4. **In this question you must show detailed reasoning.**

(i) Show by counterexample that the statement

"$\mathrm{f}(n) = \frac{5}{2}n^3 - \frac{5}{2}n^2 - 19n + 20$ is a perfect cube for all positive integers n"

is **not** true.

(3)

(ii) Prove that the following statement is true

"$(x + 1)^2 > 6x - 4$ for all real x"

(3)

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Question 4 continued

(Total for Question 4 is 6 marks)

5. The table below shows values of x and y for the curve C with equation $y = f(x)$.

x	0.9	1.5	2.1	2.7	3.3	3.9	4.5	5.1
y	1.5	0.48	0.30	0.26	0.26	0.30	0.48	1.5

(a) Using the trapezium rule with all the y values in the table, find an estimate for the area of the region bounded by C and the x-axis between the lines with equations $x = 0.9$ and $x = 5.1$

(3)

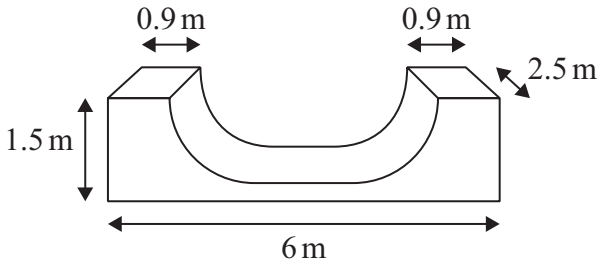


Figure 1

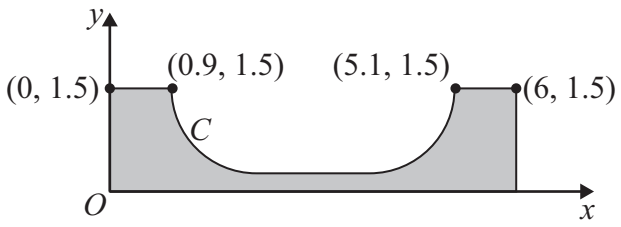


Figure 2

Figure 1 shows a sketch of a solid concrete skateboard ramp.
Figure 2 shows a graph of the cross-section of the same ramp.

The ramp

- has a total length of 6 m
- has a platform at each end at a height of 1.5 m and with a length of 0.9 m
- has a curved section C with equation $y = f(x)$, where x and y are in metres
- has a uniform cross-section and is 2.5 m wide

as shown in Figure 1 and/or Figure 2.

(b) Using the answer to part (a), find an estimate for the volume of concrete in the **whole** of the ramp.

(3)

(c) State, giving a reason for your answer, whether the answer for part (b) is an overestimate or an underestimate of the true volume of concrete in the whole of the skateboard ramp.

(1)

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