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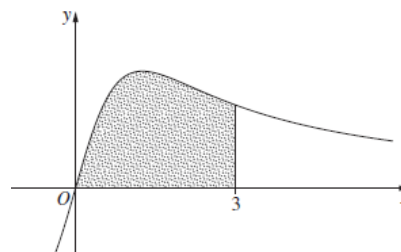
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The diagram shows the graph of $y = \frac{3x}{x^2 + 1}$.

The region enclosed by the graph, the x-axis and the line $x = 3$ is shaded.

Calculate the exact value of the area of the shaded region.



2

$$\text{Area} = \int_0^3 \frac{3x}{x^2 + 1} dx \quad \checkmark$$

$$= \frac{3}{2} \int_0^3 \frac{2x}{x^2 + 1} dx$$

$$= \frac{3}{2} [\ln(x^2 + 1)]_0^3 \quad \checkmark$$

$$= \frac{3}{2} [\ln(3^2 + 1) - \ln(0^2 + 1)]$$

$$= \frac{3}{2} [\ln 10 - \ln 1]$$

$$= \frac{3}{2} \ln 10 \quad \therefore \text{area is } \frac{3}{2} \ln 10 \text{ units}^2. \quad \checkmark$$

State Mean:
2.25/3

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

Marking Feedback:

Students should:

- use definite integrals to find areas

In better responses, students were able to:

- find the correct fraction in front of the integral in order to create a numerator which is the derivative of the denominator

Areas for students to improve include:

- integrating correctly to reach a logarithmic function
- substituting limits correctly
- showing all working
- reading the question carefully
- using brackets accurately