PA3-I3 Geometric Patterns

Ronin makes a growing or increasing pattern with squares. He creates a T-table to keep track of the number of squares.
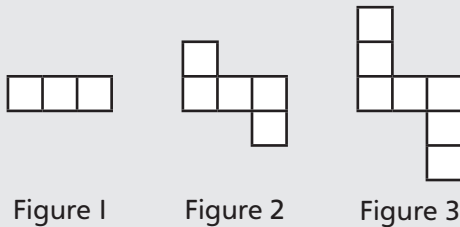
Figure I   Figure 2   Figure 3

Figure Number	Number of Squares
I	3
2	5
3	7

+2
+2
Add 2 squares each time

The number of squares in the figures makes a growing number pattern: 3, 5, 7.

The rule for the number pattern is "start at 3 and add 2 each time."

I. a) Fill in the T-table for the number of squares in each figure of the geometric pattern. Extend the number pattern.
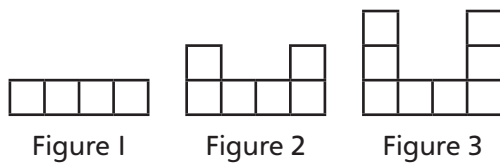
Pattern A

Figure I   Figure 2   Figure 3

Figure Number	Number of Squares
I	4
2	
3	
4	
5	

Pattern B

Figure I   Figure 2   Figure 3
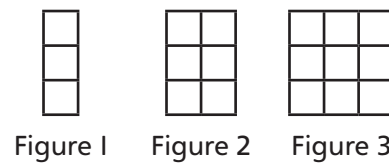
Figure Number	Number of Squares
I	
2	
3	
4	
5	

b) Write the number pattern and the rule for the number pattern.

A: Number pattern: _____

Rule: _____

_____

B: Number pattern: _____

Rule: _____

_____

c) Ronin has I4 squares. Can he make Figure 5 in each pattern?

A: _____

B: _____

2. a) Fill in the T-table for the number of squares in each figure of the decreasing geometric pattern.
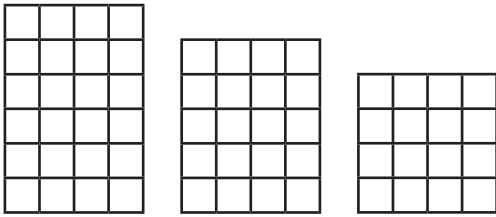
Pattern A

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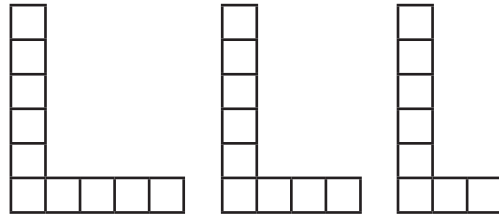
Figure Number	Number of Squares
1	
2	
3	

Pattern B

Figure 1   Figure 2   Figure 3

Figure Number	Number of Squares
1	
2	
3	

b) Write the number pattern and the rule for the number pattern.

A: Number pattern: _____   B: Number pattern: _____

    Rule: _____   Rule: _____

    _____   _____

c) How many squares will be in the next figures of the pattern?

A: Figure 4: _____ squares   B: Figure 4: _____ squares

    Figure 5: _____ squares   Figure 5: _____ squares

    Figure 6: _____ squares   Figure 6: _____ squares

3. Which number do you add or subtract each time? Write the rule for the number pattern.

a) 10 , 8 , 6 , 4 , 2

    Start at _____

    _____

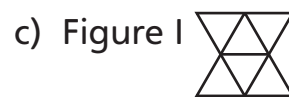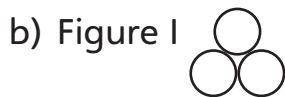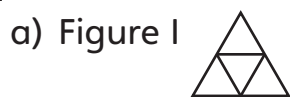b) 2 , 5 , 8 , 11 , 14

    Start at _____

    _____

4. Write the rule for the number pattern. On grid paper, sketch a pattern of squares that fits the number pattern. Check by writing a rule for the pattern of squares.

a) 3, 5, 7, 9, 11   b) 16, 13, 10, 7, 4   c) 1, 5, 9, 13, 17

        Patterns and Algebra 3-13

5. How many shapes are in Figure 6? How do you know?

a) Figure 1

Figure 2

Figure 3

b) Figure 1

Figure 2

Figure 3

c) Figure 1

Figure 2

Figure 3

6. Ella makes a pattern of long rectangles with toothpicks.
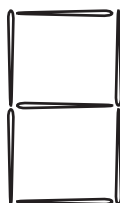
Step 1   Step 2   Step 3

a) Make a T-table for the number of toothpicks Ella needs at each step.
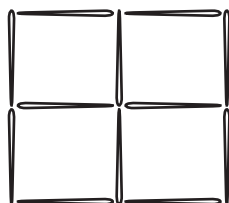
b) Ella has 20 toothpicks. How long is the longest rectangle she can make?

