HM321 Engineering Economics
Fall 2024 – Lecture 5

Instructor: Dr. Ali Ahmad

Bring Calculator Always

- Always bring your calculator with you in lectures
- Without practice you will not be able to do the calculations in your exams

Arithmetic Gradient Series Factor P/G

- A series of n payments:
  - The first payment is zero
  - Each subsequent payment increases by a fixed amount G
  - The payments are: 0, G, 2G, 3G, … , (n-1)G
- The following relation holds between P_G and G

$$\frac{P_G}{G} = \frac{1}{i}\left[\frac{(1+i)^n - 1}{i(1+i)^n} - \frac{n}{(1+i)^n}\right]$$

Cash Flow Diagram for P/G Factor
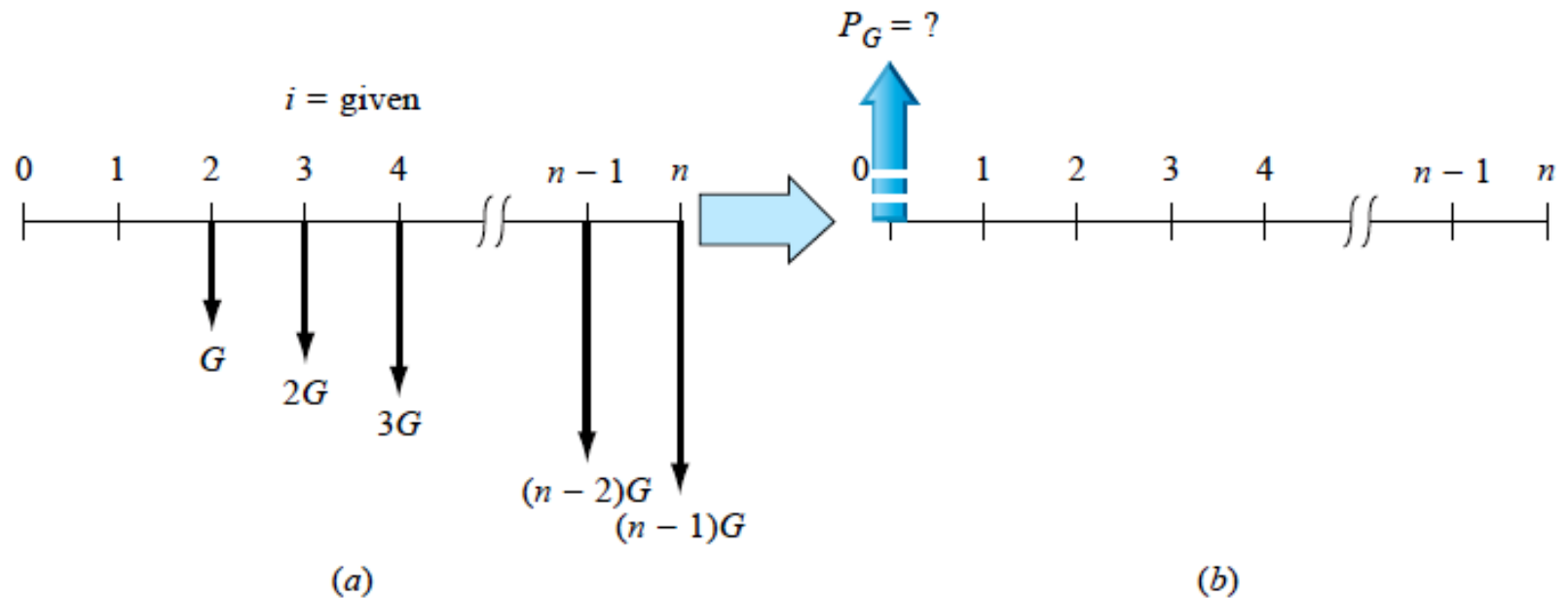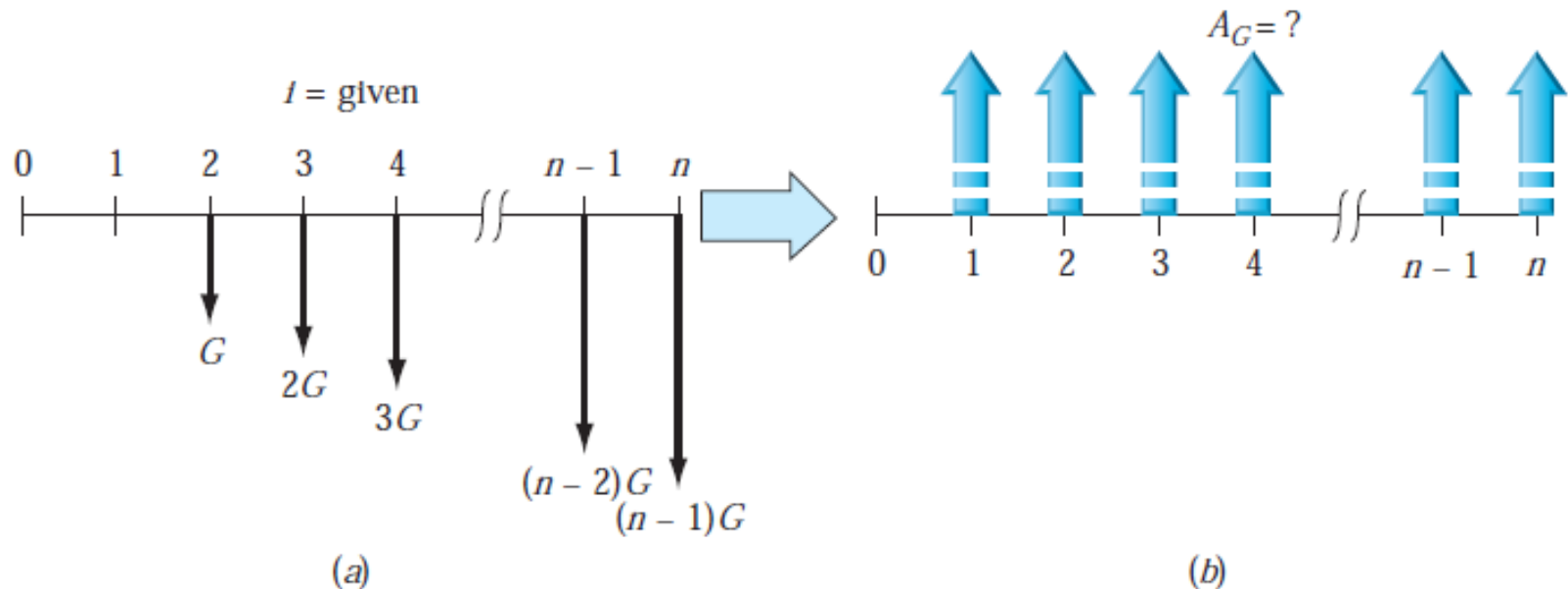

