PA6-1: Increasing Sequences

In an **increasing sequence**, each number is greater than the one before it.

Deborah wants to continue the number pattern: 6 , 8 , 10 , 12 , _?_

She finds the **difference**
between the first two numbers: 6   7   8   6 , 8 , 10 , 12 , _?_

She finds that the difference between the other numbers in
the pattern is also 2. So the pattern was made by adding 2:   6 , 8 , 10 , 12 , _?_

To continue the pattern, Deborah adds 2 to the last number
in the sequence.

The final number in the pattern is 14:   6 , 8 , 10 , 12 , _14_

---

1. Extend the following patterns. Start by finding the gap between the numbers.

a) 2 , 5 , 8 , ____ , ____ , ____

b) 1 , 7 , 13 , ____ , ____ , ____

c) 2 , 7 , 12 , ____ , ____ , ____

d) 4 , 8 , 12 , ____ , ____ , ____

e) 1 , 6 , 11 , ____ , ____ , ____

f) 4 , 10 , 16 , ____ , ____ , ____

g) 2 , 12 , 22 , ____ , ____ , ____

h) 7 , 15 , 23 , ____ , ____ , ____

i) 31 , 34 , 37 , ____ , ____ , ____

j) 92 , 98 , 104 , ____ , ____ , ____

k) 12 , 23 , 34 , ____ , ____ , ____

l) 0 , 8 , 16 , ____ , ____ , ____

2. A plant that is 17 cm high grows 2 cm each day.

a) How high will the plant be after three days? _____

b) In how many days will the plant be 27 cm high? _____

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PA6-2: Decreasing Sequences

In a **decreasing sequence**, each number is less than the one before it.

Inder wants to continue the number pattern: 25 , 23 , 21 , _?_

She finds the **difference**
between the first two numbers:

25   24   23

25 , 23 , 21 , _?_   (-2)

She finds that the difference between the other numbers in the pattern   25 , 23 , 21 , ?   (-2) (-2)
is also 2. So the pattern was made by subtracting 2.

The final number in the pattern is 19:   25 , 23 , 21 , _19_   (-2) (-2) (-2)

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
1. Extend the following patterns:

a) 18 , 15 , 12 , ____ , ____ , ____   b) 32 , 26 , 20 , ____ , ____ , ____

c) 52 , 47 , 42 , ____ , ____ , ____   d) 34 , 30 , 26 , ____ , ____ , ____

e) 51 , 46 , 41 , ____ , ____ , ____   f) 84 , 80 , 76 , ____ , ____ , ____

g) 62 , 51 , 40 , ____ , ____ , ____   h) 97 , 89 , 81 , ____ , ____ , ____

i) 71 , 64 , 57 , ____ , ____ , ____   j) 62 , 58 , 54 , ____ , ____ , ____

k) 82 , 73 , 64 , ____ , ____ , ____   l) 84 , 72 , 60 , ____ , ____ , ____

Use decreasing sequences to solve these problems:

2. Judi has saved $49. She spends $8 each day.
    How much money does she have left after 5 days?

3.   Yen has a roll of 74 stamps. She uses 7 each day for 4 days.
     How many are left?

48¢
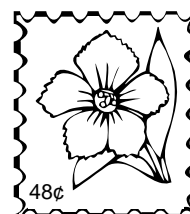
PA6-3: Extending a Pattern Using a Rule

1. Continue the following sequences by <u>adding</u> the number given:

   a) (add 4)   41, 45, _____, _____, _____

   b) (add 8)   60, 68, _____, _____, _____

   c) (add 3)   74, 77, _____, _____, _____

   d) (add 11) 20, 31, _____, _____, _____

   e) (add 8)   61, 69, _____, _____, _____

   f) (add 11) 31, 42, _____, _____, _____

2. Continue the following sequences, <u>subtracting</u> by the number given:

   a) (subtract 3)   25, 22, _____, _____, _____

   b) (subtract 2)   34, 32, _____, _____, _____

   c) (subtract 6)   85, 79, _____, _____, _____

   d) (subtract 12) 89, 77, _____, _____, _____

   e) (subtract 8)   57, 49, _____, _____, _____

   f) (subtract 7)   57, 50, _____, _____, _____

BONUS
3. Create a pattern of your own. After writing the pattern in the blanks, say what you added or subtracted each time:

   _____ , _____ , _____ , _____ , _____   My rule: _____

4. Which one of the following sequences was made by adding 7? Circle it:
   HINT: Check all the numbers in the sequence.

   a) 4, 10, 18, 21   b) 4, 11, 16, 21   c) 3, 10, 17, 24

5.   **72, 61, 50, 39, 28 ...**

   Brenda says this sequence was made by subtracting 12 each time.
   Sanjukta says it was made by subtracting 11.
   Who is right?

   _____

   _____

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PA6-4: Identifying Pattern Rules

1. What number was added to make the sequence?

   a) 12, 17, 22, 27   add ____   b) 32, 35, 38, 41   add ____

   c) 28, 34, 40, 46   add ____   d) 50, 57, 64, 71   add ____

   e) 101, 106, 111, 116   add ____   f) 269, 272, 275, 278   add ____

2. What number was subtracted to make the sequence?

   a) 58, 56, 54, 52   subtract ____   b) 75, 70, 65, 60   subtract ____

   c) 320, 319, 318, 317   subtract ____   d) 191, 188, 185, 182   subtract ____

   e) 467, 461, 455, 449   subtract ____   f) 939, 937, 935, 933   subtract ____

3. State the rules for the following patterns:

   a) 419, 412, 405, 398, 391   subtract ____   b) 311, 319, 327, 335, 343, 351   add ____

   c) 501, 505, 509, 513   _____   d) 210, 199, 188, 177,   _____

   e) 653, 642, 631, 620, 609   _____   f) 721, 730, 739, 748, 757, 766 _____

   g) 807, 815, 823, 831   _____   h) 1731, 1725, 1719, 1713,   _____

4. Use the first three numbers in the pattern to find the rule. Then fill in the blanks:

   a) 52, 57, 62, __67__, _____, _____   The rule is: ___Start at 52 and add 5_____

   b) 78, 75, 72, _____, _____, _____   The rule is: _____

   c) 824, 836, 848, _____, _____, _____   The rule is: _____

   d) 1 328, 1 319, 1 310, _____, _____, _____   The rule is: _____

5.   **5, 11, 17, 23, 29 ...**

   Tim says the pattern rule is: "Start at 5 and subtract 6 each time."

   Jack says the rule is: "Add 5 each time."

   Hannah says the rule is: "Start at 5 and add 6 each time."

   a) Whose rule is correct? _____

   b) What mistakes did the others make? _____

   _____

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PA6-5: Introduction to T-tables

Claude creates an **increasing pattern** with squares. He records the number of squares in each figure in a chart or T-table. He also records the number of squares he adds each time he makes a new figure:

Figure 1   **Figure 2**   **Figure 3**
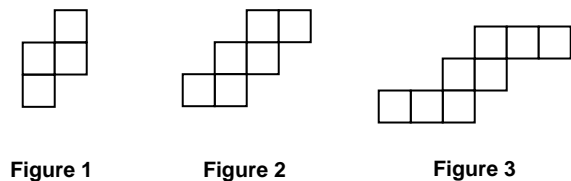
Figure	# of Squares
1	4
2	6
3	8

2 ← Number of squares
2 ← added each time

The number of squares in the figures are 4, 6, 8, …

Claude writes a rule for this number pattern:

RULE: Start at 4 and add 2 each time.

---

1. Claude makes other increasing patterns with squares.

   How many squares does he add to make each new figure?

   Write your answer in the circles provided. Then write a rule for the pattern:

a)

Figure	Number of Squares
1	2
2	8
3	14

Rule:

b)

Figure	Number of Squares
1	3
2	9
3	15

Rule:

c)

Figure	Number of Squares
1	1
2	6
3	11

Rule:

d)

Figure	Number of Squares
1	1
2	8
3	15

Rule:

e)

Figure	Number of Squares
1	5
2	13
3	21

Rule:

f)

Figure	Number of Squares
1	11
2	22
3	33

Rule:

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g)

Figure	Number of Squares
1	3
2	12
3	21

Rule:

h)

Figure	Number of Squares
1	6
2	13
3	20

Rule:

i)

Figure	Number of Squares
1	7
2	13
3	19

Rule:

2. Extend the number pattern. How many squares would be used in Figure 6?

a)

Figure	Number of Squares
1	2
2	10
3	18

b)

Figure	Number of Squares
1	4
2	9
3	14

c)

Figure	Number of Squares
1	7
2	11
3	15

3. After making Figure 3, Claude only has 35 squares left. Does he have enough squares to complete Figure 4?

a)

Figure	Number of Squares
1	4
2	13
3	22

YES   NO

b)

Figure	Number of Squares
1	6
2	17
3	28

YES   NO

c)

Figure	Number of Squares
1	9
2	17
3	25

YES   NO

4. In your notebook, make a T-table to show how many shapes will be needed to make the fifth figure in each pattern:

a)

b)

PA6-6: T-tables

1. Count the number of line segments (lines that join pairs of dots) in each set of figures by marking each line segment as you count, as shown in the example:
    HINT: Count around the outside of the figure first.

    Example:

    a) _____   b) _____   c) _____

2. Continue the pattern below, then complete the chart:
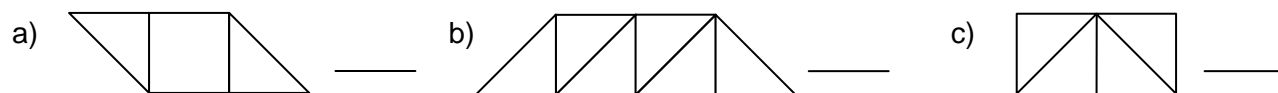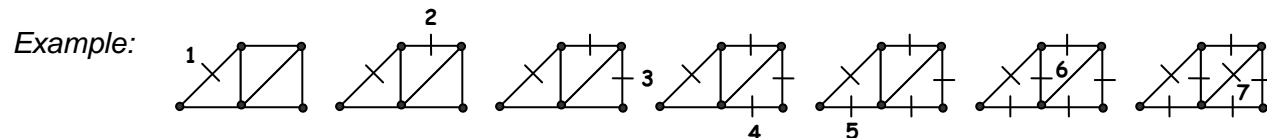
    Figure 1
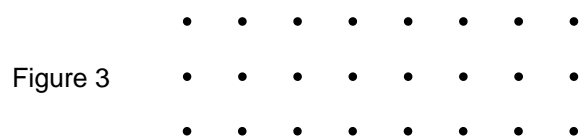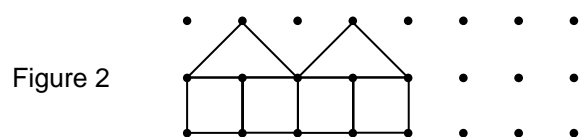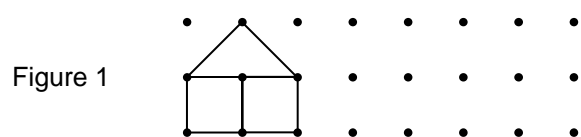
    Figure 2

    Figure 3

Figure	Number of Line Segments
1	
2	
3	

    a) How many line segments would Figure 4 have? _____

    b) How many line segments would you need to make a figure with 5 triangles? _____

3. Continue the pattern below, then complete the chart:

    Figure 1

    Figure 2
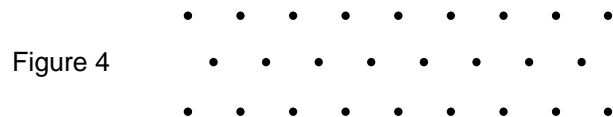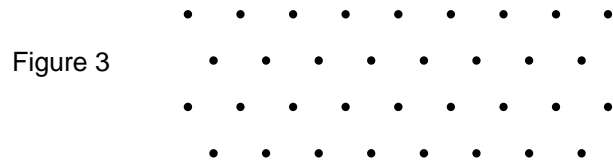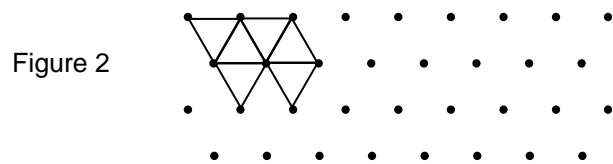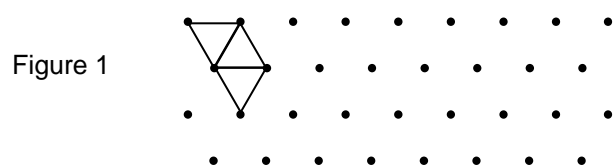
    Figure 3

    Figure 4

Figure	Number of Triangles	Number of Line Segments

    a) How many line segments would Figure 5 have? _____

    b) How many triangles would Figure 6 have?

        _____

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4. The snow is 17 cm deep at 5 pm.
   4 cm of snow falls each hour.
   How deep is the snow at 9 pm?

Hour	Depth of Snow
5 pm	17 cm

5. Philip has $42 in savings by the end of July. Each month he saves $9. How much will he have by the end of October?

Month	Savings
July	$42

6. Sarah's fish tank is leaking.
   At 6 pm, there are 21 L of water in the tank.
   At 7 pm, there are 18 L and at 8 pm, there are 15 L.
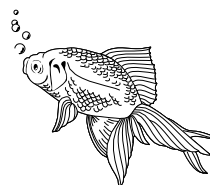
   a) How many litres of water leak out each hour?

   _____

   b) How many litres will be left in the tank at 10 pm?

   _____

   c) How many hours will it take for all the water to leak out?

   _____

Hour	Amount of water in the tank
6 pm	21 L
7 pm	18 L
8 pm	15 L
9 pm	
10 pm	

7. A store rents snowboards at $7 for the first hour and $5 for every hour after that.
   How much does it cost to rent a snowboard for 6 hours?

8. a) How many triangles would April need to make a figure with 10 squares?
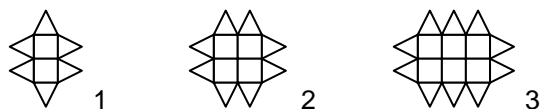
   b) April says that she needs 15 triangles to make the sixth figure. Is she correct?

9. Merle saves $55 in August. She saves $6 each month after that.
   Alex saves $42 in August. He saves $7 each month after that.
   Who has saved the most money by the end of January?

PA6-7: T-tables (Advanced)

The **terms** of a sequence are the numbers or items in the sequence.

A **term number** gives the position of each item.

*This is **term number 4** since it is in the fourth position.*

↓

4, 7, 10, 13, 16

---

1. Draw a T-table for each sequence to find the given term:

   a) Find the 5th term: 3, 8, 13, 18, …   b) Find the 7th term: 42, 46, 50, 54,…

2. Ben says that the 6th term of the sequence 7, 13, 19,… is 53. Is he correct? Explain.

3. Find the missing terms in each sequence.

   a) 8, 12, _____, 20   b) 11, _____, _____, 26

   c) 15, _____, _____, 24, _____   d) 59, _____, _____, _____, 71

4.

Term Number	Term
1	13
2	15
3	18
4	19
5	21

Term Number	Term
1	25
2	30
3	34
4	37
5	41

Each T-Table was made by adding a number repeatedly.

Find and correct any mistakes in the tables.

5. Rita made an ornament using a hexagon (shaded figure), pentagons (dotted) and triangles.

   a) How many pentagons does she need to make 7 ornaments?

   b) Rita used 6 hexagons to make ornaments.
      How many triangles and pentagons did she use?

   c) Rita used 36 pentagons. How many triangles did she use?
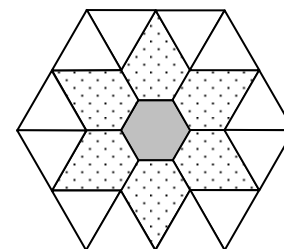
6. A newborn Siberian Tiger cub weighs 1 300 g. It gains 100 g a day.
   A newborn baby weighs 3 300 g. It gains 200 g every week.

   a) A cub and a baby are born on the same day. Who weighs more after…

      i) 2 weeks?   ii) 6 weeks?

   b) After how many weeks would the cub and the baby have the same weight?

Patterns & Algebra 1
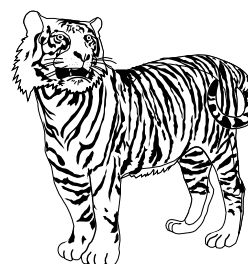
PA6-8: Repeating Patterns

Gene makes a **repeating pattern** using blocks:

△ □ △ △ □ △ △ □ △

This is the core of Gene's pattern.

The **core** of a pattern is the part that repeats.

- -

1. Circle the core of the following patterns. The first one is done for you:

    a) ✦ □ ✦ ○ ✦ □ ✦ ○

    b) □ ○ ○ ○ □ ○ ○ ○

    c) △ ▽ □ □ △ ▽ □ □

    d) △ □ ▽ △ △ □ ▽ △ △ □
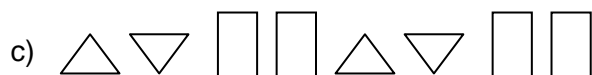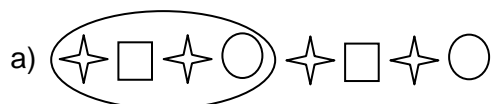
    e) Z G H H U Z G H H U Z

    f) 1 2 4 8 1 2 4 8 1 2 4 8 1 2 4

    g) 9 3 3 9 8 9 3 3 9 8 9

    h) △ ✚ ✚ ○ △ △ ✚ ✚ ○ △

    i) ▼ △ ▽ ▼ ▼ △ ▽ ▼

    j) Z Y Z Z Y Z Z Y Z

2. Circle the core of the pattern. Then continue the pattern:

    a) △ □ □ △ □ □ △ ____ ____ ____ ____ ____

    b) ◎ △ ◎ ◎ △ ◎ ___ ___ ___ ___ ___ ___
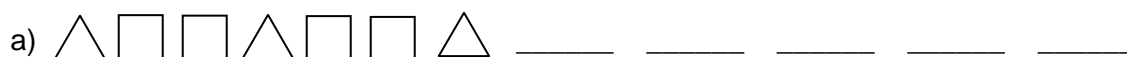
    c) 4 5 4 6 1 4 5 4 6 1 ___ ___ ___ ___ ___ ___

    d) 2 2 0 2 2 0 2 2 0 2 ___ ___ ___ ___ ___ ___

    e) A A C A A C A ___ ___ ___ ___ ___ ___

    f) 2 6 2 2 6 2 2 6 2 2 6 ___ ___ ___ ___ ___ ___

3. Draw your own repeating pattern in the space below:

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PA6-9: Extending Patterns & Predicting Positions

1. Angela makes a repeating pattern using blue (**B**) and yellow (**Y**) blocks.

    The box shows the core of her pattern. Continue the pattern by writing Bs and Ys:

    a) | Y | B | Y | | | | | | | | | | |

    b) | Y | B | B | Y | | | | | | | | |

2. Joseph tried to continue the pattern in a box. Did he continue the pattern correctly?
    HINT: Shade the yellows (Y) if it helps.

    a) | Y | R | Y | R | Y | R | YES   NO

    b) | Y | R | R | Y | R | R | Y | R | R | YES   NO

    c) | Y | R | Y | Y | R | Y | Y | R | Y | YES   NO

    d) | R | Y | R | R | Y | R | R | Y | Y | YES   NO

    e) | Y | R | R | Y | Y | Y | R | Y | R | R | YES   NO

    f) | Y | Y | R | Y | Y | Y | R | Y | YES   NO

3. For each pattern below, say whether the blocks in the rectangle are the <u>core</u> of the pattern.

    a) | R | Y | R | Y | R | Y |

    b) | R | Y | R | R | Y | R | R | Y | R | R |

    YES   NO   YES   NO

    c) | R | Y | Y | R | R | Y | Y | R | R |

    d) | Y | R | R | Y | Y | R | R | Y | Y | R | R | Y |

    YES   NO   YES   NO

    e) | Y | R | Y | Y | Y | Y | R | Y | Y | Y | Y | R |

    f) | R | Y | R | Y | Y | R | Y | R | Y | Y |

    YES   NO   YES   NO

4.   Draw a rectangle around the core of the pattern:

    a)

    b)

    c) | → | → | ↑ | ← | → | → | ↑ | ← | → | → | ↑ |

    d) | ○ | △ | △ | ○ | ○ | △ | △ | ○ |

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Sally wants to predict the colour of the 17th block in the pattern. First she finds the core of the pattern.

| R | R | Y | R | R | Y | R | R | Y | R | R | Y |

The core is 3 blocks long. Sally marks every <u>third</u> number on a hundreds chart.

Each X shows the position of a block where the core ends:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16 R	17 R	18 Y	19	20

The core ends on the 15th block.
Sally writes the letters of the core on the chart, starting at 16.
The 17th block is red.

---

5. In the patterns below, put a rectangle around the blocks that make up the core.

a) | Y | Y | B | Y | Y | B | Y | Y | B |

b) | Y | B | Y | Y | Y | B | Y | Y | Y |

c) | B | Y | Y | B | B | Y | Y | B | B | Y | Y |

d) | B | B | Y | B | B | B | Y | B |

e) | Y | B | B | B | Y | B | Y | B | B | B | Y | B |

f) | B | Y | B | B | B | Y | B | B | B | Y |

6. Predict the colour of the 19th block using the chart below:
NOTE: Start by finding the core of the pattern.

| B | B | Y | Y | B | B | Y | Y |

Colour: _____

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

7. Predict the colour of the 18th block using the chart below:

| B | R | R | Y | B | R | R | Y | B |

Colour: _____

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

8. Predict the colour of the 16th block using the chart below:

| B | R | B | Y | R | B | R | B | Y | R |

Colour: _____

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

jump math
MULTIPLYING POTENTIAL

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9. Draw a box around the core of the pattern and predict the colour of the 29th block using the chart below:

Y	B	R	Y	B	R	Y	B

Colour: _____

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

TEACHER: Your students will need a copy of a hundreds chart from the Teacher's Guide.

10.

  Megan made a pattern with 37 stickers between her bed and her window.
  The two suns are next to her bed. Which sticker is next to her window?

11. Design a repeating pattern that uses
   four colours and has a core that is
   ten squares long:

  What is the colour of the 97th square? How do you know?

12. a) What is the 15th coin in this pattern? Explain how you know.

   b) What is the total value of the first 20 coins?

BONUS
13.

| Red | Gold | Silver | Red | Gold | Silver | Red | Gold |
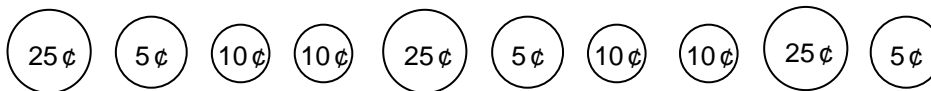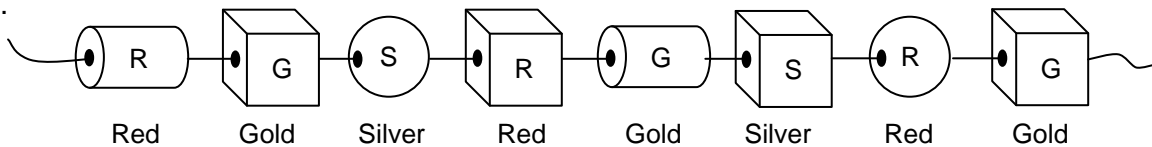
  Describe the 25th bead in this Christmas tree decoration.

14. For each pattern below, draw a picture of what the 52nd column would look like in the box provided:
   HINT: Look at the patterns in each row separately.

   a)

   b)

PA6-10: Number Lines

Jacqui is on a bicycle tour 300 km from home. She can cycle 75 km each day.

If she starts riding towards home on Tuesday morning,
how far away from home will she be by Thursday evening?

|0 25 50 75 100 125 150 175 200 225 250 275 300|

Home   **Start**
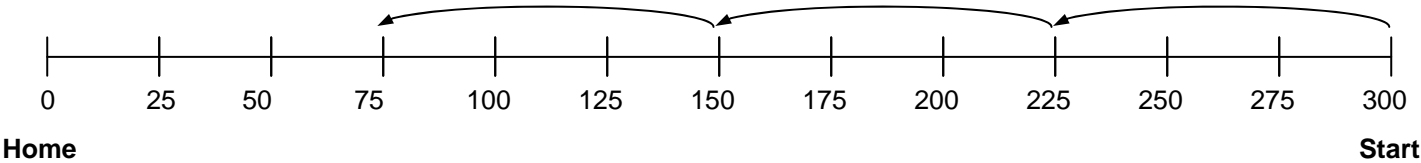
On Thursday evening, she will be 75 km from home.

- -

1. On Wednesday morning Blair's campsite is 18 km from Tea Lake.
   He plans to hike 5 km towards the lake each day.

   How far from the lake will he be on Friday evening? _____

   |0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20|
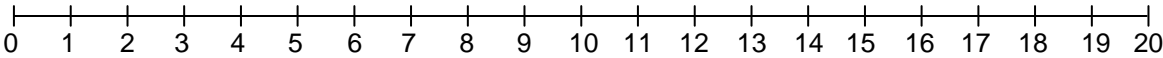
2. On Saturday morning, Samantha is 400 km from her home.
   She can cycle 75 km each day.

   How far from home will she be on Tuesday evening? _____

   |0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400|
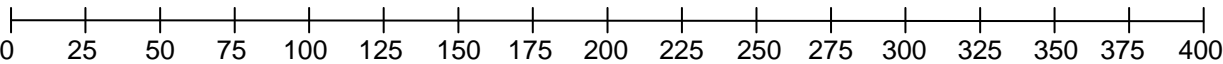
Draw and label a number line in the grid to solve the problem.

3. 15 L of water drains out of a 90 L tank each minute.

   How much water will be left after 5 minutes?

   0   5   10   15   20   25
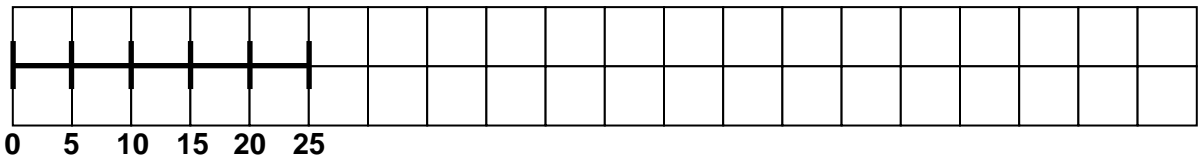
4. Brenda is 70 km from home.

   She can cycle towards home 15 km an hour.

   How far from home will she be in 3 hours?

jump math
MULTIPLYING POTENTIAL

Patterns & Algebra 1

5. A grade six class is on a field trip 250 km from home.

    Their bus travels at a speed of 75 km each hour.

    How far from home will they be after 3 hours?
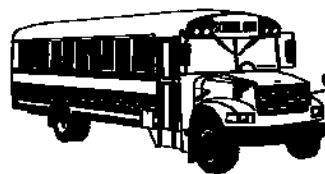
6. Paul plants 5 trees in a row.

    The nearest tree is 5 metres from his house. The farthest tree is 17 metres from his house.

    The trees are equally spaced.

    How far apart are the trees?

    HINT: Put Paul's house at zero on the number line.

7. Michael's house is 18 metres from the ocean.

    He is sleeping in a chair 3 metres away from his house (toward the ocean).

    The tide rises 5 metres every hour. How long will it take before his feet get wet?

8. Robert's bookcase has 5 shelves.

    The top shelf is 150 cm above the floor and the bottom shelf is 30 cm above the floor.

    How far apart are the shelves?

9. Aaron is training for football.

    He runs 5 metres forward and 2 metres back every 4 seconds.

    How far from where he started will he be after 16 seconds?

Patterns & Algebra 1
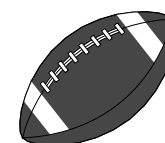
PA6-11: Lowest Common Multiples

The multiples of 2 and 3 are marked with Xs on the number lines below:

multiples of 2:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

multiples of 3:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
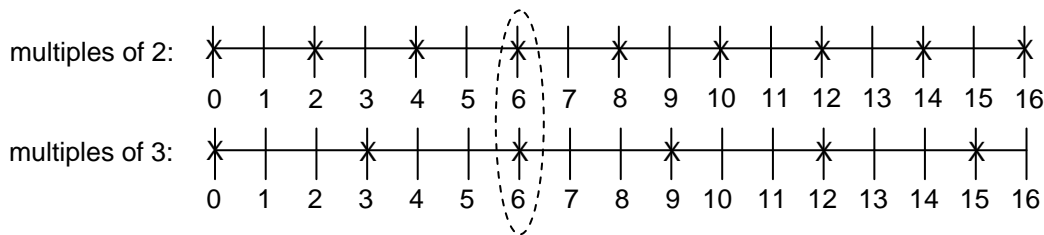
> 0 is a multiple of **every** number

The **lowest common multiple** (**LCM**) of 2 and 3 is 6: 6 is the least non-zero number that 2 and 3 **both** divide into evenly.

----

1. Mark the multiples of the given numbers on the number lines. What is the lowest common multiple of the pair?

a)

3: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

4: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 **LCM = _____**

X

b)

4: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

6: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 **LCM = _____**
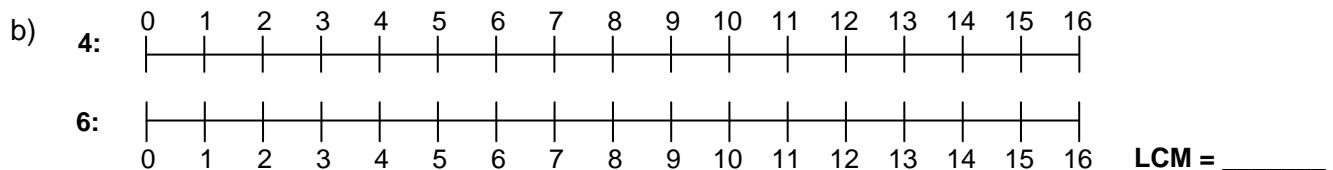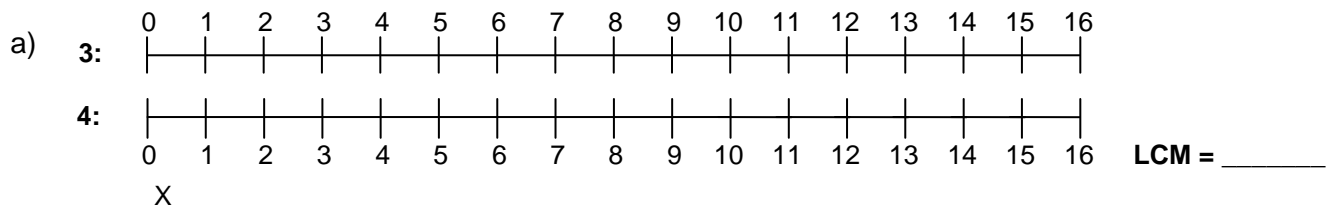
2. Find the lowest common multiple of each pair of numbers. The first one has been done for you:
   HINT: Count up by the largest number until you find a number that both numbers divide into with no remainder.

a) 3 and 5	b) 4 and 10	c) 3 and 9	d) 2 and 6
3: 3, 6, 9, 12, **15**, 18			
5: 5, 10, **15**, 20			
LCM = __15__	LCM = _____	LCM = _____	LCM = _____

e) 2 and 10   f) 3 and 6   g) 3 and 12   h) 4 and 8   i)   8 and 10

j)   5 and 15   k) 6 and 10   l)   3 and 10   m) 6 and 8   n) 6 and 9

3. Paul visits the library every <u>fourth</u> day in January (beginning on January 4th).
   Werda visits every <u>sixth</u> day (beginning on January 6th).
   Nigel visits every <u>8th</u> day (beginning on January 8th).

   On what day of the month will they all visit the library together?

Patterns & Algebra 1

PA6-12: Describing and Creating Patterns

In the first sequence, each number is greater than the one before it.
The sequence is always **increasing**:   7   8   10   15   21

In the second sequence, each number is less than the one before it.
The sequence is always **decreasing**:   25   23   18   11   8

----

1. Find the amount by which the sequence <u>increases</u> or <u>decreases</u>. Write a number in the circle, with a
    + sign if the sequence increases, and a **–** sign if it decreases. The first one has been done for you:

a) (+4) (– 2) (+7) (– 4)
    3 , 7 , 5 , 12 , 8

b) ◯ ◯ ◯ ◯
    1 , 5 , 4 , 8 , 3

c) ◯ ◯ ◯ ◯
    2 , 6 , 9 , 19 , 25

d) ◯ ◯ ◯ ◯
    4 , 8 , 7 , 1 , 10

e) ◯ ◯ ◯ ◯
    4 , 6 , 8 , 7 , 12

f) ◯ ◯ ◯ ◯
    17 , 16 , 19 , 10 , 11

g) ◯ ◯ ◯ ◯
    27 , 20 , 25 , 19 , 13

h) ◯ ◯ ◯ ◯
    58 , 61 , 54 , 62 , 57

2. Match each sequence with the sentence that describes it. This sequence ....

a) **A**   ... increases by 5 each time.
    B   ... increases by different amounts.

    ____   9 , 13 , 19 , 23 , 25

    ____   8 , 13 , 18 , 23 , 28

b) **A**   ... decreases by different amounts.
    B   ... decreases by the same amount.

    ____   21 , 20 , 18 , 15 , 11

    ____   13 , 10 , 7 , 4 , 1

BONUS

c) **A**   ... increases by 5 each time.
    B   ... decreases by different amounts.
    C   ... increases by different amounts.

    ____   18 , 23 , 29 , 33 , 35

    ____   27 , 24 , 20 , 19 , 16

    ____   24 , 29 , 34 , 39 , 44

d) **A**   ... increases and decreases.
    B   ... increases by the same amount.
    C   ... decreases by different amounts.
    D   ... decreases by the same amount.

    ____   31 , 29 , 25 , 13 , 9

    ____   10 , 14 , 9 , 6 , 5

    ____   18 , 16 , 14 , 12 , 10

    ____   8 , 11 , 14 , 17 , 20

Patterns & Algebra 1

3. Write a rule for each pattern (use the words <u>add</u> or <u>subtract</u>, and say what number the pattern starts with):

a)   4 , 7 , 10 , 13   _Start at 4 and add 3._____

b)   23 , 29 , 35 , 41   _____

c)   28 , 25 , 22 , 19   _____

d)   53 , 48 , 43 , 38   _____

4. Write a rule for each pattern:
   NOTE: One sequence doesn't have a rule – see if you can find this sequence.

a) 9 , 14 , 19 , 24   _____

b) 27 , 19 , 11 , 3   _____

c) 39 , 31 , 27 , 14 , 9   _____

d) 81 , 85 , 89 , 93   _____

5. Describe each pattern as <u>increasing</u>, <u>decreasing</u> or <u>repeating</u>:

a) 1 , 3 , 6 , 9 , 12 , 15   _____   b) 2 , 8 , 9 , 2 , 8 , 9   _____

c) 29 , 27 , 25 , 23 , 22   _____   d) 2 , 6 , 10 , 14 , 17   _____

e) 3 , 9 , 4 , 3 , 9 , 4   _____   f)   61 , 56 , 51 , 46 , 41   _____

6. Write the first five terms in the pattern:
   a) Start at 38 and add 4.   b) Start at 67 and subtract 6.   c) Start at 98 and add 7.

7. Create an increasing number pattern. Write the rule for your pattern.
   Do the same for a decreasing number pattern.

8. Create a repeating pattern using: a) letters   b) shapes   c) numbers

9. Create a pattern and ask a friend to find the rule for your pattern.

PA6-13: 2-Dimensional Patterns

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TEACHER: Review ordinal numbers before beginning this page.
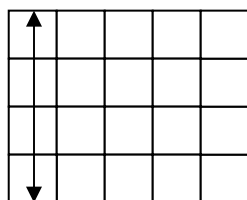
Columns run up and down.
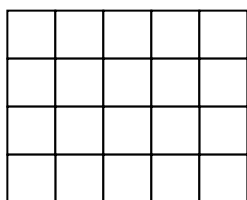
Columns are numbered left to right (in this exercise).
1st 2nd 3rd 4th 5th

Rows run sideways.

1st
2nd
3rd
4th
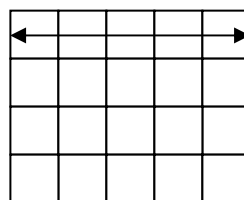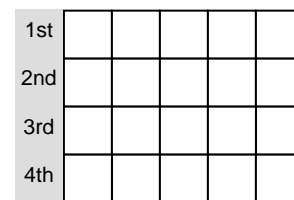
Rows are numbered from top to bottom (in this exercise).

---

1. Shade ...

    a)
2	6	10
10	14	18
18	22	26

    the 2nd row

    b)
2	6	10
10	14	18
18	22	26

    the 1st column

    c)
2	6	10
10	14	18
18	22	26

    the 3rd column

    d)
2	6	10
10	14	18
18	22	26

    the diagonals
    (one is shaded here)

2. Describe the pattern in the numbers you see in each chart below:
    NOTE: You should use the words "rows", "columns", and "diagonals" in your answer.

    a)
1	3	5
5	7	9
9	11	13

    b)
6	12	18	24
12	18	24	30
18	24	30	36
24	30	36	42

    c)
16	20	24	28
12	16	20	24
8	12	16	20
4	8	12	16

3. Make up your own pattern and describe it:

4. Place the letters X and Y so that each row and each column has two Xs and two Ys in it:

5. a) Which row of the chart has a decreasing pattern (looking left to right)?

    b) Which column has a repeating pattern?

    c) Write pattern rules for the first and second column.

    d) Describe the relationship between the numbers in the third and fourth columns.

    e) Describe one other pattern in the chart.

    f) Name a row or column that does not appear to have any pattern.

0	4	8	6	2
5	6	7	5	9
10	8	6	4	2
15	10	5	3	9
20	12	4	2	2

PA6-14: Extensions

1. In a magic square, the numbers in each row, column, and diagonal all add up to the same number (the "magic number" for the square):

   What is the magic number for this square? _____

2	9	4
7	5	3
6	1	8

2. Complete the magic squares:

   a)
2		6
9	5	
4	3	

   b)
	9	
10	5	12

   c)
		10
	12	
14		18

3. Here are some number pyramids:

5
2	3

2
1	1

9
6	3

   | 12 |
   | 5 | 7 |
   | 2 | 3 | 4 |

   Can you find the rule by which the patterns in the pyramids were made? Describe it here:

   _____

4. Using the rule you described in Question 3, find the missing numbers:

   a)
2	4

   b)
1	7

   c)
9	2

   d)
7	
4	

   e)
10	
	6

   f)
2	3	5

   g)
   | 10 | |
   | 6 | | 3 |

   h)
   | 15 |
   | 7 | |
   | 2 | | |

   i)
	19	
17		10

   j)
11	3	15

   k)
35		
		24
	8		16

   l)
29		
		32
	4		24

   m)
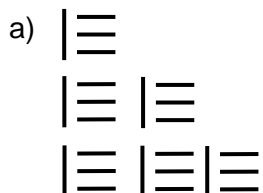 | 73 | | |
   | | | 27 |
   | | 8 | | 20 |

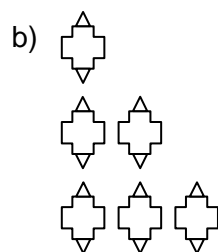# PA6-16: Finding Rules for Patterns – Part I

1. Complete the T-table for each pattern.

    Then write a rule that tells you how to calculate the second number from the first number.

a)

Number of Vertical Lines	Number of Horizontal Lines

Rule:

b)

Number of Crosses	Number of Triangles

Rule:

c)
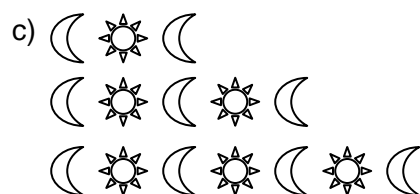
Number of Suns	Number of Moons

Rule:

d)
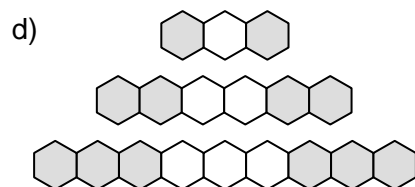
Number of Light Hexagons	Number of Dark Hexagons

Rule:

e)

Number of Diamonds	Number of Stars

Rule:

2. Make a T-table and write a rule for the number of hexagons and triangles:

    Figure 1   **Figure 2**   **Figure 3**
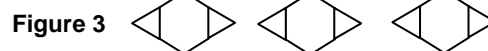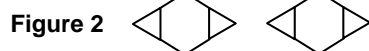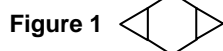
3. How many triangles are needed for 9 hexagons in the pattern in Question 2? How do you know?

Patterns & Algebra 1

PA6-17: Direct Variation

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Fill in the chart and write a rule for the number of blocks in each figure, as shown in part a).

1. a)

Figure 1   **Figure 2**   **Figure 3**
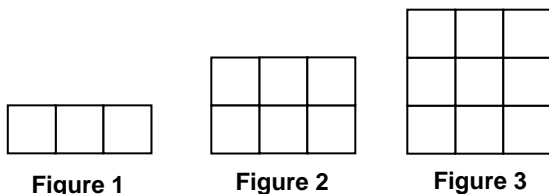
Rule: __3 × Figure Number_____

Figure Number	Number of Blocks
1	
2	
3	

b)
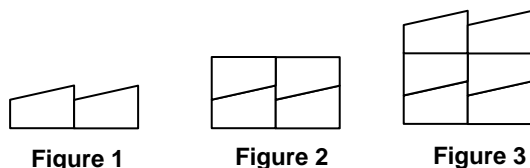
Figure 1   **Figure 2**   **Figure 3**

Rule: _____

Figure Number	Number of Blocks

c)

Figure 1   **Figure 2**   **Figure 3**

Rule: _____

Figure Number	Number of Blocks

d)

Figure 1   **Figure 2**   **Figure 3**
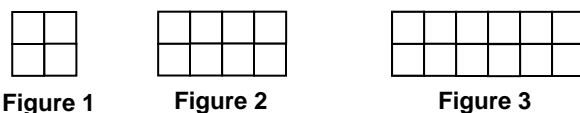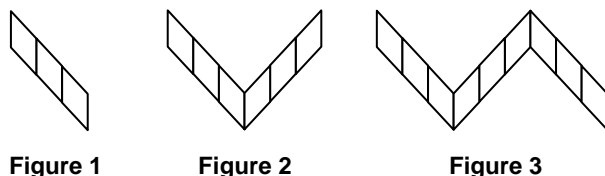
Rule: _____

Figure Number	Number of Blocks

> In each example above, you can find the **total number of blocks** by *multiplying* the **Figure Number** by the **number of blocks in the first figure**.
> In such cases, **the number of blocks** is said to vary <u>directly</u> with the <u>Figure Number</u>.

