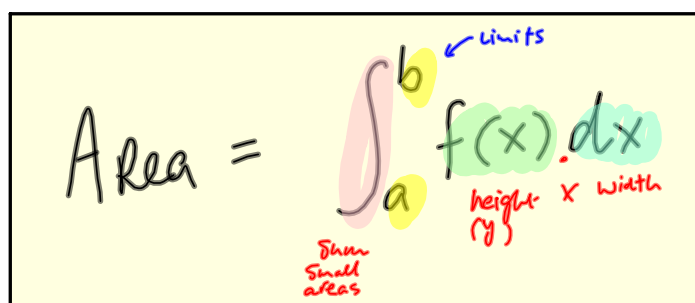
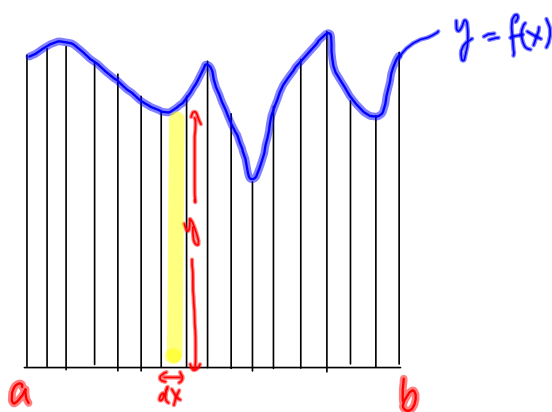


Understanding Integration

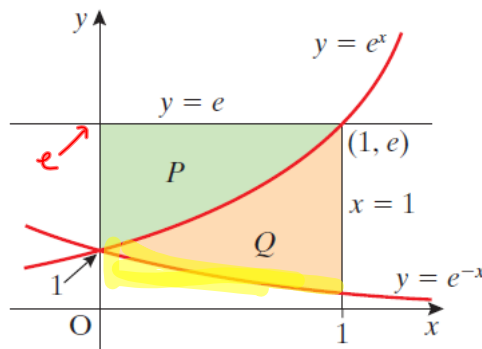


A hand-drawn diagram illustrating the integral formula. The equation $\text{Area} = \int_a^b f(x) dx$ is written in green. The limits a and b are highlighted in yellow. A blue arrow points to the limits with the word "limits". The function $f(x)$ is highlighted in green, and a red arrow points to it with the text "height (y)". The differential dx is highlighted in green, and a red arrow points to it with the text "width". A pink shaded area under the curve is labeled "Sum small areas" in red.



24. The given figure shows parts of the graphs of $y = e^x$ and $y = e^{-x}$.

The figure also shows two enclosed regions P and Q .



- (i) Find the area of region P .
- (ii) Find the area of region Q in terms of e .

Between curve and x-axis

$$\text{Area} = \int_a^b f(x) dx$$

Between curve and y-axis

$$\text{Area} = \int_a^b x \cdot dy$$

Integration

$f'(x) \rightarrow f(x)$
$e^x \rightarrow e^x$
$e^{ax} \rightarrow \frac{1}{a} e^{ax}$

$$\text{Area } Q = \text{Area } R - \text{Area } S$$

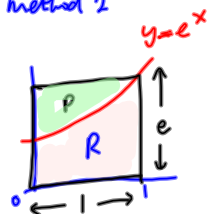
(i)
Considered to y axis

method 1

$$y = e^x \Rightarrow x = \log_e y = \ln y$$

$$\text{Area } P = \int_1^e \ln y \cdot dy \quad \text{cant do this!}$$

method 2



$$\text{Area Rectangle} = (1)(e) = e$$

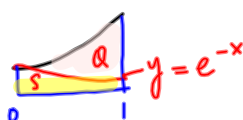
$$\text{Area } R = \int_0^1 e^x \cdot dx = [e^x + c]_0^1$$

$$= [e^1 + c] - [e^0 + c]$$

$$= e - 1$$

$$\text{Area } P = e - [e - 1] = 1$$

(ii)



$$\text{Area } S = \int_0^1 e^{-x} \cdot dx = [-e^{-x} + c]_0^1$$

$$= [-e^{-1} + c] - [-e^{-0} + c]$$

$$= -e^{-1} + 1$$

$$\text{Area } Q = (e - 1) - (-e^{-1} + 1)$$

$$= e - 1 + e^{-1} - 1$$

$$= e + e^{-1} - 2$$