1 задача

а) $(1-3x^2-y)\,dx=(x-3y^2)\,dy$

$$y(x)=-\frac{\sqrt[3]{2}\,x}{\sqrt[3]{\sqrt{(27c_1-27x^3+27x)^2-108x^3}+27c_1-27x(x^2-1)}}$$

$$\frac{\sqrt[3]{\sqrt{(27c_1-27x^3+27x)^2-108x^3}+27c_1-27x(x^2-1)}}{3\sqrt[3]{2}}$$

$$y(x)=\frac{(1+i\sqrt{3})x}{2^{2/3}\sqrt[3]{\sqrt{(27c_1-27x^3+27x)^2-108x^3}+27c_1-27x(x^2-1)}}$$

$$\frac{(1-i\sqrt{3})\sqrt[3]{\sqrt{(27c_1-27x^3+27x)^2-108x^3}+27c_1-27x(x^2-1)}}{6\sqrt[3]{2}}$$

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

$$1-3x^2-y(x)+(-x+3y(x)^2)\frac{dy(x)}{dx}=0$$

$P(x,y)=-3x^2-y+1 \qquad Q(x,y)=-x+3y^2$

$$f(x,y)=\int(-3x^2-y+1)\,dx=x-3-yx+g(y)$$

$$\frac{\partial f(x,y)}{\partial y}=\frac{\partial}{\partial y}(x-x^3-yx+g(y))=-x+\frac{dg(y)}{dy}$$

$$\frac{\partial f(x,y)}{\partial y}=Q(x,y)$$

$$-x+\frac{dg(y)}{dy}=-x+3y^2$$

$$\frac{dg(y)}{dy}=3y^2 \qquad \frac{dg(y)}{dy}$$

$g(y)=\int 3y^2\,dy=y^3$

$f(x,y)=-x^3+x+y^3-yx \qquad -x^3+x+y^3-yx=C_1$

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a) $2xy\,dx = (x^2 - 2y^3)\,dy$

$$y(x) = \frac{\sqrt[3]{\frac{2}{3}}\,C_1}{\sqrt[3]{\sqrt{3}\sqrt{4C_1^3+27x^4}+9x^2}} - \frac{\sqrt[3]{\sqrt{3}\sqrt{4C_1^3+27x^4}+9x^2}}{\sqrt[3]{2}\,3^{2/3}}$$

$$y(x) = \frac{(1-i\sqrt{3})\sqrt[3]{\sqrt{3}\sqrt{4C_1^3+27x^4}+9x^2}}{2\sqrt[3]{2}\,3^{2/3}} - \frac{(1+i\sqrt{3})C_1}{2^{2/3}\sqrt[3]{3}\sqrt[3]{\sqrt{4C_1^3+27x^4}+9x^2}}$$

$$y(x) = \frac{(1+i\sqrt{3})\sqrt[3]{\sqrt{3}\sqrt{4C_1^3+27x^4}+9x^2}}{2\sqrt[3]{2}\,3^{2/3}} - \frac{(1-i\sqrt{3})C_1}{2^{2/3}\sqrt[3]{3}\sqrt[3]{\sqrt{4C_1^3+27x^4}+9x^2}}$$

$$2x\,y(x) = (x^2 - 2y(x)^3)\frac{dy(x)}{dx} = 0$$

$R(x,y) = 2xy \quad S(x,y) = -x^2 + 2y^3$

$2y$ ~~$d\mu(y)\,R(x,y) = \frac{\partial}{\partial x}(\mu(y)S(x,y))$~~ $-2\mu(y)x$

$$\frac{\frac{\partial\mu(y)}{dy}}{u(y)} = -\frac{2}{y}$$

$\log(u(y)) = -2\log(y)$

$u(y) = \frac{1}{y^2}$

$P(x,y) = \frac{2x}{y}$

$Q(x,y) = 2y - \frac{x^2}{y^2}$

$$\frac{2x}{y(x)} + \left(2y(x) - \frac{x^2}{y(x)^2}\right)\frac{dy(x)}{dx} = 0$$

$$\frac{\partial f(x,y)}{dx}$$

$$f(x,y) = \int \frac{2x}{y}\,dx = \frac{x^2}{y} + g(y)$$

$$\frac{\partial f(x,y)}{dy} = \frac{\partial}{\partial y}\left(\frac{x^2}{y} + g(y)\right) = -\frac{x^2}{y^2} + \frac{dg(y)}{dy}$$

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

$$\frac{dg(y)}{dy} = 2y$$

$$g(y) = \int 2y\,dy = y^2$$

$$f(x,y) = y^2 + \frac{x^2}{y}$$

$$f(x,y) = C_1$$

$$y^2 + \frac{x^2}{y} = C_1$$

$y^2 + \frac{x^2}{y} = C_1$

~~3 задача~~

3 задача

а)

$y' = \ln \frac{y}{y'-1}$

$y'(y'-1) \ln \left(\frac{y}{y'-1}\right) \quad (y'-1)$

$y'(y'-1) = y \ln \left(\frac{y}{z-1}\right) \qquad z = y' \qquad y'' = \frac{dz}{dx}$

$z(z-1) = y \ln \left(\frac{y}{z-1}\right) \qquad y = z \cdot w \qquad y' = z + z'w$

$y'' = z''w + 2z'w' + zw''$

$z(z-1) = z \cdot w \ln \left(\frac{z \cdot w}{z-1}\right)$

$y = z \cdot w$

$y' = z \quad w = \frac{y}{z}$

$\frac{dw}{dz} = \frac{d}{dz}\left(\frac{y}{z}\right)$

$\frac{dw}{dz} = \frac{z\left(\frac{y}{z}\right) - y}{z^2}$

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$$\frac{dw}{dz} = \frac{y - y}{z^2}$$

$w = c$ $\quad \cancel{w} = y = z.w$

$y = z.c$

$y = c.y'$ $\quad y' = \frac{y}{c}$

$$\frac{dw}{dz} = 0$$

$$z(z-1) = z.w \ln\left(\frac{z.w}{z-1}\right)$$

$$z(z-1) = z.c.\ln\left(\frac{z.c}{z-1}\right)$$

$$z(z-1) = cz \ln\left(\frac{cz}{z-1}\right)$$

$$y = xy' - e^{y'}$$

$$\frac{dy}{dx} = x\frac{dy'}{dx}$$ $\quad u = x \quad v = y'$

$$y = xy' - e^{y'} \quad y' = \frac{dy}{dx}$$

$$y = x\frac{dy}{dx} - e^{\frac{dy}{dx}}$$

$$y = x(y')^2 - \frac{1}{y'}$$

$$y = xy' - \frac{x}{y'}$$

$$y' = \left(\frac{y + \frac{x}{y'}}{x}\right)$$