Math 254 Assignment 9 S18

~~+½ free~~ ~~*~~ 13 points

① a) $T(7,3) = 53°F$

b) $\text{Ave ROC} = \dfrac{T(8,4)-T(8,0)}{4} = \dfrac{66-35}{4} = \dfrac{31}{4} \approx 7.75°F/ft$

c) The temperature decreases to about 78°F, then increases.

+½ each

d) The temperature increases to about 78°F, then decreases.

e) $\text{Ave ROC} = \dfrac{T(7,5)-T(7,1)}{5-1} = \dfrac{64-38}{4} = \dfrac{26}{4} = 6.5°F/ft$

+~~8~~

+4

f) As one travels from (7,1) to (7,5), the temperature increases by an average of 6.5°F per foot.

g) $\text{Ave ROC} = \dfrac{T(9,1)-T(5,6)}{\sqrt{(9-5)^2+(1-6)^2}} = \dfrac{50-62}{\sqrt{41}} = -\dfrac{12}{6.4} = -1.9°F/ft$

+1

As one travels from (5,6) to (9,1), temperature decreases by an average of 1.9°F per foot.

② a) As wind speed increases, wind chill temperature decreases.

b) As actual temperature increases, wind chill temperature increases.

+2½

½ each

c) $W(10,15) = -7°F$ When the actual temperature is 10°F and the wind speed is 15 mph, the wind chill temperature is −7°F.

② d) $\text{Ave ROC} = \dfrac{W(30,10) - W(0,10)}{30-0} = \dfrac{21-(-16)}{30} = \dfrac{37}{30} = 1.2\,°F/°F$ (wind chill / actual temp)

e) $\text{Ave ROC} = \dfrac{W(20,20) - W(20,5)}{20-5} = \dfrac{4-13}{15} = -\dfrac{9}{15} = -0.6\,°F/\text{mph}$

③ a) $T(3,200) = 44°F$

b) The temperature at a depth of 3 feet and on the 200th day is 44°F.

c) $\text{Ave ROC} = \dfrac{T(1.5,50) - T(0.5,50)}{1\text{ft}} = \dfrac{-1}{1} = -1°F/\text{ft}$

+4

+½ each

d) $\text{Ave ROC} = \dfrac{T(2,182.5) - T(2,0)}{182.5} = \dfrac{41-79}{182.5} = \dfrac{-38}{182.5} = -0.2\,°F/\text{day}$

e) At a dept of 5 feet and on the 100th day, the temperature is decreasing by 0.18 °F per day.

f) At a depth of 5 feet and on the 100th day, the temperature is decreasing by 4.21 °F per foot deeper.

g) $T_t(d,t) = -0.516e^{-0.2d}\sin(0.0172t - 0.2d)$

$T_d(d,t) = 6e^{-0.2d}\sin(0.0172t - 0.2d)$
$\quad - 6e^{-0.2d}\cos(0.0172t - 0.2d)$

Assignment 9 Additional Exercises

$$f(x,y) = 5e^{-3xy^2}$$

$$\boxed{f_x(x,y) = -15y^2e^{-3xy^2}}$$

$$\boxed{f_y(x,y) = -30xy\,e^{-3xy^2}}$$

+2½

$$\boxed{f_{xx}(x,y) = 45y^4e^{-3xy^2}}$$

$$\boxed{f_{yy}(x,y) = 180x^2y^2e^{-3xy^2} - 30xe^{-3xy^2}}$$

$$\boxed{f_{xy}(x,y) = 75xy^3e^{-3xy^2} - 30y\,e^{3xy^2}}$$