**Calc III - Ch 14 – Part 2 - Required Practice** **ANSWERS ONLY**

## 14.6

#1. $2+\frac{\sqrt{3}}{2}$

#2. (i) $\nabla f = \langle 2\cos(2x+3y),\ 3\cos(2x+3y)\rangle$

(ii) $\langle 2,3\rangle$

(iii) $\sqrt{3}+\frac{3}{2}$

#3. $\frac{23}{10}$

#4. $\frac{4}{\sqrt{30}}$

#5. $\frac{2}{5}$

#6. $\sqrt{32}$ *in direction* $\langle -4,4\rangle$ *or* $\langle -1,1\rangle$

#7. $\left(\frac{3}{2},\ \frac{5}{2}\right)$

#8. (i) ascend at $0.8\ \frac{m\ height}{m\ in\ direction}$

(ii) descend at $-\frac{0.2}{\sqrt{2}}\ \frac{m\ height}{m\ in\ direction}$

(iii) $\nabla f = \langle -0.6,\ -0.8\rangle$

$1\ \frac{m\ height}{m\ in\ direction}$

$45°$

#9. (paths must cross perpendicular to contour lines)

#10. (vector starts at 4,6 goes down and slightly right in direction of fastest increase – length is about 1.5)

#11. $x+y+z=11$

## 14.7

#1. . (i) saddle point at (0,2)
(ii) local maximum at (0,2)
(iii) is inconclusive

#2. Saddle point at (0,0), local min at (1,1)

#3. Local max value of 11 at $\left(-1,\frac{1}{2}\right)$ there are no local minimum values.

#4. Absolute max of 9 at (2,0), absolute min of -14 at (0,3).

#5. Minimum distance is $\sqrt{3}$.

#6. $x=y=z=\frac{100}{3}$.

#7. Base is 40 cm x 40 cm, height = 20 cm.

## 14.8

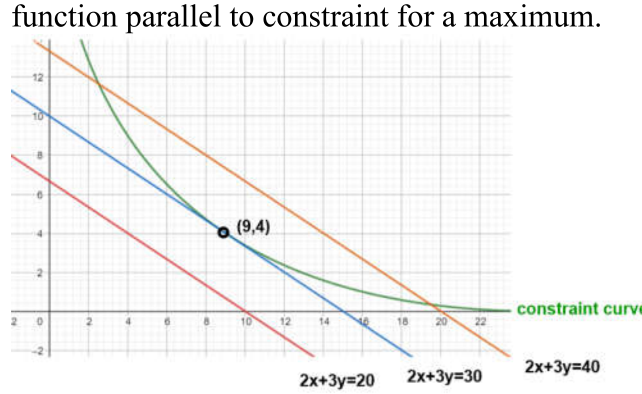
#1. Minimum of 2 at $(1,1)$ and $(-1,-1)$

#2. Maximum of 70 at $(1,3,5)$, minimum of -70 at $(-1,-3,-5)$

#3. (i) Lagrange solution is $(9,4)$

(ii) $f(25,0)=50,\ f(9,4)=30$

(iii) Lagrange can find a minimum here because at minimum objective function and constraint are parallel. There is no way to make objective function parallel to constraint for a maximum.




(iv) Objective function and constraint are parallel (tangent) at (9,4).