# 1.12 Pure: Sequences, Series and Binomial Depth: 30-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** A factory records the number of defective items produced each month. In month 1 there are 84 defective items, and this decreases by 3 each month compared with the previous month, forming an arithmetic sequence, while the process remains uncorrected.

**(a)** Find the number of defective items modelled in month 12. **(2)**

**(b)** Find the total number of defective items modelled over months 6 to 15 inclusive. **(4)**

**(c)** The process is considered corrected once the modelled number of defective items first reaches zero or fewer. Find the first month in which this occurs according to the model, and comment on whether the arithmetic model remains appropriate after this point. **(3)**

**(Total for Question 1 is 9 marks)**

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**2** The sum of the first n terms of an arithmetic series is given by $S_n = 3n^2 + 5n$.

**(a)** Find the first term and the common difference of the series. **(4)**

**(b)** Hence find the 25th term of the series. **(2)**

**(Total for Question 2 is 6 marks)**

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**3** A geometric sequence has first term 3 and common ratio 2. Find the 5th term.

**(Total for Question 3 is 1 mark)**


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**4** The first three terms of a geometric series are 4, 4r and $4r^2$ respectively, where r is real and $r \neq 1$. The sum of the first 6 terms of the series is 5 times the sum of the first 3 terms.

**(a)** Show that $r^3 = 4$. **(3)**

**(b)** Find the value of r, giving your answer to 3 significant figures. **(2)**

**(c)** Find the sum of the first 6 terms of the series, giving your answer to the nearest whole number. **(2)**

**(Total for Question 4 is 7 marks)**

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**5** A geometric sequence has first term 4 and 4th term 32. Find the common ratio, given that it is positive.

**(Total for Question 5 is 2 marks)**


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# Mark scheme · 1.12 Pure: Sequences, Series and Binomial Depth: 30-minute Pack

## Question 1

| | |
|---|---|
| (a) uses $u_n=a+(n-1)d$ with a=84, d=-3, n=12 | **M1** |
| (a) 51 cao | **A1** |
| **(a) Answer: 51** | |
| (b) identifies that months 6 to 15 inclusive is 10 terms | **B1** |
| (b) correct method, e.g. n/2(u6+u15) or S15-S5 | **M1** |
| (b) correct intermediate values u6=69 and u15=42 (or S15=945, S5=390) | **A1** |
| (b) 555 cao | **A1** |
| **(b) Answer: 555** | |
| (c) forms 84-3(n-1)≤0 (oe) and solves to n≥29 | **M1** |
| (c) cao month 29, with u28=3>0 and u29=0 checked | **A1** |
| (c) valid comment that the model breaks down beyond this point since a count of defective items cannot be negative in reality | **B1** |
| **(c) Answer: Month 29; the arithmetic model is no longer appropriate beyond this point since a count cannot go negative.** | |

## Question 2

| | |
|---|---|
| (a) finds the first term $a=S_1=8$ | **M1** |
| (a) finds $u2=S_2-S_1$ (or equivalent method comparing coefficients) leading to d | **M1** |
| (a) a=8 cao | **A1** |
| (a) d=6 cao | **A1** |
| **(a) Answer: a = 8, d = 6** | |
| (b) uses $u_n=a+(n-1)d$ with n=25 | **M1** |
| (b) 152 cao | **A1** |
| **(b) Answer: 152** | |

## Question 3

| | |
|---|---|
| 48 cao | **B1** |
| **Answer: 48** | |

## Question 4

| | |
|---|---|
| (a) uses the sum formulae for S6 and S3 with the given condition S6=5S3 (or recognises terms 4 to 6 equal $r^3$ times terms 1 to 3) | **M1** |
| (a) reaches $r^6-5r^3+4=0$ and factorises to $(r^3-1)(r^3-4)=0$ | **M1** |
| (a) cso rejects $r^3=1$ (since $r \neq 1$ is given) leaving $r^3=4$ | **A1** |
| **(a) Answer: $r^3 = 4$ (shown)** | |
| (b) takes the cube root of both sides | **M1** |
| (b) awrt 1.59 | **A1** |
| **(b) Answer: r = 1.59 (awrt, 3sf)** | |
| (c) correct method, e.g. $S6 = 4(1-r^6)/(1-r)$ using $r^6=(r^3)^2=16$, or S6=5*S3 | **M1** |
| (c) awrt 102 | **A1** |
| **(c) Answer: 102** | |

## Question 5

| | |
|---|---|
| forms $r^3 = 32/4 = 8$ | **M1** |
| r = 2 cao | **A1** |
| **Answer: r = 2** | |


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