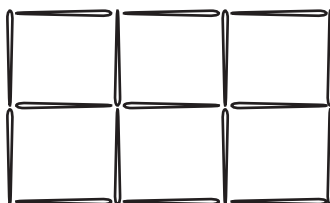**7.** Jack makes a pattern of rectangles with toothpicks.

Step 1   Step 2   Step 3

a) Make a T-table for the number of toothpicks Jack needs at each step.

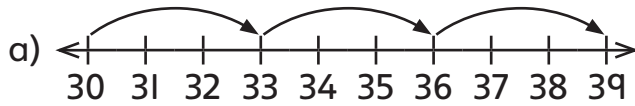b) Jack has 30 toothpicks. How long is the longest rectangle he can make?

BONUS ▶ Make a T-table for the perimeters of Jack's rectangles. What is the perimeter of the longest rectangle Jack can make using 30 toothpicks?

8. Sketch a growing or a shrinking geometric pattern on grid paper. Write the number pattern and the rule for the number pattern.
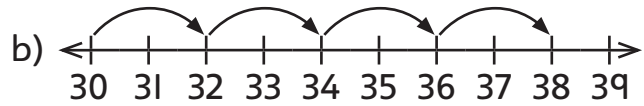
BONUS ▶ Describe your pattern. How many squares do you add or remove? How do you know where to do that?
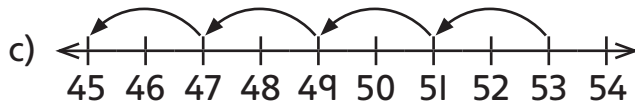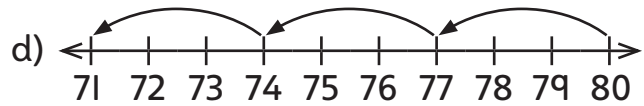
I. Write the number pattern the picture shows.

a)

30 3I 32 33 34 35 36 37 38 39

_30, 33, 36, 39_

b)

30 3I 32 33 34 35 36 37 38 39

_____

c)

45 46 47 48 49 50 5I 52 53 54

_53, 5I,_____

d)

7I 72 73 74 75 76 77 78 79 80

_____

2. Draw a dot at the start of the number pattern. Write a rule for the number pattern.

a)

30 3I 32 33 34 35 36 37 38 39
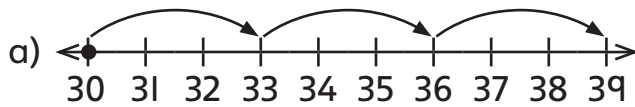
Start at 30. Add 3 each time.

_____

b)

60 6I 62 63 64 65 66 67 68 69

_____

_____

c)

40 50 60 70 80 90 I00 II0 I20

_____

_____

d)

I00 I05 II0 II5 I20 I25 I30 I35 I40

_____

_____

e)

520 525 530 535 540 545 550 555 560 565 570 575 580 585 590

_____

f)

700 705 7I0 7I5 720 725 730 735 740 745 750 755 760 765 770 775

_____

BONUS ▶

200 2I0 220 230 240 250 260 270 280 290 300 3I0 320 330 340 350

_____
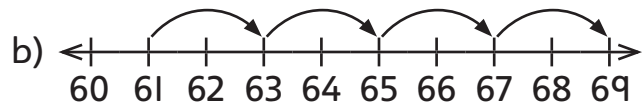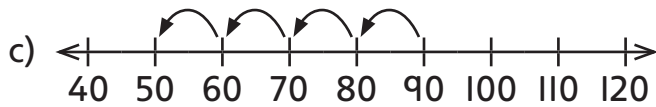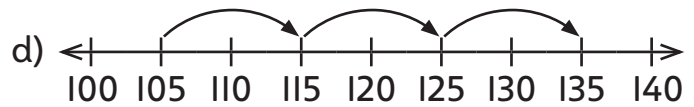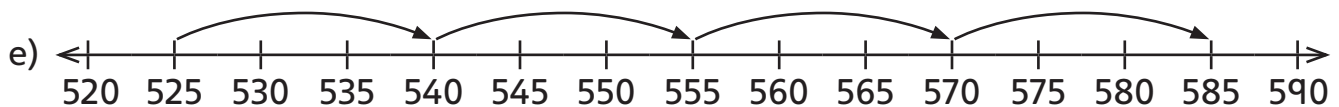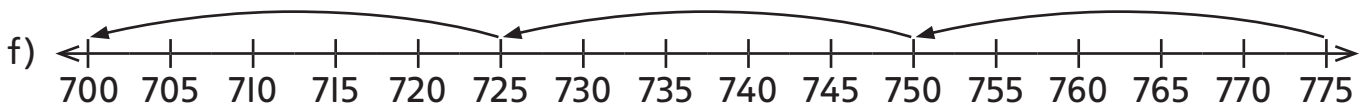
3. Draw dots and arrows to show the pattern on the number line.

