2. Given that

$$\frac{3x+4}{(x-2)(2x+1)^2} \equiv \frac{A}{x-2} + \frac{B}{2x+1} + \frac{C}{(2x+1)^2}$$

(a) find the values of the constants A, B and C.

(4)

(b) Hence find the exact value of

$$\int_7^{12} \frac{3x+4}{(x-2)(2x+1)^2}\,dx$$

giving your answer in the form $p\ln q + r$ where p, q and r are rational numbers.

(6)

DO NOT WRITE IN THIS AREA

5. (i) Find

$$\int x^2 e^x dx$$

(4)

(ii) Use the substitution $u = \sqrt{1-3x}$ to show that

$$\int \frac{27x}{\sqrt{1-3x}}\,dx = -2(1-3x)^{\frac{1}{2}}(Ax+B) + k$$

where A and B are integers to be found and k is an arbitrary constant.

(6)

DO NOT WRITE IN THIS AREA

2. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

Use integration by parts to find the exact value of $\int_1^e \frac{\ln x}{x^2}\,dx$

Write your answer in the form $a + \frac{b}{e}$, where a and b are integers.

(6)

(Total for Question 2 is 6 marks)