6\cos^2(1) - 6\sin^2(1)$

8)

$div(F) = 6$

$\iiint_C dv = 6 \; V_D$

$= 6\left(\frac{4\pi}{3} \cdot 2^3\right) = 8\pi$

9) $v = (1,0,2)$

$v = (0,1,3)$

$v \times v = (-2,-3,1)$

$\int_0^1 \int_0^1 (-16v - 14v)\, dv\, dv = -16v - 14v$

$\int_0^1 (-16v - 14v)\, dv = -8v^2 - 14vv\Big|_0^1 = -8 - 14v$

$\int_0^1 -8 - 14v \to -8v - 7v^2\Big|_0^1 \to -15$

10) $f_x = 4 - \frac{2}{2x+y}$

$f_{xx} = \frac{4}{(2x+y)^2}$

$f_y = -2y - \frac{1}{2x+y}$

$f_{yy} = \frac{1}{(2x+y)^2} \cdot 2$

$f_{xy} = \frac{2}{(2x+y)^2}$

$2(2x+y) = 1$

$2x+y = 1/2$

$y = \frac{1}{2} - 2x$

$-2(\frac{1}{2} - 2x = \frac{1}{2}x + \frac{1}{2} - 2x$

$\frac{1}{2} - 2x = 1$

$-2x = -\frac{3}{2}$

$x = 3/4$

$y = \frac{1}{2} - 2(3/4) = -1$

Saddle $\Rightarrow (3/4, -1)$

$D = f_{xx} \cdot f_{yy} - f_{xy}$

= plug in point into partial deriv

$= -8$

$-8 < 0$ ✓ saddle point confirmed

11)

$f_x = \frac{1}{2} f(x,y,z) \cdot 4x = 2/3$

$f_y = \frac{1}{2} f(x,y,z) \cdot 6y = 1$

$f_z = \frac{1}{2} f(x,y,z) \cdot 2z = 2/3$

$L(x,y,z) = 3 + 2/3(x-1) + 1(y-1) + 2/3(z-2)$

$L(1.001, .9.99, 2.001) = 3.0003$

13) $0 \le z \le 2 \mid 0 \le y \le \sqrt{4-z^2} \quad -\sqrt{4-z^2-y^2} < x < 0$

$x<0 \mid y>0 \mid z>0 \quad 0<\rho<2 \mid \pi/2 < \theta < \pi \mid 0 < \phi < \pi/2$

$(\rho \sin\phi \cos\theta)^2 \cdot \rho \sin\phi \sin\theta \cdot \rho\cos\phi \rho^2 \sin\phi$

14) $\frac{\| \langle -9,0,0 \rangle \|}{\| \langle 0, 3/2, \frac{-3\sqrt{3}}{2} \rangle \|^3} = \frac{9}{(3)^3} \Rightarrow \frac{1}{3}$

15) $u \times v = (2v, v, 0) \times (0, v, 2v) \to (2v^2, -4uv, 2v^2)$

$$\int_0^1 \int_0^1 \sqrt{4 + 16u^2v^2 + 4v^2}$$

16) $\nabla f = y^2z^3, 2xyz^3, 3xy^2)$

$\nabla f(1)^2(1)^3, 2(1)^3, 3(1)^2 = (1,2,3)$

$\nabla g = (1, 2y, 3z^2) = (1, 2\beta)$

$\nabla g \cdot \nabla f = 14$