a) 30, 32, 34, 36

30 31 32 33 34 35 36 37 38 39

b) 42, 45, 48, 51

42 43 44 45 46 47 48 49 50 51

c) 72, 69, 66, 63

63 64 65 66 67 68 69 70 71 72

d) 89, 87, 85, 83, 81

81 82 83 84 85 86 87 88 89 90
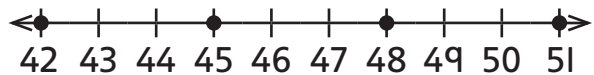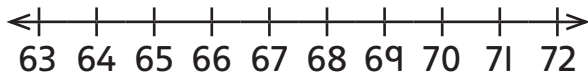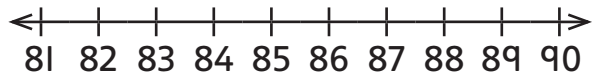
4. Write the first 4 numbers in the number pattern. Show the pattern on the number line.

a) Start at 31. Add 2 each time.

_____

30 31 32 33 34 35 36 37 38 39

b) Start at 90. Subtract 3 each time.

_____

81 82 83 84 85 86 87 88 89 90

c) Start at 105. Add 5 each time.

_____

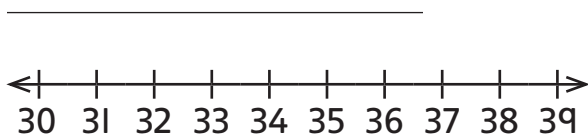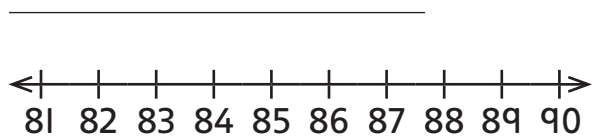100 105 110 115 120 125 130 135
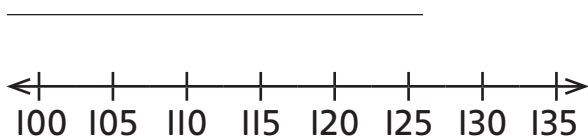
d) Start at 325. Subtract 5 each time.

_____

300 305 310 315 320 325 330 335
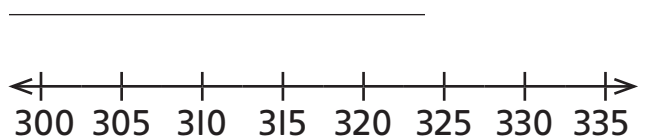
e) Start at 100. Subtract 4 each time. _____

85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
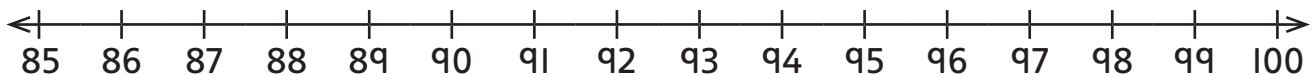
f) Start at 99. Subtract 5 each time. _____

84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99
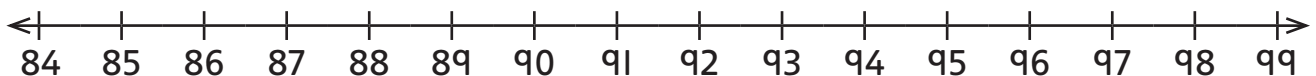
g) Start at 73. Subtract 5 each time. _____

58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73
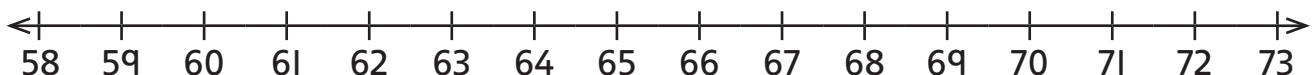
BONUS ▶ Nora writes several more numbers in the pattern for part g) and gets the number 38. Is she correct? _____

5. a) Draw an increasing pattern on the number line. Write a rule for the number pattern.

350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365
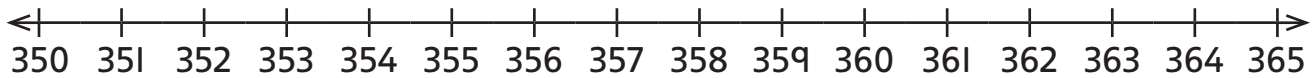
Rule: _____

b) Draw a decreasing pattern on the number line. Write a rule for the number pattern.

