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

(a) Express $\dfrac{2}{r(r+1)(r+2)}$ in partial fractions.

(2)

(b) Use the answer to part (a) and the method of differences to show that

$$\sum_{r=1}^{n} \frac{2}{r(r+1)(r+2)} = \frac{n(n+a)}{2(n+b)(n+c)}$$

where a, b and c are integers to be determined.

(5)

(c) Hence form and solve a quadratic inequality to determine the smallest value of n for which

$$\sum_{r=1}^{n} \frac{2}{r(r+1)(r+2)} > \frac{7}{15}$$

(3)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 10 marks)