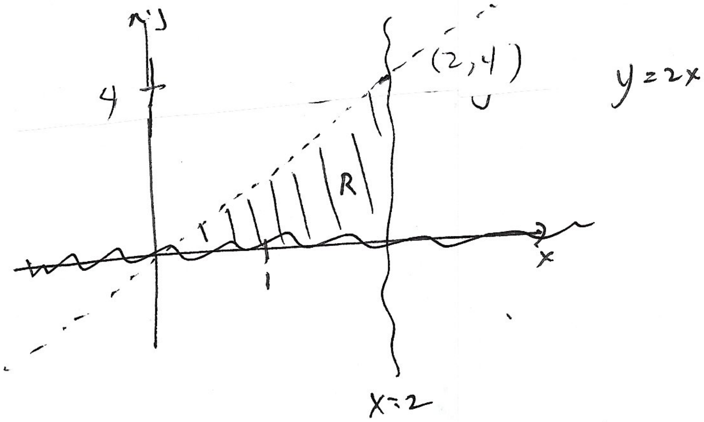
88.

#10. $f(x,y) = 2x+y$



$$V = \iint_R f(x,y)\, dA$$

$$= \int_0^2 \int_0^{2x} 2x+y \; dy\, dx$$

$$= \int_0^2 2xy + \frac{1}{2}y^2 \Big|_0^{2x} dx$$

$$= \int_0^2 2x(2x-0) + \frac{1}{2}(4x^2)\; dx$$

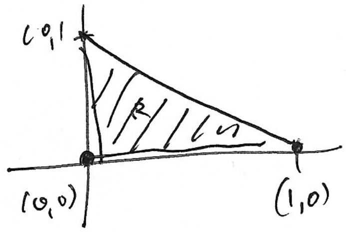
$$= \int_0^2 6x^2\, dx$$

$$= 6 \cdot \frac{1}{3}x^3 \Big|_0^2$$

$$= 2(8-0)$$

$$= 16$$

#12 $f(x,y) = e^{x+2y}$



$y = -x+1$

$$V = \iint_R f(x,y)\, dA$$

$$= \int_0^1 \int_0^{-x+1} e^{x+2y}\, dy\, dx$$

$$= \int_0^1 e^x \int_0^{-x+1} e^{2y}\, dy\, dx$$

$$= \int_0^1 e^x \, \frac{1}{2} e^{2y} \Big|_0^{-x+1} dx$$

$$= \frac{1}{2} \int_0^1 e^x \left(e^{2(-x+1)} - 1\right) dx$$

$$= \frac{1}{2} \int_0^1 e^x \left(e^{-2x+2} - 1\right) dx$$

$u = -x+2$
$du = -dx$
$-du = dx$

$$= \frac{1}{2} \int_0^1 e^{-x+2} - e^x \, dx$$

$$= \frac{1}{2} \left(-\int_2^1 e^u \, du - \int_0^1 e^x \, dx \right)$$

$$= \frac{1}{2} \left(-e^u \Big|_2^1 - e^x \Big|_0^1 \right)$$

$$= \frac{1}{2} \left(-(e - e^2) - (e-1) \right)$$

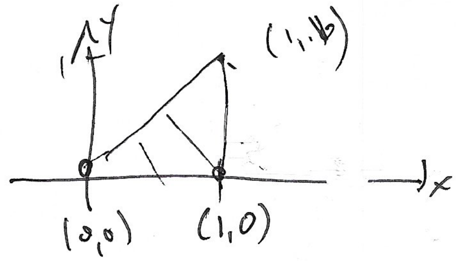
$$= \frac{1}{2} \left(-e + e^2 - e + 1 \right)$$

$$= \frac{1}{2} \left(-2e + e^2 + 1 \right)$$

$$= \frac{1}{2} (e-1)^2$$

#18. Find Ave value

$f(x,y) = x + 2y$



$y = x$

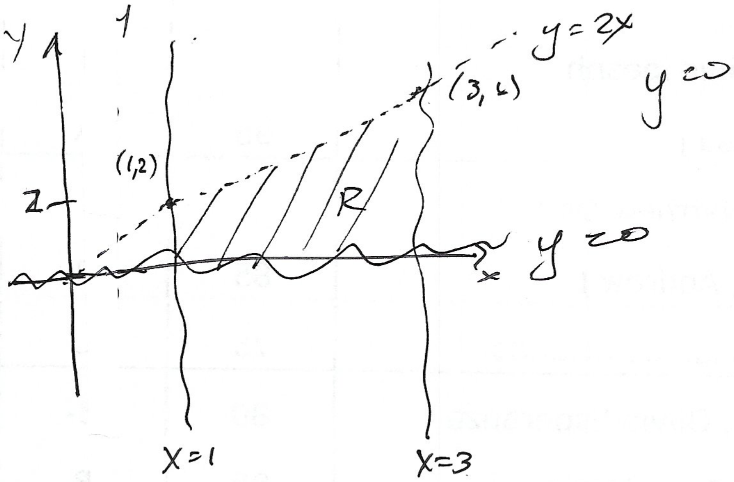
$$\text{Ave} = \frac{\iint_R f(x,y)\,dA}{\iint dA} \Rightarrow \frac{T}{B}$$