350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365

Rule: _____

6. a) Write a number pattern for the number of blocks in each figure.

Pattern A
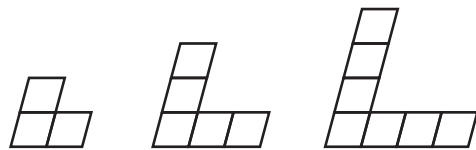
Figure 1   Figure 2   Figure 3

Number pattern: _____

Pattern B
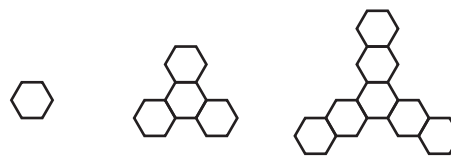
Figure 1   Figure 2   Figure 3

Number pattern: _____

b) Show the number pattern on the number line.

A:

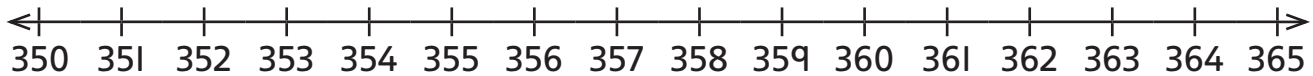1   2   3   4   5   6   7   8   9   10

B:

1   2   3   4   5   6   7   8   9   10
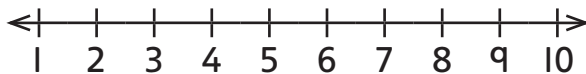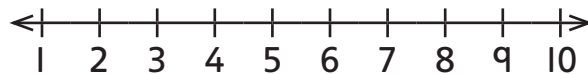
7. Show the pattern for the number of blocks in each figure on the number line. Use the number line to find how many blocks are in Figure 5.

Figure 1   Figure 2   Figure 3

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

Figure 5 will have _____ blocks.

PA3-I5 Patterns in Charts

I. **a)** Describe the number pattern in the shaded row.

Start at _____, add _____ each time.

b) Describe the number pattern in the shaded column.

_____

_____

c) Shade a row in the hundreds chart.

d) Describe the number pattern in the row you shaded.

_____

_____

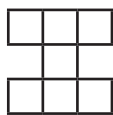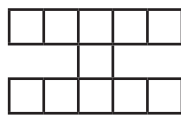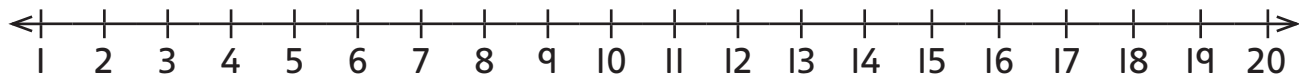| 1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

2. David shades two diagonal patterns of squares on a hundreds chart.

a) Describe the pattern in the light shaded squares. ▢

_____

_____

b) Describe the pattern in the dark shaded squares. ▩

_____

_____

c) Write nine multiples of 9. Start at 9 and add 9 each time.

_____

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
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

d) Circle the multiples of 9 on the hundreds chart.

e) Do the multiples of 9 appear in a row, in a column, or on a diagonal? _____

To count forwards by 5s starting at 4, start at 4 and add 5 each time.

$4 \overset{+5}{,} 9 \overset{+5}{,} 14 \overset{+5}{,} 19$

To count backwards by 5s starting at 36, start at 36 and subtract 5 each time.

$36 \overset{-5}{,} 31 \overset{-5}{,} 26 \overset{-5}{,} 21$

3. a) Count forwards by 5s starting at 4. Circle the numbers on the hundreds chart.

b) Describe the location of the numbers you circled.

_____

_____

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
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

c) Write the ones digits of the numbers you circled.

_____

d) Describe the pattern in the ones digits.

_____

e) Karen counts backwards by 5s starting at 94.

Will she say 39? _____ Will she say 28? _____

4. a) Count forwards by 5s starting at 2. Write 6 numbers. _____

b) Write the ones digits of the numbers you wrote in part a). _____

c) Describe the pattern in the ones digits. _____

d) Describe the pattern in the tens digits. _____

e) Use the patterns in the ones and the tens digits to write 4 more

numbers in the pattern. _____

f) Where are the numbers in the pattern on a hundreds chart?

_____

g) Shade the numbers on the hundreds chart in Question 3 to check your answer to part f).

5. a) Count backwards by 5s starting at 93. Write 6 numbers.

_____

b) Predict: If you continue skip counting, will you say 39? _____

Will you say 28? _____ How do you know? _____

_____

6. a) Write four multiples of 7.

