Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE in As Mathematics

8MA0_01 (Public release version)

Resource Set 1: Topic 4

Sequences

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an optional part of the range of evidence teachers may use when deciding on a candidate’s grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

$$1 + nx + \frac{n(n-1)}{2\times1}x^2 + \frac{n(n-1)(n-2)x^3}{3\times2\times1}$$

1.

(a) Find the first 4 terms, in ascending powers of x, in the binomial expansion of

$$(1 + kx)^{10}$$

where k is a non-zero constant. Write each coefficient as simply as possible.

(3)

① a) $(1 + kx)^{10}$

$\Rightarrow \; {}^{10}C_0 1^{10} (kx)^0 + {}^{10}C_1 1^9 (kx)^1 + {}^{10}C_2 1^8 (kx)^2 + {}^{10}C_3 1^7 (kx)^3$

$\Rightarrow \; 1 + 10kx + 45k^2x^2 + 120k^3x^3$

Given that in the expansion of $(1 + kx)^{10}$ the coefficient x^3 is 3 times the coefficient of x,

(b) find the possible values of k.

(3)

b) $120k^3 = 3(10k)$

$120k^3 = 30k$

$120k^3 - 30k = 0$

$k(4k^2 - 1) = 0$

$k(2k-1)(2k+1) = 0$

$k = 0 \; , \; k = \frac{1}{2} \; , \; k = -\frac{1}{2}$

(Total for Question 1 is 6 marks)

2.

(a) Expand $\left(1+\frac{3}{x}\right)^2$ simplifying each term.

(2)

② a) $\left(1+\frac{3}{x}\right)^2 = {}^2C_0\, 1^2\left(\frac{3}{x}\right)^0 + {}^2C_1\, 1^1\left(\frac{3}{x}\right)^1 + {}^2C_2\, 1^0\left(\frac{3}{x}\right)^2$

$= 1 + \frac{6}{x} + \frac{9}{x^2}$

(b) Use the binomial expansion to find, in ascending powers of x, the first four terms in the expansion of

$$\left(1+\frac{3}{4}x\right)^6$$

simplifying each term.

(4)

b) $\left(1+\frac{3}{4}x\right)^6$

$= 1 + 6\left(\frac{3}{4}x\right) + 15\left(\frac{3}{4}x\right)^2 + 20\left(\frac{3}{4}x\right)^3 + 15\left(\frac{3}{4}x\right)^4 + \dots$

$= 1 + \frac{9}{2}x + \frac{135}{16}x^2 + \frac{135}{16}x^3 + \frac{1215}{256}x^4 + \dots$

(c) Hence find the coefficient of x in the expansion of

$$\left(1+\frac{3}{x}\right)^2\left(1+\frac{3}{4}x\right)^6$$

(2)

c) $\left(1+\frac{6}{x}+\frac{9}{x^2}\right)\left(1+\frac{9}{2}x+\frac{135x^2}{16}+\frac{135x^3}{16}+\dots\right)$

Terms with x coefficient $= \frac{9}{2}x + \frac{6}{x}\left(\frac{135x^2}{16}\right) + \frac{9}{x^2}\left(\frac{135x^3}{16}\right)$

$\Rightarrow$ coefficient of $x = \frac{9}{2} + 6\left(\frac{135}{16}\right) + 9\left(\frac{135}{16}\right) = \underline{\underline{\frac{2097}{16}}}$

(Total for Question 2 is 8 marks)

3.

(a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of $\left(2-\frac{x}{2}\right)^7$, giving each term in its simplest form.

(4)

③ a) $\left(2-\frac{x}{2}\right)^7$

$= {}^7C_0(2)^7\left(\frac{-x}{2}\right)^0 + {}^7C_1(2)^6\left(\frac{-x}{2}\right)^1 + {}^7C_2(2)^5\left(\frac{-x}{2}\right)^2 + \cdots$

$= 128 - 224x + 168x^2 + \cdots$

(b) Explain how you would use your expansion to give an estimate for the value of 1.995^7

(1)

b) $1.995^7 = \left(2-\frac{x}{2}\right)^7$

$1.995 = 2 - \frac{x}{2}$

$\frac{x}{2} = 0.005$

$\Rightarrow x = 0.01$

replace the x in the expansion with 0.01 to find an estimate for 1.995^7

(Total for Question 3 is 5 marks)

4.

(a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$\left(2 + \frac{3x}{4}\right)^6$$

giving each term in its simplest form.

(4)

4 a) $\left(2 + \frac{3x}{4}\right)^6$

$= 2^6 + 6(2)^5\left(\frac{3x}{4}\right)^1 + 15(2)^4\left(\frac{3x}{4}\right)^2 + \cdots$

$= 64 + 1.44x + 135x^2 + \cdots$

(b) Explain how you could use your expansion to estimate the value of 1.925^6
You do not need to perform the calculation.

(1)

b) $1.925 = 2 + \frac{3x}{4}$

$x = -0.1$

$\Rightarrow$ replace the x in the expansion with -0.1 to estimate the value of 1.925^6

(Total for Question 4 is 5 marks)

5.

(a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$\left(2-\frac{x}{16}\right)^9$$

giving each term in its simplest form.

(4)

5 a) $\left(2-\frac{x}{16}\right)^9$

$= 2^9 + 9(2)^8\left(-\frac{x}{16}\right)^1 + 36(2)^7\left(-\frac{x}{16}\right)^2 + \cdots$

$= 512 - 144x + 18x^2 + \ldots$

$$f(x) = (a+bx)\left(2-\frac{x}{16}\right)^9, \text{ where } a \text{ and } b \text{ are constants}$$

Given that the first two terms, in ascending powers of x, in the series expansion of f(x) are 128 and $36x$,

(b) find the value of a,

(2)

b) $(a+bx)(512-144x+18x^2+\cdots)$

$= 512a - 144ax + 18ax^2 + 512bx - 144bx^2 + \ldots$

$= 512a - 144ax + 512bx + \cdots$

$= 512a + x(512b - 144a) + \cdots$

$\hookrightarrow$ $512a = 128$

$a = \frac{1}{4}$

(c) find the value of b.

(2)

c) $512b - 144a = 36$

$512b - 144\left(\frac{1}{4}\right) = 36$

$\Rightarrow b = \frac{9}{64}$

(Total for Question 5 is 8 marks)