Jessenia Bello Calc 3 homework

14.3

3 $\frac{\partial}{\partial y} \frac{y}{x+y} = \frac{1(y) - (x+y)1}{x+y} = \frac{1-x}{(x+y)^2}$

5) $f_x(x,y,z) = xy \rightarrow f(2,3,1) = 3 \cdot 2 = 6$

17) $z = \frac{x}{y}$; $\frac{d}{dx} z = \frac{1}{y}$; $\frac{d}{dy} z = \frac{-x-0}{y^2} = \frac{-x}{y^2}$

19) $z = \sqrt{9-x^2-y^2}$; $\frac{d}{dx} z = \frac{1}{2}(9-x^2-y^2)^{-1/2} \cdot (-2x)$; $\frac{d}{dy} z = \frac{1}{2}(9-x^2-y^2)^{-1/2}(-2y)$

21) $z = \sin x \cdot \sin y$; $\frac{d}{dx} z = \cos(x)\sin y + 0(\sin x) = \cos(x)\sin(y)$

$\frac{d}{dy} z = \sin(x)\cos(y)$

27) $w = e^{r+s} = e^{r} \cdot e^{s}$; $\frac{d}{dr} w = e^{r} \cdot e^{s} + 0 = e^{rs}$

$\frac{d}{ds} w = e^{s} \cdot e^{r} + 0 = e^{rs}$

31) $z = e^{-x^2-y^2} = e^{-x^2} \cdot e^{-y^2}$; $\frac{d}{dx} z = -2xe^{-x^2} \cdot e^{-y^2} + 0$

$\frac{d}{dy} z = e^{-x^2} \cdot -2ye^{-y^2} + 0$

39) $\theta = \frac{L}{M} \cdot e^{-L+t/M}$; $\frac{d}{dL}\theta = \frac{L}{M}\left(\frac{-1}{M}\left(\frac{-1}{M} e^{-L+t/M}\right)\right.$

$+ e^{L+t/M}\left(\frac{1}{M}\right)$

$= Le^{-L+t/M} + \frac{e^{L+t/M}}{M}$

$= \frac{-Le^{L+t/M} + L^2}{M^2} + e^{-L+t/M} = \frac{-MLe^{-L+t/M}}{M^3} + \frac{L^2 + e^{-L+t/M}}{M^3}$

$\frac{d}{dt}\theta = \frac{L}{M}\left(-\frac{1}{M} e^{-L+t/M}\right) + 0 = \frac{-L^2 e^{L+t/M}}{M^3}$

47) $I(T,H) = 45.33 + 0.6845T + 5.758H - 0.00365T^2 - 0.1565H + 0.01HT^2 = 106.132$ ✓

b) $\frac{d}{dT} I(95,50) = 1.6665$ ✓

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3) $f(x,y) = x^2 y + xy^3$ (2, 1)
$f(2, 1) = 2^2(1) + 2(1) = 6$
$f_x(2,1) = 2xy + y^3 = 2(2)(1) + 1^2 = 5$
$f_y(2,1) = x^2 + 3xy^2 = 2^2 + 3(2)(1) = 10$
$6 + 5(x-2) + 10(y-1) = z$
$5x + 10y - 14 = z$

5) $f(x,y) = x^2 + y^2$ (4, 1)
$f(4,1) = 4^2 + 1 = 17$
$f_x(4,1) = 2x + 0 = 2(4) = 8$
$f_y(4,1) = 0 + -2y^{-3} = -2(1)^2 = -2$
$z = 17 + 8(x-4) - 2(y-1)$
$8x - 2y - 13 = z$

7) $f(r,s) = r^2 s^{-1/2} + s^{-3}$ (2, 1)
$f(2,1) = 2^2 + \frac{1}{\sqrt{1}} + \frac{1}{1^3} = 5$
$f_r(2,1) = 2rs^{-1/2} + 0 = \frac{2(2)}{\sqrt{1}} = 4$
$f_s(2,1) = -\frac{1}{2} r^2 s^{-3/2} + -3s^{-4} = -\frac{1}{2^2\sqrt{1}} \cdot 2^2 - \frac{3}{1^4} = -\frac{4}{2} - 3$
$= -5$

