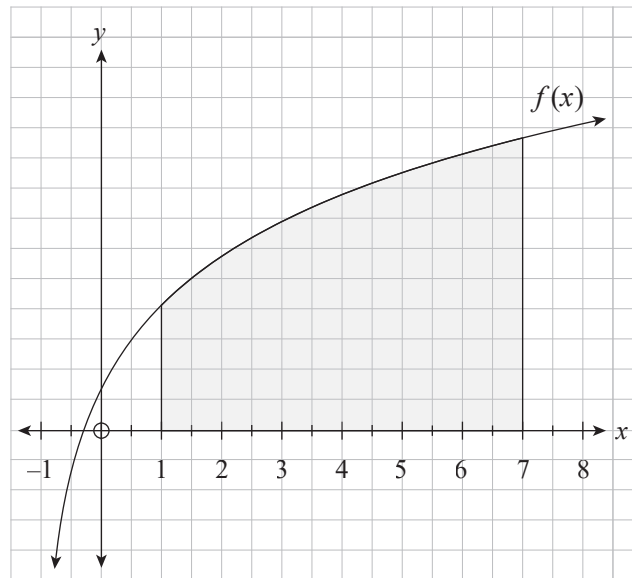


Consider the function $f(x) = \ln(2(x+1)^2)$ for $x > -1$. The graph of $y = f(x)$ is shown in Figure 9.



Let A be the area bounded by the graph of $y = f(x)$, the x -axis, and the vertical lines at $x = 1$ and $x = 7$. In Figure 9, A is represented by the shaded region.

- (i) On Figure 9, **draw** three rectangles that can be used to calculate U_3 .

(ii) Hence, calculate the value of U_3 .

(iii) Write an integral expression for the exact value of A .

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(ii) Using your result from part (b)(i), show that

$$\int \ln(2x^2) \, dx = x(\ln(2x^2) - 2) + c,$$

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Consider the functions $f(x) = \ln(2(x+1)^2)$ for $x > -1$ and $g(x) = \ln(2x^2)$ for $x > 0$. The graphs of $y = f(x)$ and $y = g(x)$ are shown in Figure 10.

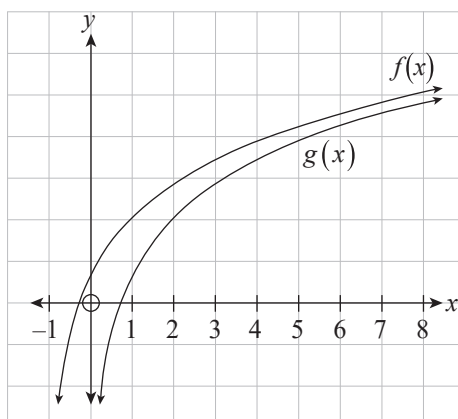


Figure 10

- (c) Describe the relationship between the graphs of $y = f(x)$ and $y = g(x)$.

(1 mark)

- (d) The exact value of A (i.e. the area bounded by the graph of $y = f(x)$, the x -axis, and the vertical lines at $x = 1$ and $x = 7$) can be calculated using a definite integral.

Use part (b)(ii) and your answer to part (c) to determine the exact value of A . Express your answer in the form $p \ln 2 + q$, where p and q are integers.

(4 marks)