



## A- level MATHS

Integration (Topic H)

Total number of marks: 41

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1 Given that

$$\int_0^{10} f(x) dx = 7$$

deduce the value of

$$\int_0^{10} \left( f(x) + 1 \right) \mathrm{d}x$$

Circle your answer.

[1 mark]

**-3** 7 8 17

6 Four students, Tom, Josh, Floella and Georgia are attempting to complete the indefinite integral

$$\int \frac{1}{x} \, \mathrm{d}x \qquad \text{for } x > 0$$

Each of the students' solutions is shown below:

Tom 
$$\int \frac{1}{x} dx = \ln x$$
Josh 
$$\int \frac{1}{x} dx = k \ln x$$

Floella 
$$\int \frac{1}{x} \, \mathrm{d}x = \ln Ax$$

Georgia 
$$\int \frac{1}{x} \, \mathrm{d}x = \ln x + c$$

**6 (a) (i)** Explain what is wrong with Tom's answer.

[1 mark]

6 (a) (ii) Explain what is wrong with Josh's answer.

[1 mark]

**6 (b)** Explain why Floella and Georgia's answers are equivalent.

[2 marks]

**16 (a)** 
$$y = e^{-x}(\sin x + \cos x)$$

Find 
$$\frac{\mathrm{d}y}{\mathrm{d}x}$$

Simplify your answer.

[3 marks]

**16 (b)** Hence, show that

$$\int e^{-x} \sin x \, dx = ae^{-x} (\sin x + \cos x) + c$$

where a is a rational number.

[2 marks]

5 Use integration by substitution to show that

$$\int_{-\frac{1}{4}}^{6} x \sqrt{4x+1} \, \mathrm{d}x = \frac{875}{12}$$

Fully justify your answer.

[6 marks]

5 Solve the differential equation

$$\frac{\mathrm{d}t}{\mathrm{d}x} = \frac{\ln x}{x^2 t} \qquad \text{for } x > 0$$

given x = 1 when t = 2

Write your answer in the form  $t^2 = f(x)$ 

[7 marks]

7 (a) Express 
$$\frac{4x+3}{(x-1)^2}$$
 in the form  $\frac{A}{x-1} + \frac{B}{(x-1)^2}$ 

[3 marks]

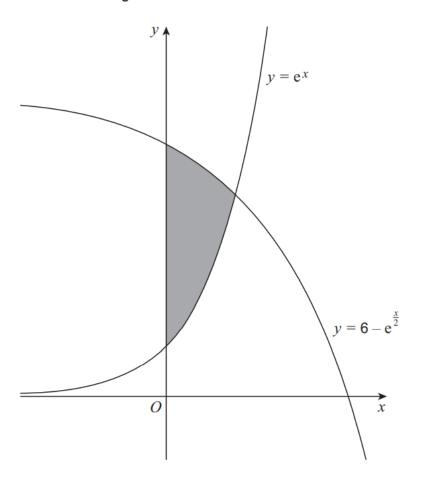
7 (b) Show that

$$\int_{3}^{4} \frac{4x+3}{(x-1)^{2}} \, \mathrm{d}x = p + \ln q$$

where p and q are rational numbers.

[5 marks]

The region enclosed between the curves  $y = e^x$ ,  $y = 6 - e^{\frac{x}{2}}$  and the line x = 0 is shown shaded in the diagram below.



Show that the exact area of the shaded region is

$$6 \ln 4 - 5$$

Fully justify your answer.

[10 marks]