$$y = \cos(x)^{\ln(x)}$$

$$\ln y = \ln\left[\cos(x)^{\ln(x)}\right]$$

$$\ln y = \ln(x)\,\ln[\cos(x)]$$

$$\left[\frac{1}{y}\,y'\right] = \left[\frac{1}{x}\ln[\cos(x)] + \ln(x)\frac{1}{\cos(x)}\cdot(-\sin(x))\right]\cdot y$$

$$y' = \left[\frac{1}{x}\ln[\cos(x)] - \ln(x)\tan(x)\right]\cos(x)^{\ln(x)}$$

ex) $y = \ln(x)^{\cos(x)}$

$$\ln(y) = \ln\left[\ln(x)^{\cos(x)}\right]$$

$$\ln(y) = \cos(x)\,\ln\left[\ln(x)\right]$$

$$\left[\frac{1}{y}\,y'\right] = \left[-\sin(x)\ln\left[\ln(x)\right] + \cos(x)\frac{1}{x\ln(x)}\right] y$$

$$y' = \left[-\sin(x)\ln\left[\ln(x)\right] + \frac{\cos(x)}{x\ln(x)}\right]\ln(x)^{\cos(x)}$$

$$s(t) = \frac{1}{3}t^3 - \frac{1}{2}t^2 - 6t + 5$$

1) t where standing still $\rightarrow \boxed{t = 3}$

2) forward $\rightarrow (3, \infty)$

3) backward $\rightarrow [0, 3)$

$$v(t) = t^2 - t - 6$$

$$0 = (t-3)(t+2)$$

$\boxed{t = 3}$, ~~$t = -2$~~

$$v(1) = 1^2 - 1 - 6 = -6 < 0$$

$$v(4) = 4^2 - 4 - 6 = 16 - 10 = 6 > 0$$

$$6 = x^2y + e^{xy} + \tan(y) + \ln(xy^2)$$

$$0 = 2xy + x^2\frac{dy}{dx} + e^{xy}\left[y + x\frac{dy}{dx}\right] + \sec^2(y)\frac{dy}{dx} + \frac{1}{xy^2}\left[y^2 + 2xy\frac{dy}{dx}\right]$$

$$-2xy - e^{xy}y - \frac{1}{x} = \left[x^2 + e^{xy}x + \sec^2(y) + \frac{2}{y}\right]\frac{dy}{dx}$$

$$\boxed{\frac{dy}{dx} = \frac{-2xy - e^{xy}y - \frac{1}{x}}{x^2 + e^{xy}x + \sec^2 y + \frac{2}{y}}}$$