$1 \times 7 =$ _____

$2 \times 7 =$ _____

$3 \times 7 =$ _____

$4 \times 7 =$ _____

November

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				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	

b) Circle the multiples of 7 on the calendar.

c) Describe the locations of the multiples of 7 on the calendar.

_____

d) Shade one row of the calendar. Describe the pattern in the row.

_____

e) Use a different colour to shade a column of the calendar.
Describe the pattern in the column.

_____

7. a) Write five multiples of 6.

$1 \times 6 =$ _____

$2 \times 6 =$ _____

$3 \times 6 =$ _____

$4 \times 6 =$ _____

$5 \times 6 =$ _____

July

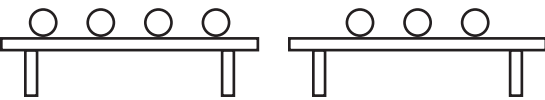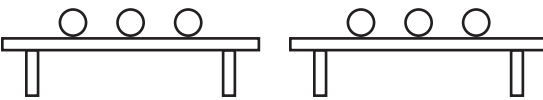| Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

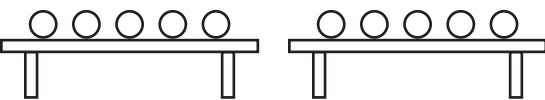**b)** Circle the multiples of 6 on the calendar.

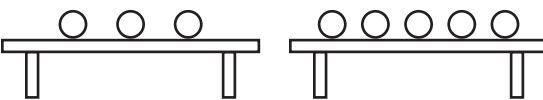**c)** Describe the locations of the multiples of 6 on the calendar.

PA3-16 Equal and Not Equal

1. Write the number of balls on each table. Write = if the tables have the same number. Write ≠ if they do not have the same number.
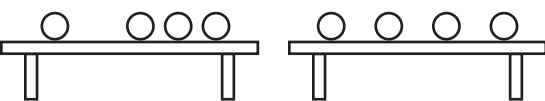
a)

    _4_   ≠   _3_
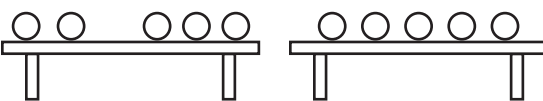
b)
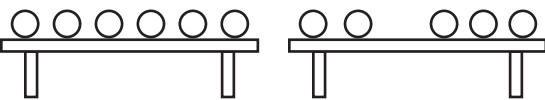
c)
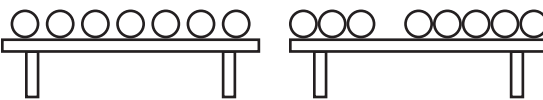
d)
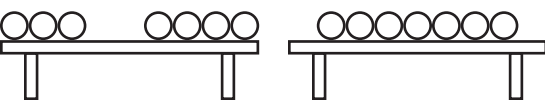
2. Write the number of balls. Write = or ≠ in the box.

a)

    _1_ + _3_ ☐   _4_
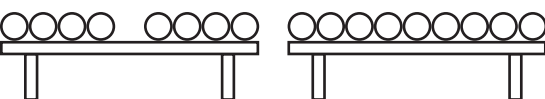
b)

    ____ + ____ ☐   ____

c)

    ____ ☐ ____ + ____

d)

    ____ ☐ ____ + ____

e)

    ____ + ____ ☐   ____

f)

    ____ + ____ ☐   ____

g)

    ____ + ____ ☐   ____

h)

    ____ ☐ ____ + ____

3. Circle the correct addition sentence.

a) $\boxed{7 = 3 + 4}$ b) $9 = 5 + 3$ c) $8 = 6 + 2$

  $7 \neq 3 + 4$ $\boxed{9 \neq 5 + 3}$ $8 \neq 6 + 2$

d) $5 = 3 + 1$ e) $11 + 5 = 16$ f) $12 + 3 = 15$

  $5 \neq 3 + 1$ $11 + 5 \neq 16$ $12 + 3 \neq 15$

An **equation** is a number sentence that has an **equal sign** (=).

$$3 + 5 = 8$$
$$\uparrow$$

  equal sign

The equal sign shows that the left side of the number sentence has the same value as the right side.