$z = 5 + 4(r-2) - 5(s-1)$
$= 5 + 4r - 8 - 5s + 5$
$= 4r - 5s + 2 = z$

13) $L(x,y) = f(a,b) + f_x(a,b)(x-a) + f_y(a,b)(y-b)$
$= 4 + 4(x-2) + 12(y-1)$
$L(2.01, 1.02) = 4 + 4(2.01 - 2) + 12(1.02 - 1)$
$= 4 + 4(0.01) + 12(.02)$
$= 4 + 0.04 + 0.24$
$= 4.28$
$L(1.97, 1.01) = 4 + 4(1.97 - 2) + 12(1.01 - 1) = 4.2234$

12. let $f(x,y) = x^3 y^{-4}$

$F_x(x,y) = 3x^2 y^{-4}$

$F_y(x,y) = -4x^3 y^{-5}$

$f(a,b) = 2^3(1)^{-4} = 8$

$8 + 12(x-2) - 32(y-1)$

$= 8 + 12x - 24 - 32y + 32$

$12x - 32y + 16$

$L(2.03, 0.9) = 12(2.03) - 32(.9) + 16$

17) $L(x,y) = 1 + 0(x-0) + 1(y-0)$

$= y + 1$

$L(0.01, -0.02) = -0.02 + 1 = .98$

23-27) using linear approximation to estimate the value given by a calculator.

23) $L(2.01, 1.02) = 8 + 12(2.01 - 2) + 16(1.02 - 1)$

$= 8.44$ ✓

25) $\sqrt{3.01^2 + 3.98^2}$

$= f_x(3,4) = \frac{1}{2}(3^2+4^2)^{-1/2} \cdot 3^2 = .9$

$f_y(3,4)\ \frac{1}{2}(3^2+4^2)^{-1/2} \cdot 4^2 = 1.6$

27) $\sqrt{(1.9)(2.02)(4.05)}$

$f(2,2,4) = \sqrt{2 \cdot 2 \cdot 4} = 4$

$f(2,2,4)^{-1/2}\ 2 \cdot 4 = 1$

$f(2,2,4) = \frac{1}{2}(2 \cdot 2 \cdot 4)^{-1/2} \cdot 2 \cdot 2 = .5$

$L(x,y,z) = 4 + (x-2) + y(y-2) + 0.5(z-4)$

$L(1.9, 2.02, 4.05) = 4 + 0.1 + 0.2 + 0.025$

$= 3.945$

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7) $h(x,y,z) = xyz^{-3}$
$= \langle yz^{-3}, zz^{-3}, -3xyz^{-7} \rangle$

4-19) use calculator for d/dt

11) $f(x,y) = x^2 - 3xy$
$r(t) = \langle \cos(t), \sin(t) \rangle$ $t=0$
$d/dt\ f(r(t)) = \nabla f(r(t)) \cdot r'(t)$
$d/dx\ f(r(t)) = \nabla f\ r(0) = r'(0)$ $= \langle 2, -3 \rangle \langle 0, 1 \rangle = -3$

13) $f(x,y) = \sin(x \cdot y)$, $r(t) = \langle e^{2t}, e^{3t} \rangle$ $t=0$
$d/dx\ f(r(0)) = \langle \cos(1), \cos(1) \rangle \langle 2, 3 \rangle = 5\cos(1)$

19) $\frac{d}{dt} f(r(t)) \langle 1, \pi e \rangle \langle e, 1, 2 \rangle = e + \pi e - 2e = 0$

27) $f(x,y) = \ln(x^2 + y^2)$ $v = 3i - 2j$ $P = (1,0)$
$0 \rangle \langle \frac{3}{\sqrt{13}}, -\frac{2}{\sqrt{13}} \rangle = \sqrt{13}$ ✓

31) DNE because the limit exist

33) $(3, 9, 4)$
$\frac{\langle e^{3}, 3e^{3}, -3e^{3} \rangle \langle 2, -2, -1 \rangle}{\sqrt{2^2 + 2^2 + 1^2}} = 2e^{3} - 6e^{3} + 3e^{3} = -\frac{e^{3}}{3}$

37) $\nabla f(x,y,z) = \langle \cos(xy+z) \ldots$

41) find vector normal to the surface
$x^2 + y^2 - z^2 = 6$ at $P(3,1,2)$

43) $\langle \frac{x}{2}, \frac{y}{2}, \frac{2z}{1} \rangle = y = \frac{x}{2}$ $y = \frac{2y}{2} - x = 2$