19 M **12 d** The diagram shows the graph of $y = \dfrac{3x}{x^2+1}$.
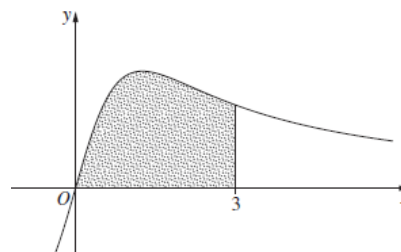
The region enclosed by the graph, the x-axis and the line $x = 3$ is shaded.

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

2

Area $= \displaystyle\int_0^3 \dfrac{3x}{x^2+1} \, dx$ ✔

$= \dfrac{3}{2}\displaystyle\int_0^3 \dfrac{2x}{x^2+1} \, dx$

$= \dfrac{3}{2}\Big[\ln(x^2+1)\Big]_0^3$ ✔

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

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

$= \dfrac{3}{2}\ln 10$ $\qquad \therefore$ area is $\dfrac{3}{2}\ln 10$ units^2. ✔

State Mean:
2.25/3

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