15.1.22 From the given parametrization of the curve C, we have

$$x = \cos t,$$
$$y = \sin t,$$
$$0 \leq t \leq 2\pi.$$

Differentiating,

$$\mathrm{d}x = -\sin t\,\mathrm{d}t,$$
$$\mathrm{d}y = \cos t\,\mathrm{d}t,$$

so

$$đs = \|\mathrm{d}\mathbf{r}\| = \|\mathrm{d}(x,y)\| = \|\langle \mathrm{d}x, \mathrm{d}y\rangle\| = \sqrt{\mathrm{d}x^2 + \mathrm{d}y^2} = \sqrt{(-\sin t\,\mathrm{d}t)^2 + (\cos t\,\mathrm{d}t)^2} = |\mathrm{d}t|.$$

Therefore,

$$\begin{aligned}\int_C (x - y + 3)\,đs &= \int_{t=0}^{2\pi} \big((\cos t) - (\sin t) + 3\big)\ |\mathrm{d}t| = \int_0^{2\pi} (\cos t - \sin t + 3)\,\mathrm{d}t = (\sin t + \cos t + 3t)\big|_{t=0}^{2\pi} \\ &= \big(\sin(2\pi) + \cos(2\pi) + 3(2\pi)\big) - \big(\sin(0) + \cos(0) + 3(0)\big) \\ &= (0 + 1 + 6\pi) - (0 + 1 + 0) = (6\pi + 1) - (1) = 6\pi.\end{aligned}$$

You can also guess this answer geometrically, since C is the circle of radius 1 centred at the origin. Both x and y are completely balanced between positive and negative around this circle (since it is centred at the origin), so the integrals of $x\,đs$ and of $y\,đs$ will be zero. As for the integral of $3\,đs$, this is simply 3 times the circumference of the circle, which is 2π (since it has radius 1). Thus, the final answer is

$$0 - 0 + 3(2\pi) = 6\pi.$$