$$P_G = G(P/G, i, n)$$

Arithmetic Gradient Series Factor A/G

- The following relation holds between A_G and G

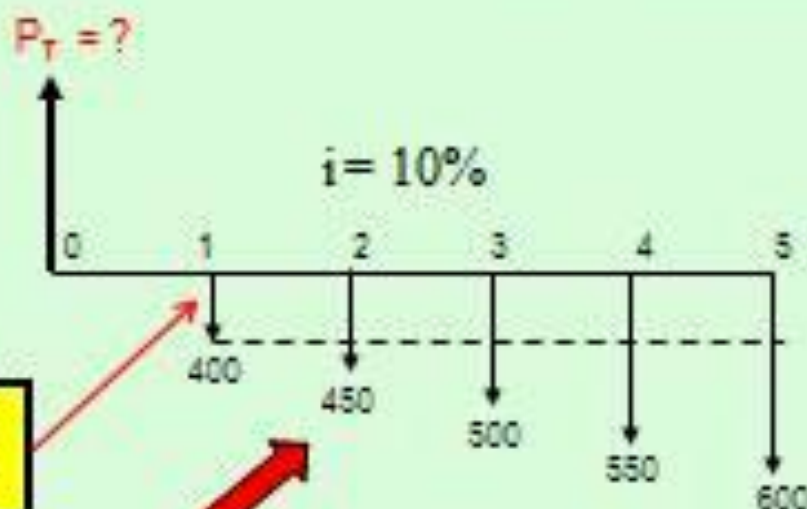$$\frac{A_G}{G} = \left[\frac{1}{i} - \frac{n}{(1+i)^n - 1} \right]$$

