7. A geometric sequence has first term a and common ratio r, where $r > 0$

Given that

- the 3rd term is 20
- the 5th term is 12.8

(a) show that $r = 0.8$

(1)

(b) Hence find the value of a.

(2)

Given that the sum of the first n terms of this sequence is greater than 156

(c) find the smallest possible value of n.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(4)

DO NOT WRITE IN THIS AREA

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

The sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_{n+1} = 1 - \frac{1}{u_n}$$

$$u_1 = 4$$

(a) Show that this is a periodic sequence of order 3

(3)

(b) Find the value of

$$\sum_{n=1}^{180} (5n + 3 + u_n)$$

(4)

DO NOT WRITE IN THIS AREA

1. An arithmetic series starts

$$78 + 75 + 72 + \ldots$$

Find

(a) the 18th term in the series,

(2)

(b) the sum of the first 100 terms of the series.

(2)

DO NOT WRITE IN THIS

10. (i) (a) Find, in ascending powers of x, the 2nd, 3rd and 5th terms of the binomial expansion of

$$(3 + 2x)^6$$

(3)

For a particular value of x, these three terms form consecutive terms in a geometric series.

(b) Find this value of x.

(3)

(ii) In a **different** geometric series,

- the first term is $\sin^2\theta$
- the common ratio is $2\cos\theta$
- the sum to infinity is $\frac{8}{5}$

(a) Show that

$$5\cos^2\theta - 16\cos\theta + 3 = 0$$

(3)

(b) Hence find the exact value of the 2nd term in the series.

(3)

2: A geometric series has first term a and common ratio r.

Given that

- the third term in the series is 64
- the sixth term in the series is –8

(a) show that $r = -\frac{1}{2}$

(2)

(b) find the sum to infinity of the series.

(4)

blank

2. The adult population of a town at the start of 2019 is 25 000

A model predicts that the adult population will increase by 2% each year, so that the number of adults in the population at the start of each year following 2019 will form a geometric sequence.

(a) Find, according to the model, the adult population of the town at the start of 2032

(3)

It is also modelled that every member of the adult population gives £5 to local charity at the start of each year.

(b) Find, according to these models, the total amount of money that would be given to local charity by the adult population of the town from 2019 to 2032 inclusive. Give your answer to the nearest £1 000

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE
DO NOT WRITE IN THIS ARE
DO NOT WRITE IN THIS AREA

1. An arithmetic series starts

$$78 + 75 + 72 + ...$$

Find

(a) the 18th term in the series,

(2)

(b) the sum of the first 100 terms of the series.

(2)

DO NOT WRITE IN THIS