



**Calculator Assumed**  
**Arithmetic and Geometric Sequences**  
**Mixed Applications 1**

Time: 45 minutes  
Total Marks: 45  
Your Score: / 45

**Question One: [2, 1, 2, 2, 3 = 10 marks]**

Annaliese signs up for a car loan offering 7% p.a. simple interest. She buys a car for \$22 000. By the terms of the loan she must pay her loan back over 10 years and make equal monthly installments.

- (a) How much in total will Annaliese have to repay?
  
  
  
  
  
  
  
  
  
  
- (b) If she repays her loan in full in exactly 10 years, how much does she pay each month?
  
  
  
  
  
  
  
  
  
  
- (c) How much does she owe at the end of the 23<sup>rd</sup> repayment?
  
  
  
  
  
  
  
  
  
  
- (d) Show, with a mathematical calculation, that she has repaid the load at the end of 10 years.
  
  
  
  
  
  
  
  
  
  
- (e) If after the 24<sup>th</sup> repayment, Anneliese wants to pay off her loan in four years time, what must she repay each month to reach her goal?

### **Question Two: [5 marks]**

In 2014 the ALS Ice-Bucket Challenge swept through Australia. The challenge went like this:

On social media, usually Facebook, a person would film themselves dumping a bucket of ice and water over their heads, all in the name of raising awareness and money for ALS. They would then nominate three friends to take on the challenge, and these friends had 24 hours to respond to the challenge.

Let's say that the first person to take on the challenge was John, and he put his video and his 3 nominations on social media on 1<sup>st</sup> August 2014.

If we assume there are approximately 18 000 000 adults in Australia, and they can all be nominated for the challenge, and if they are nominated they all accept and go on to nominate others, on what day will all adult Australians have completed the challenge?

Option A: 5.8% p.a. compounded monthly, guaranteed rate for 3 years.

(a) Write a recursive rule defining Jimmy's investment per month if he invests in Option A.

(b) Write a general rule defining Jimmy's investment per fortnight, if he invests in Option B.

(c) At the end of 1 year, which option is the better investment?

(d) Jimmy decides he wants to put his \$35 000 away in a term deposit for two and a half years. Which investments should he choose? Use mathematical reasoning to support your answer.

**Question Four: [2, 2, 2, 1, 2 = 9 marks]**

Leonard is planning a cycling trip from Perth to Albany. On the first day he cycles 90 km, on the second day 72 km and on the third day 57.6 km.

- (a) How far does he cycle on the fourth day?
  
  
  
  
  
  
  
  
  
  
- (b) Write a general rule defining the distance Leonard cycles each day.
  
  
  
  
  
  
  
  
  
  
- (c) How far has he cycled by the end of the 1 week?
  
  
  
  
  
  
  
  
  
  
- (d) How far does he cycle on the 10<sup>th</sup> day?
  
  
  
  
  
  
  
  
  
  
- (e) If the distance from Perth to Albany is 550 km, how long will it take for Leonard to arrive in Albany?

**Question Five: [2, 3 = 5 marks]**

Eighty students participate in a fundraising event for charity. The student who raises the most money is rewarded with an \$80 credit to spend at the canteen. The student who raises the second largest amount receives a \$79 credit and this continues with the person who raises the least receiving just a \$1 credit.

- (a) How much money is needed to give each of the 80 students their reward?
  
  
  
  
  
  
  
  
  
  
- (b) How much money is needed to give each of the bottom 20 students their reward?

**Question Six: [6 marks]**

Peta starts her first job in an interior architecture firm. She is offered the following two pay packages.

Option A: Starting salary of \$45 000 with a \$1500 increase each year.

Option B: Starting salary of \$40 000 with a 5% increase each year.

If she plans to stay at the firm for 10 years, which pay package should she choose? Explain your answer with mathematical reasoning.



**SOLUTIONS**  
**Calculator Assumed**  
**Arithmetic and Geometric Sequences**  
**Mixed Applications 1**

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Your Score: / 45

**Question One: [2, 1, 2, 2, 3 = 10 marks]**

Annaliese signs up for a car loan offering 7% p.a. simple interest. She buys a car for \$22 000. By the terms of the loan she must pay her loan back over 10 years and make equal monthly installments.