---

4. Circle the number sentences that are equations.

  A. $5 + 7 \neq 13$ **B.** $6 < 9$ **C.** $15 - 2 = 13$

  D. $4 = 32 \div 8$ **E.** $6 \times 5 > 15$ **F.** $14 \neq 12 + 3$

5. Write "T" if the equation is true. Write "F" if the equation is false.

a) $3 + 7 = 10$ __T__ b) $9 + 4 = 12$ __F__ c) $2 + 17 = 18$ _____

d) $6 - 2 = 4$ _____ e) $24 - 5 = 19$ _____ f) $25 - 13 = 11$ _____

g) $3 \times 9 = 27$ _____ h) $6 \times 7 = 42$ _____ i) $56 = 8 \times 8$ _____

j) $24 \div 4 = 8$ _____ k) $12 \div 3 = 4$ _____ l) $6 = 35 \div 5$ _____

m) $14 + 13 = 27$_____ n) $9 \times 3 = 28$ _____ o) $9 = 45 \div 5$ _____

p) $18 - 12 = 7$ _____ q) $4 = 15 - 10$ _____ r) $8 = 80 \div 10$ _____

BONUS ▶
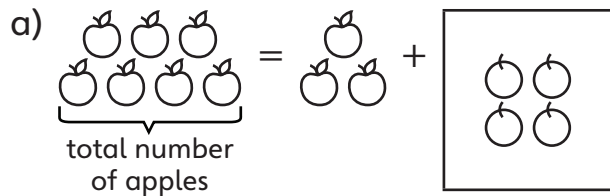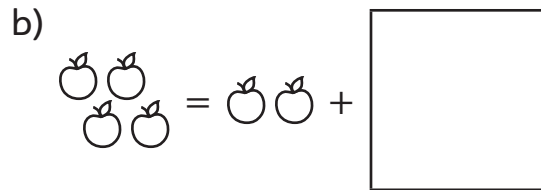
s) $2 + 4 = 3 \times 2$ _____ t) $5 + 6 = 14 - 2$ _____ u) $24 \div 6 = 10 - 6$ _____
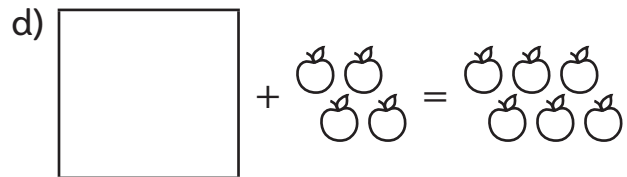
PA3-17 Addition Equations
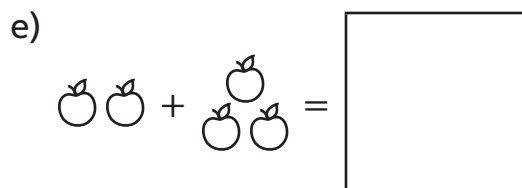
1. Some apples are inside the box and some are outside. Draw the missing apples in the box.

a)

total number of apples
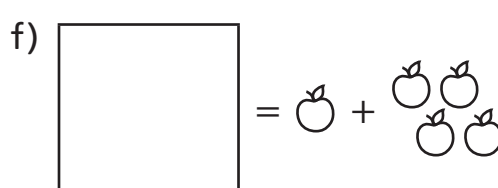
b)
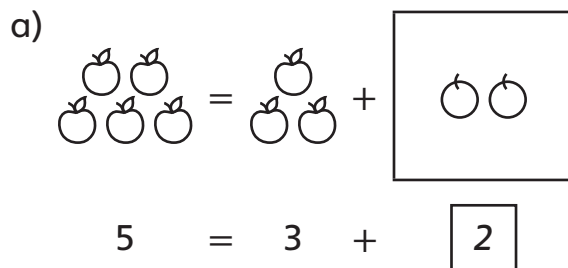
c)

d)
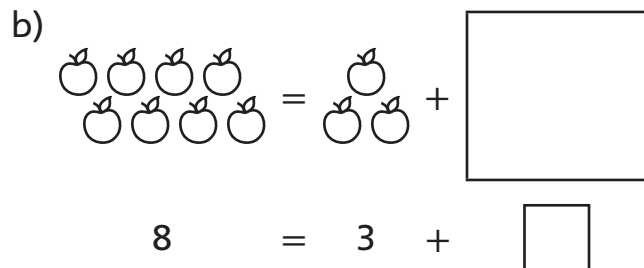
e)

f)
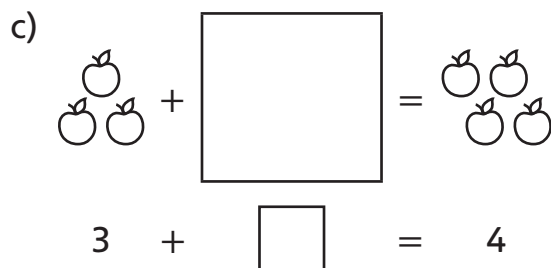
2. Draw the missing apples in the box. Then write the missing number in the smaller box.

a)
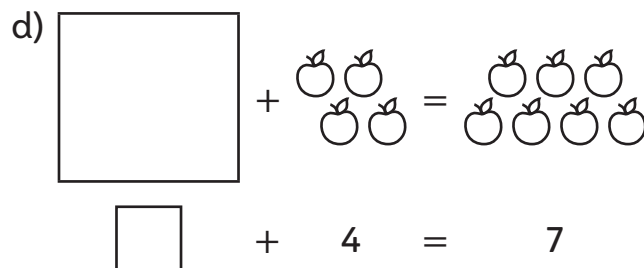
$5 \quad = \quad 3 \quad + \quad \boxed{2}$

b)
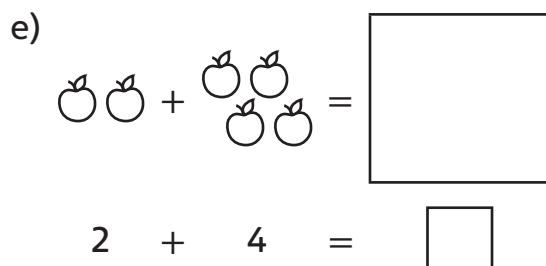
$8 \quad = \quad 3 \quad + \quad \boxed{}$

c)
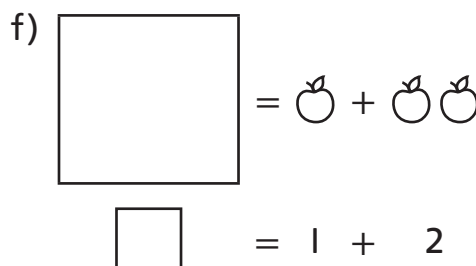
$3 \quad + \quad \boxed{} \quad = \quad 4$

d)

$\boxed{} \quad + \quad 4 \quad = \quad 7$

e)

$2 \quad + \quad 4 \quad = \quad \boxed{}$

f)

$\boxed{} \quad = \quad 1 \quad + \quad 2$

When you find the missing number in the equation, you **solve** it.

3. Draw a picture for the equation. Use your picture to solve the equation.

a) $5 + \boxed{} = 6$

b) $\boxed{} + 4 = 9$

c) $8 = \boxed{} + 3$

d) $\boxed{} = 4 + 4$

To solve $\boxed{} + 3 = 7$, Megan guesses the unknown number is 3.

Megan checks her guess. $\boxed{3} + 3 = 7$ is not true.

6 is too small. To make a bigger sum, she tries 4.

Megan checks her new guess. $\boxed{4} + 3 = 7$ is true, so the unknown number is 4.

4. Solve the equation by guessing and checking.

a) $\boxed{} + 3 = 4$

b) $2 + \boxed{} = 9$

c) $9 = \boxed{} + 4$

d) $10 = 6 + \boxed{}$

e) $5 + 7 = \boxed{}$

f) $\boxed{} = 7 + 6$

g) $15 = 9 + \boxed{}$

h) $\boxed{} + 8 = 16$

You can write 2 addition equations and 2 subtraction equations for this picture.

⬤⬤⬤○○○○

| $3 + 4 = 7$ | $4 + 3 = 7$ | $7 - 3 = 4$ | $7 - 4 = 3$ |

These equations make a **fact family**.

5. Write the fact family for the picture.

a) ⬤⬤○○○○○

b) ⬤⬤⬤○○○○○

c) ○○○○○○○⬤

6. Draw a picture for the equation. Write the rest of the fact family.

a) $4 + 2 = 6$

⚪⚪⚪⚪⚫⚫

$\underline{2 + 4 = 6, 6 - 2 = 4,}$

$\underline{6 - 4 = 2}$

b) $6 + 1 = 7$

_____

_____

c) $6 - 1 = 5$

_____

_____

d) $9 - 4 = 5$

_____

_____

Some circles are in a box. ⚪⚪⚪ ⬚

There are 8 circles in total. Anton wants to find how many circles are in the box.

He writes the equation $3 + \boxed{} = 8$.

