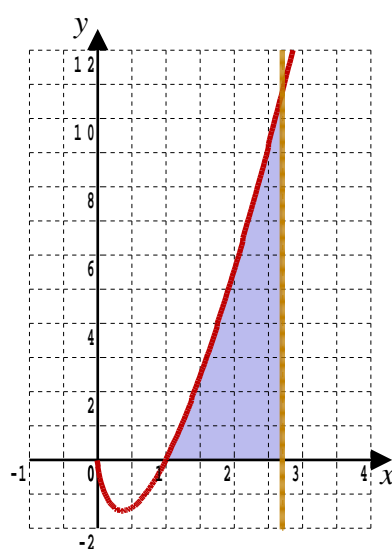


Grade Grabber 3

*Any solution based entirely on graphical
or numerical methods is not acceptable*

Marks Available : 30

Question 1



The graph is of the curve $y = 4x \ln x$. and the vertical line $x = e$

Find the exact area bounded by the curve, the x-axis, and the lines, $x = 1$ and $x = e$

[6 marks]

Question 2

Prove that

$$\sum_{n=0}^{\infty} x^{2n} = \frac{1}{1-x^2}$$

[4 marks]

Question 3

A curve has parametric equations

$$x = 7 - \frac{3}{4t} \quad y = 8t + 1$$

Show that the Cartesian equation of the curve can be expressed in the form

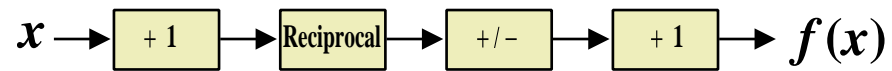
$$y = \frac{a-x}{b-x} \quad x \neq c$$

where a , b and c are constants to be found

[7 marks]

Question 4

The flowchart describes a function f



- (i) Show that the function described can be written as

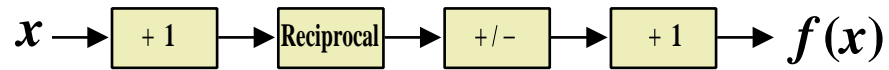
$$f(x) = \frac{x}{x + 1} \quad x \neq -1$$

[3 marks]

- (ii) Use algebraic manipulation to find $f^{-1}(x)$

[4 marks]

The task now is to use the flowchart of f to obtain your part (ii) answer.



- (iii) Explain your strategy, drawing an appropriately modified flowchart, and so verify your part (ii) answer from this alternative method.

[6 marks]

This document is a part of a **Mathematics Community Outreach Project** initiated by Shrewsbury School

It may be freely duplicated and distributed, unaltered, for non-profit educational use

In October 2020, Shrewsbury School was voted "**Independent School of the Year 2020**"

© 2025 Number Wonder

Teachers may obtain detailed worked solutions to the exercises by email from MHHShrewsbury@Gmail.com