



SHENTON  
COLLEGE

# YEAR 12 MATHEMATICS: APPLICATIONS

## Test 2 (Sequences) Semester 1 2018

NAME: \_\_\_\_\_

TEACHER: McRae Mackenzie Ryan Staffe

No Calculator No notes

Formula sheet provided

Total time: 20 minutes

TOTAL

54

21

### QUESTION 1 [10 marks - 2, 2, 2, 2, 2]

State whether the following are arithmetic or geometric progressions or neither and give a reason for your choice.

a) 19, 16, 13, 10, .....

b) 8, 12, 18, 27, .....

c)  $\frac{1}{12}, \frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \dots$

d)  $5x, 5x^2, 5x^4, 5x^8, \dots$

e) 0.06, 0.18, 0.54, 1.62, .....





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33

NAME: \_\_\_\_\_

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Calculator Assumed 1-page A4 single-sided notes Formula sheet provided Total time: 30 minutes

**QUESTION 1 [8 marks – 1, 2, 2, 1, 2]**

a) For the following sequence, find  $T_{14}$

8, 15, 22, 29, 36, .....

b) Given that  $T_n = T_{n-2} + \frac{1}{2} T_{n-1}$  and  $T_1 = 2$  and  $T_2 = 4$ , find the first five terms.

.

c) A geometric progression has a third term of 0.5 and a sixth term of 0.0625.

Find i) the common ratio

ii) the seventh term

iii) write an explicit rule in terms of n.

**QUESTION 2 [7 marks - 3, 2, 1, 1]**

John buys a new car X for \$30,000 which loses 20% of its value per year. At the same time Julie buys a new car Y for \$20,000 which loses approximately \$1500 of its value per year.

- a) Write the **two** recursive rules that represent John and Julie's car values, where  $n$  is the number of years since they bought the car.

**John:**

**Julie:**

- b) Determine the value of John's car after five years to the nearest \$100.

- c) During which year does Julie's car exceed John's in value?

- d) John will sell his car during the year when his car is only worth a quarter of its original value. When does this happen?

**QUESTION 3 [9 marks - 1, 1, 2, 2, 2, 1]**

Bob and Roberta both colour their hair. The colours they use are not permanent and wash out gradually when they wash their hair. They have 100% colour when they first colour their hair.

(a) The product that Bob uses is such that the colour reduces by 15% of the current amount every time he washes his hair. What percentage of the original level of colour remains after

(i) 1 wash?

(ii) 2 washes?

(b) Write an explicit rule for  $n$  washes.

(c) Bob wants to re-colour his hair **before** the percentage of colour falls below 10%. How many times can he wash his hair before he must colour it again?

(d) Roberta pays more for her hair colouring product and the colour reduces by only 10% of the current amount every time she washes her hair.

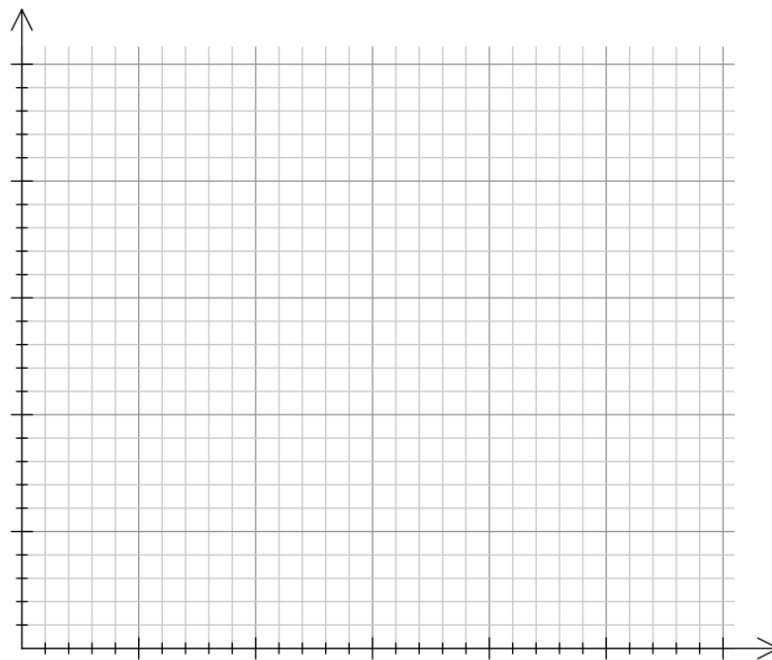
(i) What percent remains after  $n$  washes?

(ii) How often does she need to recolour her hair if, like Bob, she does not want the percentage of colour to fall below 10%.

**QUESTION 4 [9 marks – 3, 1, 2, 3]**

Derek owns a pool and is always struggling to keep his chlorine levels in the effective range so that it is safe to swim in the pool. A bag of chlorine brings the chlorine levels up by 50 ppm (parts per million) in the pool whenever it is added. Derek must not allow chlorine levels to drop below 70ppm, otherwise algae begins to form in the pool and it is unsafe to swim in. Chlorine levels decrease by 40% each month so Derek decides to add a bag of chlorine at the end of every month.

- a) Write a recursive rule that describes this situation if the pool initially starts the month with a level of 140ppm.
  
  
  
  
  
  
  
  
  
  
- b) How much chlorine will be in the pool after 6 months (to 2 d.p.)?
  
  
  
  
  
  
  
  
  
  
- c) Draw a graphical representation of the above situation for the first 6 months of Derek’s pool chlorination routine.



- d) Derek is concerned that his routine of adding a bag of chlorine at the end of each month will not keep his pool safe and free of algae in the long term. Is he on the right track with his chlorination routine? Justify your choice with mathematical reasoning.