Greenwood College
Year 12 Applications
Test 1 2018/2019
Resource-Free

Nov 2018

Name.....

/50

No calculators nor notes allowed.
25 mark total.

Formula sheet allowed.
25 minute time limit

Question 1 **[4 marks: 1, 3]**

A number sequence is described using the recursive equation:

$T_{n+1} = 2T_n - 1$, $T_3 = 5$

(a) Determine T_4

$T_4 = 2 \times T_3 - 1$
$= 2 \times 5 - 1$
$= 9$ ✓

(b) Determine T_1

$T_2 = \frac{5+1}{2}$
$= 3$ ✓

$T_1 = \frac{3+1}{2}$
$= 2$ ✓✓

Question 2 **[2 marks]**

A number sequence is defined as follows:

$u_n = 2u_{n-1} - u_{n-2}$, $u_1 = 8$ and $u_2 = 15$

Calculate u_3.

$u_3 = 2 \times u_2 - u_1$
$= 2 \times 15 - 8$
$= 30 - 8$
$u_3 = 22$ ✓✓

(-1) if 15 and 8 wrong way around.

6

Question 3 **[4 marks]**

A recursive sequence is defined as

$u_n = pu_{n-1} + q$

Given that $u_1 = -8$, $u_2 = 8$ and $u_3 = 4$, write down the two equations to determine the values of p and q. Do not solve for p and q.

$8 = -8p + q$

$4 = 8p + q$

Question 4 **[5 marks: 2, 3]**

A number sequence is generated by $T_n = 3n + 2$, with n = 1, 2, 3,...

(a) Express in the form $T_n = a + (n - 1) \times d$

5, 8, 11, ...

$a = 5, d = 3$

$\therefore T_n = 5 + (n-1) \times 3$

(b) Express the number sequence in recursive form.

$T_{n+1} = T_n + 3, \quad T_1 = 5$

Question 5 **[4 marks: 2, 2]**

For this number sequence $\frac{1}{2}$, -4, 32, -256,....

Determine the...

(a) nth term formula $a = 1/2, \quad r = \frac{-4}{\frac{1}{2}} = -8$

$T_n = \frac{1}{2} \times (-8)^{n-1}$ ✓ ✓ ✓

(b) the recursive formula

$T_{n+1} = -8 \times T_n, \quad T_1 = \frac{1}{2}$ ✓ ✓

Question 6 **[4 marks: 2, 2]**

The first term of a geometric progression is 4.

The fourth term is 108.

(a) Show that the ratio is 3.

$T_n = a \times r^{n-1}$

$108 = 4 \times r^3$

$r^3 = 27$ ✓

$r = 3$ ✓

(b) Write the recursive formula.

$T_{n+1} = 3 \times T_n, \quad T_1 = 4$ ✓ ✓

8

Question 7 **[2 marks]**

Express the geometric ratio of r = 0.76 as a % increase/decease.

$0.76 = 76\% = 100\% - 24\%$

$= 24\%$ decrease ✓ ✓

2

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Formula sheet, one A4 page double-sided of notes and calculators allowed.

25 mark total. 25 minute time limit

Question 8 **[11 marks: 2, 2, 2, 2, 3]**

Mary buys a car with a purchase price of $15 000. However, she has been told to expect the car to depreciate in value. The value of the car after *n* years can be determined by using the recursive rule.

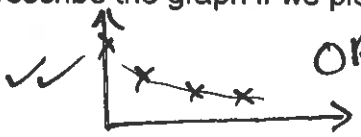
$$T_{n+1} = 0.82T_n \text{ , } T_0 = 15\,000$$

(a) Complete the table below to show the value of the car at the end of each year, to the nearest dollar.

n	0	1	2	3
Value of car after n years ($)	15000	12300	10086	8271

−1 per error ✓✓

(b) Describe the graph if we plotted the value of the car versus the year.



✓✓ OR Decreasing ✓ exponentially ✓

(c) Express the car values from year to year as a nth term formula.

$T_n = 15000 \times 0.82^n$ ✓✓

(d) Determine the value of Mary's car after 10 years, correct to the nearest dollar.

15000×0.82^{10}
$= \$2062$ ✓✓

8

Question 8 cont.

(e) Mary decided that she will sell her car at the end of the year in which its value drops to 80% of its original purchase price. After how many years should she sell the car? 80% of $15000 = $12000 ✓

3rd year ✓✓

Question 9 **[5 marks: 2, 3]**

5, x, 20,.... is a number sequence.

(a) Determine x if the number sequence is an arithmetic progression.

$x - 5 = 20 - x$ OR $x = \frac{20+5}{2}$

$2x = 25$

$x = 12.5$ ✓✓

(b) Determine x if the number sequence is a geometric progression.

$\frac{x}{5} = \frac{20}{x}$ ✓

$x^2 = 100$

$x = +10, -10$

✓ ✓

Question 10 **[5 marks: 2, 3]**

5, x, y, 78.125,.... is a number sequence.

(a) Determine *x* and *y* if the number sequence is an arithmetic progression.

$3d = 78.125 - 5$

$d = 24.375$ ✓

$x = 29.375$ ✓ $y = 53.75$ ✓

(b) Determine *x* and *y* if the number sequence is a geometric progression.

$a = 5$, $ar^3 = 78.125$

$r^3 = 15.625$

$r = 2.5$ ✓

$x = 5 \times 2.5 = 12.5$ ✓ $y = 5 \times 2.5^2 = 31.25$ ✓

Question 11 **[4 marks: 2, 2]**

$T_{n+1} = 0.6T_n - 150$, $T_1 = 85$ is used to generate a number sequence.

(a) Explain why this is neither an arithmetic progression nor a geometric progression.

AP → $T_{n+1} = T_n + d$ ✓

GP → $T_{n+1} = r \times T_n$ ✓

(b) T_{n+1} will become constant as n gets very large. Show how this value can be found using an algebraic equation.

Solve $x = 0.6x - 150$

OR Using 85, −99, −209.40 to show that d's and r's are not equal.

9