$$T = \iint f(x,y)\,dA$$
$$= \int_0^1 \int_0^x x+2y \; dy\,dx$$
$$= \int_0^1 xy + y^2 \Big|_0^x \, dx$$
$$= \int_0^1 x(x-0) + (x^2 - 0) \; dx$$
$$= \int_0^1 2x^2 \, dx$$
$$= \frac{2}{3} x^3 \Big|_0^1$$
$$= \frac{2}{3}$$

$$B = \frac{1}{2} bh$$
$$= \frac{1}{2}(1)(1)$$
$$= \frac{1}{2}$$

$$\text{Ave value} = \frac{\frac{2}{3}}{\frac{1}{2}}$$
$$= \frac{4}{3}$$

#29. $f(x,y) = \ln x$



Ave Value

$$= \frac{\iint_R f(x,y)\,dA}{\iint dA} = \frac{I}{B}$$

$$I = \int_1^3 \int_0^{2x} \ln x \, dy\, dx$$

$$= \int_1^3 \ln x \; y\Big|_0^{2x} dx$$

$$= \int_1^3 \ln x \,(2x - 0)\, dx$$

$$= \int_1^3 2x \ln x \, dx$$

$u = \ln x \qquad dv = x\,dx$

$du = \frac{1}{x} dx \qquad v = \frac{1}{2}x^2$

$$= 2\left(\frac{1}{2}x^2 \ln x \Big|_1^3 - \frac{1}{2}\int_1^3 x\,dx\right)$$

$$= 9\ln 3 - 0 - \frac{1}{2}x^2\Big|_1^3$$

$$= 9\ln 3 - \frac{1}{2}(9-1)$$

$$= 9\ln 3 - 4$$

B = Area by geometry Rec + Tri

$$= 4 + \frac{1}{2}(2)(4)$$

$$= 4 + 4$$

$$= 8$$

$$\text{Ave value} = \frac{I}{B}$$

$$= \frac{9\ln 3 - 4}{8}$$

$=$

9.1

#12. $y = \frac{C}{1+Ae^{-Ckt}}$ $\qquad \frac{dy}{dt} = ky(C-y)$

$$\frac{dy}{dt} = \frac{-C(-ACk e^{-Ckt})}{(1+Ae^{-Ckt})^2}$$

$$= \frac{AC^2 k e^{-Ckt}}{(1+Ae^{-Ckt})^2}$$

$$\frac{dy}{dt} = ky(C-y)$$

$$\frac{AC^2 k e^{-Ckt}}{(1+Ae^{-Ckt})^2} = (k)\left(\frac{C}{1+Ae^{-Ckt}}\right)\left(C - \frac{C}{1+Ae^{-Ckt}}\right)$$

$$= C^2 k \left(\frac{1}{1+Ae^{-Ckt}}\right)\left(1 - \frac{1}{1+Ae^{-Ckt}}\right)$$

$$= \frac{C^2 k (1+Ae^{-Ckt} - 1)}{(1+Ae^{-Ckt})^2}$$

$$= \frac{C^2 k A e^{-Ckt}}{(1+Ae^{-Ckt})^2} \checkmark$$

9.1

#18 $y = C_1 x^3 + C_2 x^2$

$x^2 y'' - 4xy' + 6y = 0$

$y(2) = 0$ & $y'(2) = 4$

$y' = 3C_1 x^2 + 2C_2 x$

$y'' = 6C_1 x + 2C_2$

$y(2) = 0$

$y(2) = C_1 8 + C_2(4)$

$0 = 8C_1 + 4C_2$

$0 = 2C_1 + C_2$

$y'(2) = 4$

$y'(2) = 3C_1 4 + 2C_2 2$

$4 = 12C_1 + 4C_2$

$1 = 3C_1 + C_2$

① $1 = 3C_1 + C_2$

①-② ② $0 = 2C_1 + C_2$

$1 = C_1$ where $C_2 = -2$

$\therefore$ $y = x^3 - 2x^2$

$y' = 3x^2 - 4x$

$y'' = 6x - 4$

check

$x^2 y'' - 4xy' + 6y = 0$

$x^2(6x-4) - 4x(3x^2-4x) + 6(x^3-2x^2) = 0$

$6x^3 - 4x^2 - 12x^3 + 16x^2 + 6x^3 - 12x^2 = 0$

$0 = 0$ ✓

9.1

#2(4)

let $S(t)$ = supply of a commodity

$$\frac{ds}{dt} = k\underbrace{(D(t) - s(t))}$$

difference btwn Demand & the supply.

directly portional
proportionality const

#24 $A' = C - KA$

C = const rate g/min ← (rate in)

$A(t)$ = glucose at

$A' = \frac{dA}{dt}$ amt of change of the amt of Glucose.

$\therefore$ KA = proportional to amt of Glucose present (rate out)

for this prob.

$$\frac{dA}{dt} = (\text{rate in}) - (\text{rate out})$$

$$= C - KA$$

NAME: