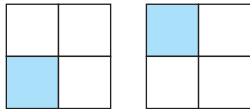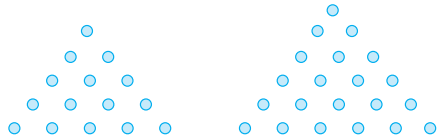# Fully-Worked Solutions

CHAPTER  1  Patterns and Sequences

## UPSKILL 1.1

**1** (a)



(b)



**2** (a) 1 March 2022, 8, 15, 22, 29
(Tuesday) $\quad$ + 7 + 7 + 7 + 7

The Mathematics Society committee meeting will be held every Tuesday in March 2022.

(b) 2, 7, 12, 17, …
$\quad$ + 5 + 5 + 5

Add 5 to the previous number

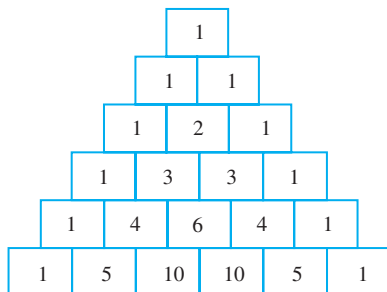(c) 3, 9, 27, 81, …
$\quad$ × 3 × 3 × 3

Multiply the previous number by 3

**3**

| | | |
|---|---|---|
| (a) | 1, 4, 16, 64 , … | Subtract 5 from the previous number |
| (b) | 0, 2, 4, 6, … | Divide the previous number by 10 |
| (c) | 40, 35, 30, 25, … | Add 2 to the previous number |
| (d) | 100, 10, 1, 0.1, … | Multiply the previous number by 4 |

**4**



**5** (a) 0, 2, 2, 4, 6, 10, 16, …

(b) 1, 3, 4, 7, 11, 18, 29, …

## UPSKILL 1.2

**1** (a) 10, 16, 22, 28, 34, …
$\quad$ + 6 + 6 + 6 + 6

Pattern: + 6
It is a sequence

(b) −2, 0, 5, 8, 14, …
$\quad$ + 2 + 5 + 3 + 6

No pattern is shown. Not a sequence.

(c) −3.5, −3.0, −2.5, −2.0, −1.5, …
$\quad$ + 0.5 + 0.5 + 0.5 + 0.5

Pattern: + 0.5
It is a sequence

**2** (a) 16, 22, 28, 34, 40, 46, 52, …

(b) −7, −2, 3, 8, 13, 18, …

(c) 1, 2, 4, 8, 16, 32, 64, 128, …

(d) 192, 96, 48, 24, 12, 6, …

(e) 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, …

**3** (a) 8, 11, 14, 17, 20, 23, …

(b) 25, 20, 15, 10, 5, 0, …

(c) 4, 8, 16, 32, 64, 128, …

(d) 256, 64, 16, 4, 1, 0.25, …

## UPSKILL 1.3

**1** (a) 4, 9, 14, 19, …

**Numbers**
Pattern: +5

**Words**
Add 5 to the previous number

**Algebraic expressions**
$4 = 5 \times 1 - 1$
$9 = 5 \times 2 - 1$
$14 = 5 \times 3 - 1$
$19 = 5 \times 4 - 1$

Therefore, the pattern of the number sequence can be expressed as $5n - 1$, where $n = 1, 2, 3, …$

(b) 19, 16, 13, 10, …

**Numbers**
Pattern: −3

**Words**
Subtract 3 from the previous number

**Algebraic expressions**
$19 = 22 - 3 \times 1$
$16 = 22 - 3 \times 2$
$13 = 22 - 3 \times 3$
$10 = 22 - 3 \times 4$

Therefore, the pattern of the number sequence can be expressed as $22 - 3n$, where $n = 1, 2, 3, …$

(c) 96, 48, 24, 12, …

**Numbers**
Pattern: ÷ 2

**Words**
Divide the previous number by 2

**Algebraic expressions**
$96 = 192 \div 2^1$
$48 = 192 \div 2^2$
$24 = 192 \div 2^3$
$12 = 192 \div 2^4$

Therefore, the pattern of the number sequence can be expressed as $192 \div 2^n$, where $n = 1, 2, 3, …$

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(d) $3, 5\frac{1}{2}, 8, 10\frac{1}{2}, \ldots$

**Numbers**

Pattern: $+2\frac{1}{2}$

**Words**

Add $2\frac{1}{2}$ to the previous number

**Algebraic expressions**

$$3 = 2\frac{1}{2} \times 1 + \frac{1}{2}$$

$$5\frac{1}{2} = 2\frac{1}{2} \times 2 + \frac{1}{2}$$

$$8 = 2\frac{1}{2} \times 3 + \frac{1}{2}$$

$$10\frac{1}{2} = 2\frac{1}{2} \times 4 + \frac{1}{2}$$

Therefore, the pattern of the number sequence can be expressed

as $2\frac{1}{2} \times n + \frac{1}{2}$ or $\frac{5n + 1}{2}$, where $n = 1, 2, 3, \ldots$

2  (a) $1, 3, 5, 7, \ldots$ [odd numbers]
   $1, 3, 5, 7, 9, 11, 13, \mathbf{15}, 17, 19, 21, \mathbf{23}$
   $T_8 = 15, T_{12} = 23$

   (b) $-7, -3, 1, 5, 9, \ldots$ [add 2]
   $-7, -3, 1, 5, 9, 13, 17, \mathbf{21}, 25, 29, 33, \mathbf{37}$
   $T_8 = 21, T_{12} = 37$

   (c) $11, 8, 5, 2, -1, \ldots$ [subtract 3]
   $11, 8, 5, 2, -1, -4, -7, \mathbf{-10}, -13, -16, -19, \mathbf{-22}$
   $T_8 = -10, T_{12} = -22$

3

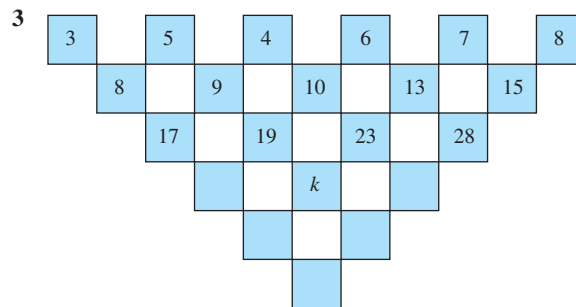| $n$ | $m$ |
|-----|-----|
| 1 | 3 |
| 2 | 5 |
| 3 | 7 |
| 4 | 9 |
| 5 | 11 |

$m = 1 + 2n$, where $n = 1, 2, 3, \ldots$

4  (a) $T_1 = 90 = 94 - 4 \times 1$
   $T_2 = 86 = 94 - 4 \times 2$
   $T_3 = 82 = 94 - 4 \times 3$
   $T_4 = 78 = 94 - 4 \times 4$
   $\therefore T_n = 94 - 4 \times n, n = 1, 2, 3, \ldots$

   (b) $94 - 4n = 2$
   $-4n = 2 - 94$
   $-4n = -92$
   $n = 23$
   $\therefore$ It is $23^{rd}$ term

5  (a) $\frac{5}{6}, \frac{6}{7}$

   (b) $T_{50} = \frac{50}{51}$

   (c) $T_n = \frac{n}{n + 1}, n = 1, 2, 3, \ldots$

# Summative Practice 1

## Section A

**1** $-2, -1, 1, 4, p, 13, \ldots$
$+1 \quad +2 \quad +3 \quad +4 \quad +5$

$p = 4 + 4$
$\quad = 8$
*Answer*: **C**

**2** $2, 5, 8, 11, \ldots$
$+3 \quad +3 \quad +3$
*Answer*: **A**

**3**

| 3 | | 5 | | 4 | | 6 | | 7 | | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | | 9 | | 10 | | 13 | | 15 | |
| | | 17 | | 19 | | 23 | | 28 | | |
| | | | | $k$ | | | | | | |

$k = 19 + 23 = 42$
*Answer*: **D**

**4** $2, \underline{3}, 5, \underline{8}, \underline{13}, m, \underline{\quad}.$
$m = 8 + 13 = 21$
*Answer*: **C**

**5** $-11 = 9 \times 1 - 20$
$-2 = 9 \times 2 - 20$
$7 = 9 \times 3 - 20$
$16 = 9 \times 4 - 20$
$9n - 20$, where $n = 1, 2, 3, \ldots$
*Answer*: **C**

**6** $T_1 = 1 = 1^2, T_2 = 4 = 2^2, T_3 = 9 = 3^2, T_4 = 16 = 4^2$
$\therefore T_{10} = 10^2 = 100$
*Answer*: **A**

**7** $1 = 1$
$3 = 1 + 2$
$6 = 1 + 2 + 3$
$8^{th}$ arrangement $= 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8$
$= 36$
*Answer*: **C**

