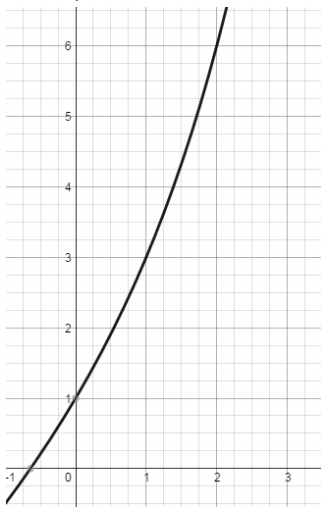


**Trapezium Rule**

(1) The diagram below shows part of the curve with equation  $y = x + 2^x$



(a) Fill in the missing values in the table below for  $y = x + 2^x$

$x$	0	1	2
$y$			

(b) Use the trapezium rule with 2 strips to find an estimate for the area trapped under the curve  $y = x + 2^x$  between the lines  $x = 0$  and  $x = 2$  using the values found in part (a).

(c) Fill in the missing values in the table below for  $y = x + 2^x$

$x$	0	0.5	1	1.5	2
$y$					

(d) Use the trapezium rule with 4 strips to find an estimate for the area trapped under the curve  $y = x + 2^x$  between the lines  $x = 0$  and  $x = 2$  using the values found in part (c).

(e) Explain which of the two estimations found in part (b) and (d) is closest to the actual area trapped under the curve  $y = x + 2^x$  between the lines  $x = 0$  and  $x = 2$  giving a reason for your answer.

(f) How could you make the estimation ever more accurate?

(g) State whether the answers found in part (b) and (d) are overestimates or underestimates for the area under the curve giving a reason for your answer.

(2) (a) Sketch the curve  $y = x^2 - 4x + 2$  showing any points of intersection with the coordinate axes.

(b) Using the trapezium rule with 4 strips, find an estimate for the area trapped under the curve  $y = x^2 - 4x + 2$  between the lines  $x = 5$  and  $x = 13$ .

(c) State with the aid of a sketch whether the estimate found in part (b) is an overestimate or an underestimate.

(d) Write down an equation for a quadratic function that would give an underestimate when using the trapezium rule.

(e) Use integration to find the exact area trapped under the curve  $y = x^2 - 4x + 2$  between the lines  $x = 5$  and  $x = 13$ .

(f) Find the percentage error between the answers found in part (b) and part (e).

(g) Explain what would happen to the percentage error in part (f) if 12 strips had been used in part (b).

(3) The trapezium rule is used with 2 strips to estimate the area trapped under the curve with

$$\text{equation } y = \frac{x-1}{x}, \quad x \geq 1,$$

between the lines  $x = k$  and  $x = 3k$ . Given that the estimate obtained using the trapezium

rule is  $\frac{17}{6}$  find the value of the constant  $k$ .