

$$f(x) = -x \ln(x)$$

$f(x)$

$$e \ln x + (-e) = 0$$

$$x > 0 \quad f(x) = -x \ln x < 0 \quad (x)$$

$$f(x) = -x \ln(-x)$$

$$f(x) = -x \ln x \quad (0, +\infty)$$

$$f(x)_{\min} = f(x) = -x \ln x + (-e) = 0$$

$$e(\ln x - 1) + (-e) = 0 \quad \frac{x}{e} - \ln x$$

$$f(x) = \frac{x}{e} - \ln x \in (0, +\infty)$$

$$f'(x) = \frac{(1) \cdot e - (x + (-e)) \cdot 1}{e} = \frac{e - x - (-e)}{e} = \frac{(-x + 2e)(-1)}{e}$$

$$f'(x) > 0 \quad -x < -2e$$

$$0 < -x < -2e \quad 0 < x < 2e \quad f'(x) > 0 \quad (x) \quad (0, 2e)$$

$$x > 2e \quad f'(x) < 0 \quad (x) \quad (2e, +\infty)$$

$$f(x)_{\max} = f(x) = \frac{x}{e} - \ln x \quad (x) \quad (x) \quad (x) =$$

$$\frac{x}{e} - \ln x \quad 0 < \frac{x}{e}$$

$$x > 2e \quad 0 < -x < -2e \quad 0 < x < 2e \quad f'(x) < 0 \quad (x) \quad \left(0, \frac{2e}{e}\right)$$

$$-x < -2e < x \quad f'(x) > 0 \quad (x) \quad \left(-\frac{2e}{e}, \frac{2e}{e}\right) \quad f'(x) < 0 \quad (x)$$

$$(x, +\infty) \quad f(x) = \frac{x}{e}$$

$$\left(0, \frac{e}{e}\right]$$

$$\frac{x}{e} - \ln x =$$

$$\frac{e}{e} > 0 < \frac{e}{e}$$

$$0 < \frac{e}{e}$$

$$f(x) = \frac{x^2 + x}{e^x} \quad x \in (0, +\infty)$$

$$f'(x) = \frac{(2x+1)e^x - (x^2+x)e^x}{e^{2x}} = \frac{-x^2 + x + 1}{e^x} = \frac{-(x-1)(x+1)}{e^x}$$

$$0 < \frac{e}{e} > 0 \quad - + - < 0$$

$$0 < x < 1 \quad f'(x) > 0 \quad x > 1 \quad f'(x) < 0$$

$$f(x) \text{ increases on } (0, 1) \quad \text{decreases on } (1, +\infty)$$

$$f(x)_{\max} = f(1) = \frac{1+1}{e} = \frac{2}{e} - \ln 1$$

$$\left(0, \frac{e}{e}\right]$$

$$0 < \frac{e}{e} \quad 0 < \frac{e}{e}$$

$$\frac{x^2 + x}{e} + \ln x -$$

$$f(x) = \frac{x^2 + x}{e} + \ln x -$$

$$f'(x) = \frac{(2x+1)[e^x + (x^2+x)e^x]}{e^{2x}}$$

$$0 < 0 < \frac{e}{e} \quad +(-) + e > 0$$

$$0 \quad f'(x) > 0 \quad f'(x) > 0$$

$$f(x) \text{ increases on } (0, 1) \quad \text{decreases on } (1, +\infty)$$

$$f(x)_{\max} = f(1) \quad \left(0, \frac{e}{e}\right]$$

$$0 < \frac{e}{e} \quad 0 < \frac{e}{e}$$

$$0 < \frac{e}{e} \quad \frac{x^2 + x}{e} \quad \frac{(e-x) + (e-x)}{e}$$

$$f(x) = \frac{(e-x) + (e-x)}{e} \quad x \in (0, +\infty)$$

$$f'(x) = \frac{-(e-x) + (e-x) - e + 3}{e} = \frac{-x + 3}{e} = \frac{-(x-3)}{e}$$

