Jessenia Bello 10/11/2020
calc homework

14.6

1) $f(x,y,z) = x^2y^3+z^4$ $x = s^2$ $y = st^2$ $z = s^2t$

A $\frac{df}{dx} = 2xy^3$ B $\frac{dx}{ds} = 2s$ C $d[\frac{\partial y}{\partial x} + \frac{\partial f}{\partial y}\frac{\partial y}{\partial s} + \frac{\partial f}{\partial z}$

$= 3x^2y^2$ $\frac{df}{dz} = 4z^3$ $\frac{dy}{ds} = t^2$ $\frac{dz}{ds} = 2st$ $= 4s \cdot s^2 \cdot s^3 t^6 + 3t^2$

$\cdot s^4 \cdot s^2 t^4 + 8st \cdot s^6 t^3$

3) $\frac{df}{ds} = (y)(2s) + (x)(2r) + (2z)(0)$ $= 7s^6t^6 + 2s^7t^4$

$df / ds = 2ys + zr$ $\frac{df}{ds} = 2(2rs)s + 2(s^2)r$

$df / ds = 6rs^2$, using chainrule $= \frac{df}{ds}(y)(0) + (x)(2s) + (2z)(2r) = 2xs + 4zr$

5) $\frac{dg}{dx} = -\sin(x-y)$ $\frac{dg}{dy} = \sin(x-y)$ $\frac{dx}{du} = 3$ $\frac{dy}{du} = -7$

$-3\sin(x-y) - 7\sin(x-y)$ $\frac{dx}{dv} = -5$ $\frac{dy}{dv} = 15$

$= -10\sin(10u - 20v)$

and $5\sin(x-y) + 15\sin(x-y) = 20\sin(10u-20v)$

7) $f(u,v) = e^{u+v}$

$\frac{df}{du} = e^{u+v}$ $\frac{\partial f}{\partial v} = e^{u+v}$ Chainrule $0 + xe^{u+v}$

$\frac{du}{dy} = 0$ $\frac{dv}{dy} = x$ $= xe^{x^2+xy}$

$= xe^{x(x+y)}$

15) $\frac{dg}{dx} = 2x$ $\frac{dg}{dy} = -2y$

$\frac{dx}{dv} = e^u\cos v$ $\frac{dy}{dv} = e^u\sin v$ $\frac{dg}{dv}\Big|_{u,v=(0,1)}$

$\frac{dg}{dv} = 2xe^u\cos v - 2ye^u\sin v$ $= 2\cos^2(1) - \sin^2(1) =$

$2\cos(2)$

17) $\frac{dD}{dt} = 2/10 \times 20 + \frac{1}{2}/10 \times 10$

$= \frac{134}{5}$ ft/s

$= 26.8$ ft/s $= \frac{dD}{dt}$

23) $\frac{df}{dt} = \frac{\partial f}{dx}\frac{dx}{dt} + \frac{df}{dy}\frac{dy}{dt}$ $= \frac{df}{dy} \cdot (-1) = \frac{df}{dx} - \frac{df}{dy}$

$= (\frac{df}{dx})^2 - (\frac{df}{dy})^2 = \frac{df}{ds}\frac{df}{dt}$

27 $f(x,y,z) = x^2y + y^2z + xz^2 - 10$

$f_x = 2xy + z^2$

$f_z = y^2 + 2xz$

$\frac{\partial z}{\partial x} = -\frac{f_x}{f_z} = \frac{2xy+z^2}{2xz+y^2}$

$\frac{dz}{dx} = -\frac{2xy+z^2}{2xz+y^2}$ ✓

29 $f(x,y,z) = e^{xy} + \sin(xz) + y$

$f_y = xe^{xy} + 1$

$f_z = x\cos(xz)$

$\frac{dz}{dy} = -\frac{f_y}{f_z} = \frac{xe^{xy}+1}{x\cos(xz)}$

$\frac{dz}{dy} = -\frac{xe^{xy}+1}{x\cos(xz)}$ ✓

31 $f(x,y,w) = \frac{1}{w^2+x^2} + \frac{1}{w^2+y^2} - 1$

$f_y = -\frac{2y}{(w^2+y^2)^2}$

$f_w = \frac{-2w}{(w^2+x^2)^2} - \frac{2w}{(w^2+y^2)^2}$

$= \frac{-y(w^2+x^2)^2}{w((w^2+y^2)^2+(w^2+x^2)^2)}$

$\left.\frac{dw}{dy}\right|_{(1,1,1)} = \frac{y}{4+4} = -1/2$ ✓

Jessenia Bell calc homework
14.7

1.) $f(x,y) = x^2 + y^2 - 4xy$
$b = 0$ $a = 2b = 0$, $(0,0)$
$b = \sqrt{2}$, $a = 2b = 2\sqrt{2}$ $(2\sqrt{2}, \sqrt{2})$
$b = -\sqrt{2}$ $a = 2b = (-2\sqrt{2}, -\sqrt{2})$
$f(x,y)$ is 4

| -16 |
| 32 |
| 32 |

3.) $f_y(x,y) = 32(2x)^5 + x - 6(-2x) - 3(2x^2) = 0$
$= x(256x^2 + 12x - 13) = 0$
$x = \frac{-12 \pm \sqrt{144 - 4(-13)(256)}}{512}$ $x = \frac{13}{64}, -\frac{1}{4}$ and 0
at $(0,0)$ -> decreasing

5.) $D(0,0) = -1 < 0$ both are local minima
$D(1,0) = -1 < 0$
$D(0,-1) = -1 < 0$
$D(1/3, -1/3) = -4(1/3)(-1/3) - (-2/3 - 2/3 + 1)^2 = 1/3 > 0$
$\therefore$ $(0,0)$ $(1,0)$ $(0,-1)$ are saddle points $(1/3, -1/3)$ -> minima

7) $f_{xx}(x,y) = 2$
$f_{yy}(x,y) = 2$
$f_{xy}(x,y) = 1$
3, $(-2/3, -1/3)$ is local minimum

11) $f_{xx} = -18x$
$f_{yy} = -4x$
$f_{xy} = -4y$
$= 32$ for all four - discriminant
$(0, \sqrt{2})$ is saddle point

13) $D(1,1) = 128 > 0$
$D(-1,-1) = 128 > 0$
$D(0,0) = -16 < 0$

19) $f_{xx} = -1/x^2$
$f_{yy} = -2/y^2$
$f_{xy} = 0$
Discriminate $= 8$ $D > 0$ $f_{xx} < 0$

21) $f_x = 1 - \frac{1}{x+y}$
$f_y = -2y - \frac{1}{x+y}$
$f_x = 0$ $f_y = 0$
$f_{xx} = \frac{1}{(x+y)^2}$
$f_{yy} = -2 + \left(\frac{1}{x+y}\right)^2$
$f_{xy} = \frac{1}{(x+y)^2}$
Discriminate $= -2$
$\therefore$ saddle points $D < 0$