**8** $2, 4, 6, 8, \ldots$ are even numbers.
*Answer*: **B**

**9** $T_n = n(6n - 11)$
$T_{10} = 10(6 \times 10 - 11) = 490$
*Answer*: **A**

**10** $1^2, 2^2, 3^2, 4^2, \ldots n^2$
*Answer*: **D**

## Section B

**1**

| | | | |
|---|---|---|---|
| (a) | 1, 4, 16, 64, … | | Subtract 10 from the previous number |
| (b) | 5, 8, 11, 14, … | | Divide the previous number by 2 |
| (c) | 100, 50, 25, 12.5, … | | Add 3 to the previous number |
| (d) | 45, 35, 25, 15, … | | Multiply the previous number by 4 |
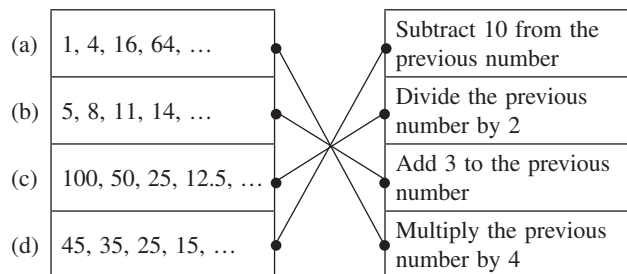
**2** (a) $16, 22, \underline{28}, 34, 40, \underline{46}, 52, \ldots$
[Add 6 to the previous number]

   (b) $\underline{-7}, -2, 3, 8, \underline{13}, \ldots$
[Add 5 to the previous number]

**3** (a) Add 8 to the previous number:
   $16, 24, 32, 40, 48, 56$

   (b) Add 2 to the previous number:
   $9, 11, 13, 15, 17, 19$

## Section C

**1** (a) (i)
$$+5 \quad +5 \quad +5 \quad +5$$
$$-7, \quad -2, \quad 3, \quad 8, \quad 13, \ldots$$
It is a sequence

    (ii)
$$\times 2 \quad \times 3 \quad \times 2 \quad \times 1.5$$
$$3, \quad 6, \quad 18, \quad 36, \quad 54, \ldots$$
It is not a sequence

  (b) Area of $10^{\text{th}}$ square $= 10 \times 10$
$$= 100 \text{ cm}^2$$
Area of square $= n^2$, $n = 1, 2, 3, \ldots$

  (c) (i) $T_7 = 1 + 2 + 3 + 4 + 5 + 6 + 7 = 28$

    (ii) $1 + 2 + 3 + 4 + \ldots + 20 = 210$
The $20^{\text{th}}$ term is equal to 210

**2** (a) 6, 2, −2, −6, −10, −14, −18, −22

  (b) $10 = 4 + 6 \times 1$
$16 = 4 + 6 \times 2$
$22 = 4 + 6 \times 3$
$28 = 4 + 6 \times 4$
$\vdots$
The algebraic expression is $4 + 6n$, $n = 1, 2, 3, \ldots$

  (c) (i) Square 1: 4 spots, Square 2: 8 spots
Square 3: 12 spots, Square 4: 16 spots

    (ii) $4 = 4 \times 1$
$8 = 4 \times 2$
$12 = 4 \times 3$
$16 = 4 \times 4$
The algebraic expression is $4n$, $n = 1, 2, 3, \ldots$

**3** (a)
$$-8 \quad -8 \quad -8 \quad -8$$
$$11, \quad p, \quad -5, \quad -13, \quad q$$
$p = 11 - 8 = 3$
$q = -13 - 8 = -21$

  (b) (i) $7^2 = 49$

    (ii) $h = 2k - 1$
$= 2(20) - 1$
$= 39$

  (c) $10\,000 \times 1.03 = 10\,300$
$10\,000 \times 1.03 \times 1.03 = 10\,000 \times 1.03^2 = 10\,609$
$10\,000 \times 1.03 \times 1.03 \times 1.03 = 10\,000 \times 1.03^3 = 10\,927.27$
$10\,000 \times 1.03 \times 1.03 \times 1.03 \times 1.03 = 10\,000 \times 1.03^4$
$= 11\,255.09$

Total saving at the end of $10^{\text{th}}$ year
$= 10\,000 \times 1.03^{10}$
$= \text{RM}13\,439.16$