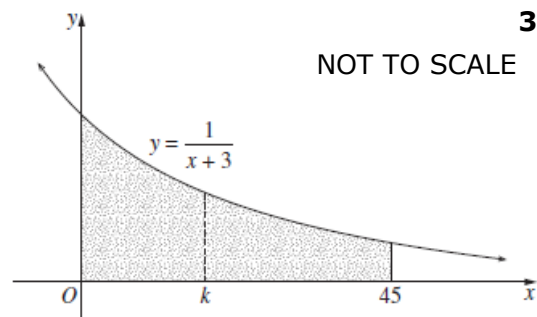




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- 2018 15** The diagram shows the region bounded by the
b curve $y = \frac{1}{x+3}$ and the lines $x = 0$, $x = 45$ and $y = 0$. The region is divided into two parts of equal area by the line $x = k$, where k is a positive integer. What is the value of the integer k , given that the two parts have equal area?



$$\int_0^k \frac{1}{x+3} dx = \int_k^{45} \frac{1}{x+3} dx$$

$$[\ln(x+3)]_0^k = [\ln(x+3)]_k^{45}$$

$$\ln(k+3) - \ln(0+3) = \ln(45+3) - \ln(k+3)$$

$$\ln(k+3) - \ln 3 = \ln 48 - \ln(k+3)$$

$$2\ln(k+3) = \ln 48 + \ln 3$$

$$\ln(k+3)^2 = \ln 144$$

$$(k+3)^2 = 144$$

$$k+3 = 12$$

$$k = 9$$

State Mean:
1.81

* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by NESA.

NESA: Marking Feedback

Skills addressed:

- equating the two parts of equal area using definite integrals, finding primitive functions and solving the resulting logarithmic equation
- knowing that $k > 0$ and discarding $k = -15$

Areas for students to improve include:

- using the correct order when substituting limits into the primitive function
- solving logarithmic equations