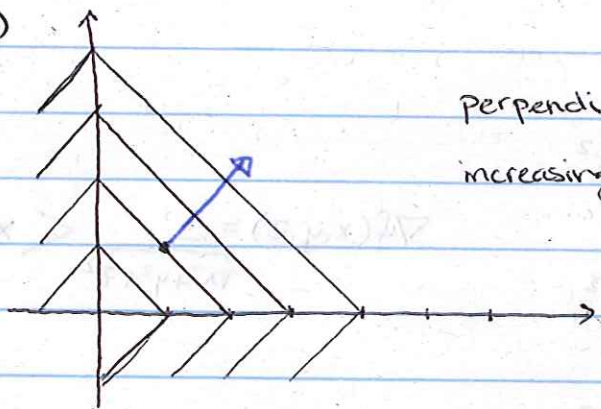


## Hw #17 Solutions:

1.)



perpendicular; pointing toward z  
increasing

2.) a)  $f(x,y) = 7x\sqrt{y}$  ,  $(1,4)$

(i)  $f_x = 7\sqrt{y}$

$f_y = \frac{7x}{2} \cdot \frac{1}{\sqrt{y}}$

$$\nabla f(x,y) = \left\langle 7\sqrt{y}, \frac{7x}{2\sqrt{y}} \right\rangle$$

~~XXXXXXXXXX~~

(ii)  $\nabla f(1,4) = \left\langle 7(2), \frac{7(1)}{2(2)} \right\rangle = \left\langle 14, \frac{7}{4} \right\rangle$

b.) (i)  $f_s = 2te^{st}$

$f_t = ste^{st} + e^{st}$

$$\nabla f(s,t) = \left\langle t^2e^{st}, ste^{st} + e^{st} \right\rangle$$

(ii)  $\nabla f(0,2) = \langle 4, 1 \rangle$

c.) (i)  $f(u,w) = \sin(uw)$

$f_u = w \cos(uw)$

$f_w = u \cos(uw)$

$$\nabla f(u,w) = \langle w \cos(uw), u \cos(uw) \rangle$$

(ii)  $\nabla f(2,0) = \langle 0, 2 \rangle$

$$(d) \quad f(x, y, z) = \sqrt{x^2 + y^2 + z^2} \quad (3, 6, -2)$$

$$(i) \quad f_x = \frac{x}{\sqrt{x^2 + y^2 + z^2}}$$

$$f_y = \frac{y}{\sqrt{x^2 + y^2 + z^2}}$$

$$f_z = \frac{z}{\sqrt{x^2 + y^2 + z^2}}$$

$$\nabla f(x, y, z) = \frac{1}{\sqrt{x^2 + y^2 + z^2}} \langle x, y, z \rangle$$

(ii)

$$\nabla f(3, 6, -2) = \frac{1}{\sqrt{9+36+4}} \langle 3, 6, -2 \rangle$$

$$= \frac{1}{7} \langle 3, 6, -2 \rangle$$

OR  $\nabla f(3, 6, -2) = \left\langle \frac{3}{7}, \frac{6}{7}, -\frac{2}{7} \right\rangle$