

- b) Identify the coordinates of the top left hand vertex of each of the three rectangular sheets of width 1 metre, for $x \in [0,3]$ and hence calculate the sum of the areas of the rectangular sheets.

2 marks

There is a problem with iron jutting into the rollercoaster, so that workers cut the sheets so that the heights of the rectangular sheets match the right hand height of the curve.

- c) Calculate the sum of the areas of these new right endpoint rectangular sheets.

2 marks

There is still a problem with the height of the sheets so the workers decide to use sheets of smaller width.

- d) Calculate the left hand endpoint approximate area covered by 6 sheets of 0.5 m width.

2 marks

- e) Calculate the left hand endpoint approximate area covered by 12 sheets.

2 marks

- f) Write down and evaluate an expression for the left hand endpoint estimate using 15 sheets.

2 marks

- g) Write down and evaluate an expression for the right hand endpoint estimate using 15 sheets.

2 marks

h) Comment on the reliability of the left and right hand estimates.

1 mark

SAFE Constructions employed an engineer to investigate the situation. She concluded that the most efficient method of cutting a new frontal coating would be to cut the exact shape from one sheet of iron.

j) Write down and evaluate the integral statement that calculates the exact area.

3 marks

Question 3

A medium is kept at a constant temperature T of 20°C . A body is placed in this medium. The temperature at time t min of this body is given by:

$$T = 40e^{-0.36t} + 20, t \geq 0$$

a) Find the initial temperature of the body.

1 mark

b) Sketch the graph of T against t , $t \geq 0$.

2 marks

c) Find the rate of change of temperature with respect to time (in terms of t).

d) Find:

(i) The average rate of change between $t = 3$ and $t = 5$ minutes.

(ii) Find the instantaneous rate of change at $t = 5$ minutes.

(iii) Find the average value of the temperature of the medium for the first 5 minutes.

2 + 1 = 3 marks