- (a) How much in total will Annaliese have to repay?

$$22000 \times 0.07 \times 10 = 15400 \quad \checkmark$$

$$22000 + 15400 = \$37400 \quad \checkmark$$

- (b) If she repays her loan in full in exactly 10 years, how much does she pay each month?

$$\$37400 \div (10 \times 12) = \$311.67 \quad \checkmark$$

- (c) How much does she owe at the end of the 23<sup>rd</sup> repayment?

$$\$37400 - 22 \times 311.67 = \$30543.26 \quad \checkmark$$

- (d) Show, with a mathematical calculation, that she has repaid the load at the end of 10 years.

$$\$37400 - 120 \times 311.67 = \$0 \quad \checkmark$$

- (e) If after the 24<sup>th</sup> repayment, Anneliese wants to pay off her loan in four years time, what must she repay each month to reach her goal?

$$\$37400 - 23 \times 311.67 = \$30231.59 \quad \checkmark$$

$$30231.59 \div (12 \times 4) = \$629.82 \quad \checkmark$$

**Question Two: [5 marks]**

In 2014 the ALS Ice-Bucket Challenge swept through Australia. The challenge went like this:

On social media, usually Facebook, a person would film themselves dumping a bucket of ice and water over their heads, all in the name of raising awareness and money for ALS. They would then nominate three friends to take on the challenge, and these friends had 24 hours to respond to the challenge.

Let's say that the first person to take on the challenge was John, and he put his video and his 3 nominations on social media on 1<sup>st</sup> August 2014.

If we assume there are approximately 18 000 000 adults in Australia, and they can all be nominated for the challenge, and if they are nominated they all accept and go on to nominate others, on what day will all adult Australians have completed the challenge?

$$T_n = 3^{n-1} \quad \checkmark \checkmark$$

$$S_{15} = 7174453 \quad \checkmark$$

$$S_{16} = 21523360 \quad \checkmark$$

$\therefore$  During the 16th day  $\checkmark$

**Question Three: [2, 2, 3, 3 = 10 marks]**

Jimmy has \$35 000 that he wants to invest in a term deposit. From his research, he has narrowed it down to one of the following two options:

Option A: 5.8% p.a. compounded monthly, guaranteed rate for 3 years.

Option B: 5.4% p.a. compounded fortnightly, guaranteed rate for 4 years.

- (a) Write a recursive rule defining Jimmy's investment per month if he invests in Option A.

$$A_n = 1.0048333 \times A_{n-1}; A_0 = 35000$$

- (b) Write a general rule defining Jimmy's investment per fortnight, if he invests in Option B.

$$B_n = 35000 \times 1.0020769^n$$

- (c) At the end of 1 year, which option is the better investment?

$$A_{12} = \$37084.84$$
$$B_{26} = \$36939.87$$

Option A

- (d) Jimmy decides he wants to put his \$35 000 away in a term deposit for two and a half years. Which investments should he choose? Use mathematical reasoning to support your answer.

$$A_{30} = \$40447.25$$
$$B_{65} = \$40053.12$$

Option A



**Question Four: [2, 2, 2, 1, 2 = 9 marks]**

Leonard is planning a cycling trip from Perth to Albany. On the first day he cycles 90 km, on the second day 72 km and on the third day 57.6 km.

- (a) How far does he cycle on the fourth day?

$$57.6 \times 0.8 = 46.08 \text{ km}$$

- (b) Write a general rule defining the distance Leonard cycles each day.

$$T_n = 90 \times 0.8^{n-1}$$

- (c) How far has he cycled by the end of the 1 week?

$$S_7 = 355.63 \text{ km}$$

- (d) How far does he cycle on the 10<sup>th</sup> day?

$$T_{10} = 12.08 \text{ km}$$

- (e) If the distance from Perth to Albany is 550 km, how long will it take for Leonard to arrive in Albany?

$$S_{\infty} = 450 \text{ km}$$

Leonard won't arrive in Albany

**Question Five: [2, 3 = 5 marks]**

Eighty students participate in a fundraising event for charity. The student who raises the most money is rewarded with an \$80 credit to spend at the canteen. The student who raises the second largest amount receives a \$79 credit and this continues with the person who raises the least receiving just a \$1 credit.

- (a) How much money is needed to give each of the 80 students their reward?

$$T_n = 80 - 1(n - 1) \quad \checkmark$$

$$S_{80} = \$3240 \quad \checkmark$$

- (b) How much money is needed to give each of the bottom 20 students their reward?

$$S_{80} - S_{60} = 3240 - 3030 \quad \checkmark \checkmark$$

$$= \$210 \quad \checkmark$$

**Question Six: [6 marks]**

Peta starts her first job in an interior architecture firm. She is offered the following two pay packages.

Option A: Starting salary of \$45 000 with a \$1500 increase each year.

Option B: Starting salary of \$40 000 with a 5% increase each year.

If she plans to stay at the firm for 10 years, which pay package should she choose? Explain your answer with mathematical reasoning.

$$A_{10} = 45000 + 1500(10 - 1) = \$58500 \quad \checkmark$$

$$S_{10} = \$517500 \quad \checkmark$$

$$B_{10} = 40000 \times 1.05^{(10-1)} = \$62053 \quad \checkmark$$

$$S_{10} = \$503115.70 \quad \checkmark$$

Although the salary in the 10<sup>th</sup> year is greater with option B, the total amount earned over the 10 years is greater with option A. ✓