- *P/G* and *A/G* factors are listed in Tables 1 to 26
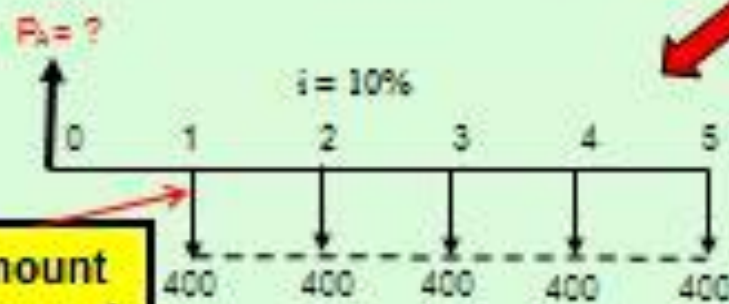
Cash Flow Diagram for A/G Factor

$$A_G = G(A/G, i, n)$$
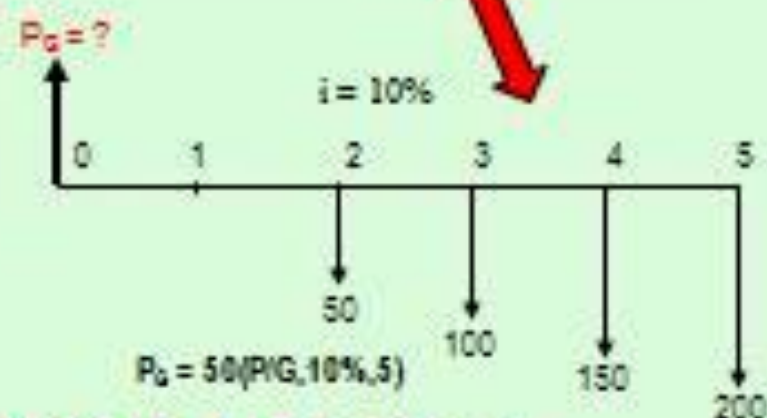
Typical Arithmetic Gradient Cash Flow

$P_T = ?$

$i = 10\%$

```
0      1      2      3      4      5
       400
              450
                     500
                            550
                                   600
```

Amount in year 1 is base amount

This diagram = this *base amount* plus this gradient

$P_A = ?$

$i = 10\%$

```
0    1    2    3    4    5
    400  400  400  400  400
```

Amount in year 1 is base amount

$P_A = 400(P/A,10\%,5)$

+

$P_G = ?$

$i = 10\%$

```
0    1    2    3    4    5
              50
                  100
                      150
                          200
```

$P_G = 50(P/G,10\%,5)$

$P_T = P_A + P_G = 400(P/A,10\%,5) + 50(P/G,10\%,5)$

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Typical Arithmetic Gradient Cash Flow

- An arithmetic gradient series may be <u>increasing</u> or <u>decreasing</u> by a constant amount
- For <u>increasing</u> arithmetic gradient series

$$P_T = P_A + P_G$$
$$A_T = A_1 + A_G$$

- For <u>decreasing</u> arithmetic gradient series

$$P_T = P_A - P_G$$
$$A_T = A_1 - A_G$$

- Alternately, P_T can be calculated first and A_T can then be calculated using A/P factor

- Quiz #1 was given

Reference

- Basics of Engineering Economy by Leland Blank and Anthony Tarquin, 2nd edition, McGraw-Hill