

接点の  $x$  座標を  $a$  とおくと  $x=a$  における接線の方程式は

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

これが原点を通るので  $-\frac{a-1}{a} = -\frac{1}{a}$

よって  $a=2$

(2)  $l$  は原点と  $(2, \frac{1}{2})$  を通るので  $y = \frac{1}{4}x$

(3)  $D$  の面積を  $S$  とおくと

$$S = \text{triangle with vertices } (0,0), (2,0), (2, \frac{1}{2}) - \text{triangle with vertices } (1,0), (2,0), (2, \frac{1}{2})$$

$y = \frac{x-1}{x} = 1 - \frac{1}{x}$

$$= \frac{1}{2} - \int_1^2 (1 - \frac{1}{x}) dx$$

$$= \frac{1}{2} - [x - \log x]_1^2 = \underline{\underline{\log 2 - \frac{1}{2}}}$$

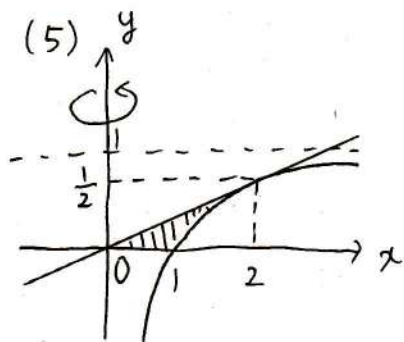
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(4)  $V = \frac{1}{4}\pi \cdot 2 \cdot \frac{1}{3} - \pi \int_1^2 (1 - \frac{1}{x})^2 dx$

$$= \frac{1}{6}\pi - \pi \int_1^2 (\frac{1}{x^2} - \frac{2}{x} + 1) dx$$

$$= \frac{1}{6}\pi - \pi [-\frac{1}{x} - 2\log x + x]_1^2$$

$$= \underline{\underline{\pi (2\log 2 - \frac{4}{3})}}$$



$y = \frac{1-x}{x}$  を  $x$  について解くと  $x = \frac{1}{1-y}$

よって  $V = \pi \int_0^{\frac{1}{2}} (\frac{1}{1-y})^2 dy - 4\pi \cdot \frac{1}{2} \cdot \frac{1}{3}$

$$= \pi [\frac{1}{1-y}]_0^{\frac{1}{2}} - \frac{2}{3}\pi$$

$$= \pi - \frac{2}{3}\pi = \underline{\underline{\frac{1}{3}\pi}}$$