2. Circle the sequences where the number of blocks varies <u>directly</u> with the Figure Number:

a)
Figure Number	Number of Blocks
1	3
2	6
3	9

b)
Figure Number	Number of Blocks
1	4
2	7
3	10

c)
Figure Number	Number of Blocks
1	6
2	12
3	18

d)
Figure Number	Number of Blocks
1	5
2	10
3	16

Patterns & Algebra 1

PA6-19: Predicting the Gap Between Terms in a Pattern

1. Fill in the chart using the rule.

   a) Rule: <u>Multiply by 4 and add 3</u>

INPUT	OUTPUT
1	
2	
3	

   Gap: _____

   b) Rule: <u>Multiply by 2 and add 3</u>

INPUT	OUTPUT
1	
2	
3	

   Gap: _____

   c) Rule: <u>Multiply by 5 and add 4</u>

INPUT	OUTPUT
1	
2	
3	

   Gap: _____

   d) Rule: <u>Multiply by 10 and add 1</u>

INPUT	OUTPUT
1	
2	
3	

   Gap: _____

   e) Compare the **gap** in each pattern above to the rule for the pattern. What do you notice?

   _____

   _____

2. For each pattern below, make a T-table as shown.

   Fill in the total number of blocks (shaded and unshaded) and the gap.

   Can you predict what the gap will be for each pattern before you fill in the chart?
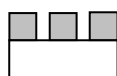
Figure Number	Number of Blocks
1	
2	
3	

   Figure 1

   Figure 2
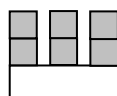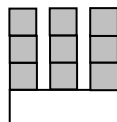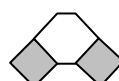
   Figure 3
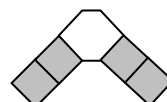
   Figure 1

   Figure 2

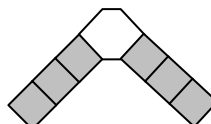   **Figure 3**

   Figure 1

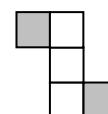   **Figure 2**

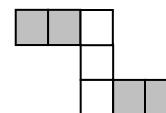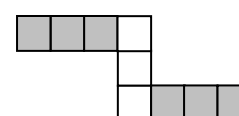   **Figure 3**

   Can you write a rule for each pattern that tells how to find the number of blocks from the figure number?

Patterns & Algebra 1

PA6-20: Finding Rules for T-tables – Part II

In the T-table shown here, the output is calculated from the input by two operations:

To find the rule:

INPUT	OUTPUT
1	5
2	8
3	11

Step 1:
Find the step (or gap) between the numbers in the OUTPUT column.

INPUT	INPUT x GAP	OUTPUT
1		5
2		8
3		11

3
3

Step 2:
Multiply the INPUT numbers by the gap.

INPUT	INPUT x GAP	OUTPUT
1	3	5
2	6	8
3	9	11

3
3

Step 3:
What must you add to each number in the second column?

INPUT	INPUT x GAP	OUTPUT
1	3	5
2	6	8
3	9	11

3
3

Add 2

Step 4:
Write a rule for the T-table – **Rule:** _Multiply the input by 3 and add 2_

----

1. Use the steps above to find the rule that tells you how to calculate the OUTPUT from the INPUT:

a)

INPUT	INPUT x GAP	OUTPUT
1		9
2		13
3		17

Add _____

Rule: Multiply by _____ then add _____.

b)

INPUT	INPUT x GAP	OUTPUT
1		3
2		5
3		7

Add _____

Rule: Multiply by _____ then add _____.

c)

INPUT	INPUT x GAP	OUTPUT
1		7
2		10
3		13

Add _____

Rule: Multiply by _____ then add _____.

d)

INPUT	INPUT x GAP	OUTPUT
1		6
2		8
3		10

Add _____

Rule: Multiply by _____ then add _____.

jump math
MULTIPLYING POTENTIAL

Patterns & Algebra 1

2. Write a rule that tells you how to calculate the OUTPUT from the INPUT:

a)

INPUT	INPUT x GAP	OUTPUT
1		9
2		14
3		19

Multiply by _____ then add _____.

b)

INPUT	INPUT x GAP	OUTPUT
1		12
2		18
3		24

Multiply by _____ then add _____.

c)

INPUT	INPUT x GAP	OUTPUT
1		6
2		10
3		14

Multiply by _____ then add _____.

d)

INPUT	INPUT x GAP	OUTPUT
1		6
2		11
3		16

Multiply by _____ then add _____.

3. Write the rule that tells you how to calculate the OUTPUT from the INPUT:
   NOTE: In this case you will have to subtract rather than add.

a)

INPUT	INPUT x GAP	OUTPUT
1		4
2		9
3		14

Multiply by _____ then subtract _____.

b)

INPUT	INPUT x GAP	OUTPUT
1		1
2		4
3		7

Multiply by _____ then subtract _____.

c)

INPUT	INPUT x GAP	OUTPUT
1		2
2		6
3		10

Multiply by _____ then subtract _____.
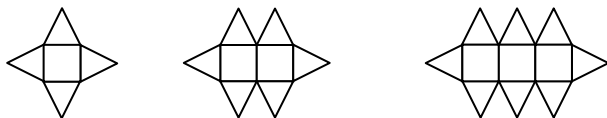
d)

INPUT	INPUT x GAP	OUTPUT
1		5
2		11
3		17

Multiply by _____ then subtract _____.

PA6-21: Applying Rules for Patterns

1. For each, draw Figure 4 and fill in the T-table.
   Then write a rule that tells you how to calculate the input from the output:
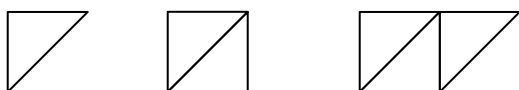
a)

1	2	3	4

Figure	Number of Triangles
1	
2	
3	
4	

Rule for T-table: _____

Use your rule to predict how many triangles will be needed for Figure 9: _____

b)

1	2	3	4

Figure	Number of Line Segments
1	
2	
3	
4	

Rule for T-table: _____

Use your rule to predict the number of line segments in Figure 11: _____

c)

1	2	3	4
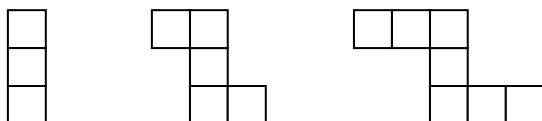
Figure	Number of Squares
1	
2	
3	
4	

Rule for T-table: _____

Use your rule to predict the number of squares needed for Figure 10: _____

d)

1	2	3	4
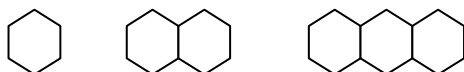
Figure	Perimeter
1	
2	
3	
4	

Rule for T-table: _____

Use your rule to predict the perimeter of Figure 23: _____