$$0 < x < 3 \quad f'(x) > 0 \quad x > 3 \quad f'(x) < 0$$

$$f(x) \text{ increases on } (0, 3) \quad \text{decreases on } (3, +\infty)$$

$$\begin{aligned}
& f(x)_{\max} = f(x) = \frac{e^x + x}{e} - \ln x \\
& 0 < x < e \\
& \left(0, \frac{e}{e}\right] \\
& f'(x) = e^x + (-e^{-x}) - \frac{1}{x} < 0 \\
& \frac{e^x \ln x + (-e^{-x})}{-} \\
& \ln x - \frac{1}{x} = \\
& \frac{e^x \ln x + (-e^{-x})}{-} = \frac{e^x (x - 1) + (-e^{-x})}{-} = \frac{e^x - 1}{x} \\
& f(x) = \frac{e^x - 1}{x} \in (0, +\infty) \quad f'(x) = \frac{(x-1)[e^x(x-1) + 1]}{(x+1)^2} \\
& f(x) = e^x(x-1) + \frac{1}{x} \\
& f'(x) = e^x > 0 \quad f(x) \in (0, +\infty) \quad f(x) > f(0) = 0 \\
& 0 < x < e \quad f'(x) < 0 \quad x > e \quad f'(x) > 0 \\
& f(x) \in (0, e) \quad f(x) \in (e, +\infty) \quad f(x)_{\min} = f(x) = \frac{e^x - 1}{x} \\
& = \frac{e^x \ln x + (-e^{-x})}{-} = \frac{e^x - 1}{x} \\
& \left(0, \frac{e}{e}\right] \\
& \frac{e^x \ln x + (-e^{-x})}{-} \\
& \ln x - \frac{1}{x} = \\
& f(x) = \frac{e^x \ln x + (-e^{-x})}{x} - 0 \\
& f'(x) = \frac{(x-1) \left\{ e \left[ (x-1) \ln x + \frac{1}{x} \right] + \frac{1}{x} \right\}}{(x+1)^2} \\
& \ln x - \ln \frac{1}{x} - 0 = -0 - (x-1) \ln x - \frac{(x-1)}{x} \\
& (x-1) \ln x + \frac{1}{x} - \frac{-(x-1)}{x} + 0 = f'(x) > 0 \quad f(x) \in (0, e) \\
& \ln x - (x-1) \ln x - (x-1) \left( \frac{1}{x} \right) = -x + \frac{1}{x} \\
& (x-1) \ln x + \frac{1}{x} + \frac{1}{x} - 0 = f'(x) > 0 \quad f(x) \in (e, +\infty) \\
& f(x) = \frac{-e^{-x}}{x} = \frac{e^{-x}}{x}
\end{aligned}$$

$$\begin{aligned}
 & \left(0, \frac{e}{\beta}\right) \\
 & \frac{e \ln \left(\frac{e}{\beta}\right) + \left(\frac{e}{\beta}\right)}{\beta} \\
 & \left(\frac{e}{\beta}\right) = \frac{e \ln \left(\frac{e}{\beta}\right) + \left(\frac{e}{\beta}\right)}{\beta} \\
 & \frac{e \ln \left(\frac{e}{\beta}\right) + \left(\frac{e}{\beta}\right)}{\beta} + \frac{e}{\beta} \left(\frac{e}{\beta}\right) \\
 & e^{-\beta} + \frac{e}{\beta} \left(\frac{e}{\beta}\right) = e^{-\beta} + \frac{e^2}{\beta^2} \\
 & \left(\frac{e}{\beta}\right) = \frac{e \ln \left(\frac{e}{\beta}\right) + \left(\frac{e}{\beta}\right)}{\beta} = \frac{e^{-\beta} + \frac{e^2}{\beta^2}}{\beta} \\
 & = \left(\frac{e}{\beta}\right)_{\min} = \frac{e^{-\beta}}{\beta}
 \end{aligned}$$

$$\left(0, \frac{e}{\beta}\right]$$

$$\begin{aligned}
 & \frac{e}{\beta} + > 0 \\
 & \frac{e}{\beta} + > 0
 \end{aligned}$$

$$\begin{aligned}
 & e \ln \left(\frac{e}{\beta}\right) + \left(\frac{e}{\beta}\right) = e \ln \left(\frac{e}{\beta}\right) + \frac{e}{\beta} + \left(\frac{e}{\beta}\right) \\
 & \left(\frac{e}{\beta}\right) = e \ln \left(\frac{e}{\beta}\right) + \frac{e}{\beta} + \left(\frac{e}{\beta}\right) \in (0, +\infty) \\
 & \varphi' \left(\frac{e}{\beta}\right) = e \left(\ln \left(\frac{e}{\beta}\right) + \frac{e}{\beta} + \left(\frac{e}{\beta}\right)\right) + \\
 & \varphi \left(\frac{e}{\beta}\right) = e \left(\ln \left(\frac{e}{\beta}\right) + \frac{e}{\beta} + \left(\frac{e}{\beta}\right)\right) + e^{-\beta} \\
 & \varphi' \left(\frac{e}{\beta}\right) = e \left(\ln \left(\frac{e}{\beta}\right) + \frac{e}{\beta} + \left(\frac{e}{\beta}\right)\right) + e^{-\beta}
 \end{aligned}$$

$$(\ ) 0 \quad e \ln + \quad +(-e) \quad 0$$