1.10 Series and Summation: 30-minute Pack

Total Marks

EDEXCEL 9FM0 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Aisha and Daniel are exploring sums of the positive integers and their subsets.

(a) Find the smallest positive integer n such that $\sum_{r=1}^{n} r > 1000$. **(3)**

(b) Calculate $\sum_{r=1}^{40} 2r$, the sum of the first 40 positive even integers. **(2)**

(c) Hence, or otherwise, find the sum of the first 40 positive odd integers. **(2)**

(Total for Question 1 is 7 marks)

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2 Use the standard results for the sums of r and r^2 to answer this question.

(a) Show that the sum from r = 1 to n of $(3r^2 - 5r + 5)$ can be written as $n(6n^2 - 6n + 18)/6$. **(4)**

(b) Hence evaluate the sum from r = 4 to r = 17 of $(3r^2 - 5r + 5)$. **(4)**

(Total for Question 2 is 8 marks)

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3 Consider the series with general term r(r+1), for r = 1, 2, 3, ...

(a) Show that $\sum_{r=1}^{n} r(r+1) = n(n+1)(n+2)/3$. **(4)**

(b) Hence evaluate $\sum_{r=1}^{25} r(r+1)$. **(2)**

(c) Use your answer to part (a) to find $\sum_{r=10}^{25} r(r+1)$. **(3)**

(Total for Question 3 is 9 marks)

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Mark scheme · 1.10 Series and Summation: 30-minute Pack

Question 1

(a) forming the inequality $n(n+1)/2 > 1000$, i.e. $n(n+1) > 2000$ **M1**

(a) trial (or solving the quadratic) to compare n=44 and n=45 **M1**

(a) n = 45 cao, with $44*45=1980<2000$ and $45*46=2070>2000$ shown **A1**

(a) Answer: n = 45

(b) using sum 2r = 2*sum r with n=40 **M1**

(b) 1640 cao **A1**

(b) Answer: 1640

(c) valid method, e.g. $\sum_{r=1}^{80} r - \sum_{r=1}^{40} 2r$, or using $\text{sum}(2r-1)=n^2$ with n=40 **M1**

(c) 1600 cao **A1**

(c) Answer: 1600

Question 2

(a) uses $n(n + 1)(2n + 1)/6$ for the r^2 term and $n(n + 1)/2$ for the r term **M1**

(a) writes $3n(n + 1)(2n + 1)/6 - 5n(n + 1)/2 + 5n$ over a common denominator **M1**

(a) expands and collects like terms **A1**

(a) $n(6n^2 - 6n + 18)/6$ (cso) **A1**

(a) Answer: $n(6n^2 - 6n + 18)/6$

(b) S(17) - S(3) **M1**

(b) S(17) = 4675 **A1**

(b) S(3) = 27 **A1**

(b) 4648 **A1**

(b) Answer: 4648

Question 3

(a) expanding $r(r+1) = r^2 + r$ **M1**

(a) substituting both standard results: sum r^2 + sum r = $n(n+1)(2n+1)/6 + n(n+1)/2$ **M1**

(a) combining over a common denominator of 6 and factorising out n(n+1) **M1**

(a) cso: simplifies to $n(n+1)(n+2)/3$ **A1**

(a) Answer: n(n+1)(n+2)/3

(b) substituting n = 25 into the result of part (a) **M1**

(b) 5850 cao **A1**

(b) Answer: 5850

(c) recognising $\sum_{r=10}^{25} = \sum_{r=1}^{25} - \sum_{r=1}^{9}$ **M1**

(c) computing $\sum_{r=1}^{9} r(r+1) = 9*10*11/3 = 330$ **M1**

(c) 5520 cao **A1**

(c) Answer: 5520

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