

Answer on Question #66464, Math / Calculus.

$$\int_4^8 \frac{dx}{x} = \ln|x| \Big|_4^8 = \ln 8 - \ln 4 = \ln \frac{8}{4} = \ln 2.$$

Trapezium rule

$$\begin{aligned} \int_4^8 \frac{dx}{x} &= \frac{8-4}{2 \cdot 4} \left(\frac{1}{4} + \frac{1}{8} + 2 \left(\frac{1}{5} + \frac{1}{6} + \frac{1}{7} \right) \right) = \frac{1}{2} \left(\frac{3}{8} + 2 \cdot \frac{42+35+30}{210} \right) = \frac{1}{2} \left(\frac{3}{8} + \frac{107}{105} \right) = \\ &= \frac{1}{2} \cdot \frac{315+856}{840} = \frac{1171}{1680} \approx 0.697. \end{aligned}$$

Simpson's rule

$$\begin{aligned} \int_4^8 \frac{dx}{x} &= \frac{8-4}{6 \cdot 2} \left(\frac{1}{4} + \frac{1}{8} + 2 \cdot \frac{1}{6} + 4 \cdot \left(\frac{1}{5} + \frac{1}{7} \right) \right) = \frac{1}{3} \left(\frac{3}{8} + \frac{1}{3} + 4 \cdot \frac{12}{35} \right) = \frac{1}{3} \left(\frac{3}{8} + \frac{1}{3} + \frac{48}{35} \right) = \\ &= \frac{1}{3} \cdot \frac{3 \cdot 105 + 280 + 1152}{840} = \frac{1}{3} \cdot \frac{315 + 280 + 1152}{840} = \frac{1}{3} \cdot \frac{1747}{840} = \frac{1747}{2520} \approx 0.693 \end{aligned}$$

Hence

$$\ln 2 \approx \frac{1}{2} (0.697 + 0.693) = 0.695.$$

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