

Question 9**(11 marks)**

Giuseppe wishes to set up an annuity. He is told that an annuity with quarterly investment returns and quarterly payments is modelled by the recursive rule:

$$A_{n+1} = A_n \times 1.019 - P, A_0 = Q \text{ with the values of } P \text{ and } Q \text{ consistent with the spreadsheet below.}$$

Quarter	Opening balance	Investment gain	Payment	Closing balance
1	\$648 000	\$12 312	\$15 000	X
2		Y	\$15 000	
3				

- (a) Determine the values of P , Q , X and Y and write them in the table below. (4 marks)

P	Q	X	Y

- (b) What is the annual compound interest rate for this investment? (1 mark)

When the balance in the annuity first falls below \$300 000, Giuseppe converts the payment to a perpetuity so that his children are left with some inherited benefits. The interest rate remains the same as that calculated in part (b).

- (c) Determine the number of years the annuity operates before the perpetuity starts. (2 marks)

- (d) What are the quarterly payments under this perpetuity? (2 marks)

- (e) Giuseppe believes that his investment returns are at an effective interest rate of 7.93% p.a. Use a clear calculation to comment on the accuracy of this belief. (2 marks)