Anton subtracts to find the number of circles in the box: $8 - 3 = \boxed{5}$

⚫⚫⚫ ⬚⚪⚪⚪⚪⚪⬚

---

7. Draw a picture for the equation. Then write the subtraction to find the missing number.

a) $7 + \boxed{} = 9$

⚫⚫⚫⚫⚫⚫⚫ ⬚

$\underline{9 - 7 = 2}$

b) $3 + \boxed{} = 10$

_____

c) $\boxed{} + 4 = 8$

_____

d) $5 = \boxed{} + 1$

_____

8. Write the subtraction equation to find the missing number.

a) $7 = 4 + \boxed{}$

$\underline{7 - 4 = 3}$

b) $10 = \boxed{} + 3$

_____

c) $\boxed{} + 6 = 11$

_____

d) $10 + \boxed{} = 19$

_____

e) $\boxed{} + 21 = 32$

f) $42 + \boxed{} = 95$
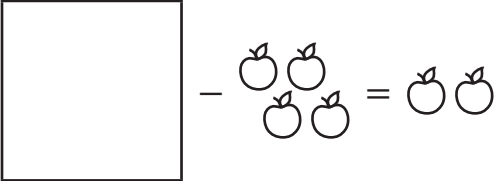
g) $69 = \boxed{} + 14$
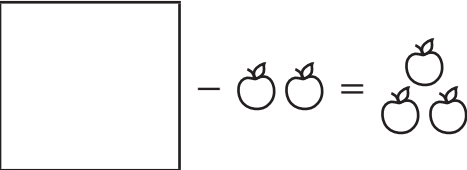
h) $80 = 36 + \boxed{}$

PA3-18 Subtraction Equations

1. Sam takes some apples from a box. Draw the apples that were in the box before.

a)

Sam takes away this many   this many are left

b)

c)

d)
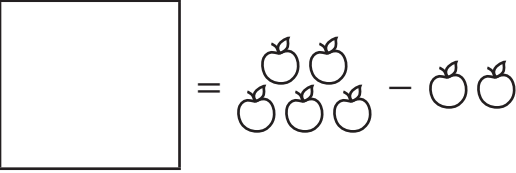
2. Draw the missing apples. Then write the missing number in the smaller box.

a)

$$\square = 5 - 2$$

b)

$$6 - \square = 3$$

c)

$$4 = 5 - \square$$

d)

$$7 - 4 = \square$$

3. Draw a picture for the equation. Use your picture to solve the equation.

a) $6 - \square = 1$

b) $3 = \square - 6$

4. Solve the equation by guessing and checking.

a) $\boxed{} - 2 = 2$ b) $3 = \boxed{} - 4$ c) $8 - 3 = \boxed{}$ d) $\boxed{} = 10 - 2$

e) $9 - \boxed{} = 2$ f) $3 = 10 - \boxed{}$ g) $8 = \boxed{} - 2$ h) $15 - 7 = \boxed{}$

i) $\boxed{} - 8 = 10$ j) $13 = \boxed{} - 4$ k) $28 - 13 = \boxed{}$ l) $7 = \boxed{} - 9$

m) $16 - \boxed{} = 8$ n) $8 = 15 - \boxed{}$ o) $8 = \boxed{} - 6$ p) $20 - \boxed{} = 20$

Lela takes 3 apples from a box. 2 apples are left in the box.

$$\boxed{} - \text{🍎🍎🍎} = \text{🍎🍎}$$

$$\boxed{} \quad - \quad 3 \quad = \quad 2$$

Lela adds the number of apples she took out and the number of apples left to find the number of apples that started in the box.
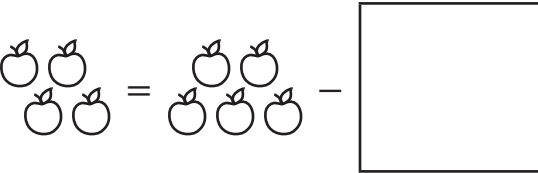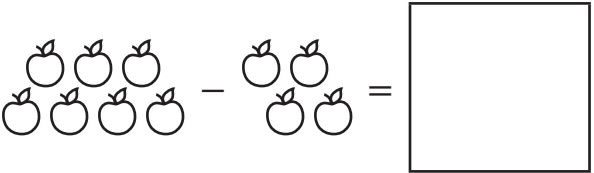
$$3 \quad + \quad 2 \quad = \quad \boxed{5}$$

$$\text{🍎🍎🍎} + \text{🍎🍎} = \boxed{\text{🍎🍎🍎🍎🍎}}$$

5. Write an addition equation to find the number of apples that were in the box before.

a) $4 = \boxed{} - 3$ b) $\boxed{} - 1 = 8$ c) $10 = \boxed{} - 3$ d) $6 = \boxed{} - 4$

3 + 4 = 7 _____ _____ _____

e) $\boxed{} - 6 = 6$ f) $\boxed{} - 9 = 4$ g) $9 = \boxed{} - 7$ h) $\boxed{} - 10 = 9$

_____ _____ _____ _____

i) $\boxed{} - 16 = 6$ j) $\boxed{} - 23 = 14$ k) $19 = \boxed{} - 27$ l) $\boxed{} - 10 = 75$

_____ _____ _____ _____

m) $\boxed{} - 21 = 32$ n) $\boxed{} - 42 = 40$ o) $61 = \boxed{} - 11$ p) $80 = \boxed{} - 50$

_____ _____ _____ _____

REMINDER ▶ You can write a fact family for this picture. ●●○○○○

$$2 + 3 = 5, 3 + 2 = 5, 5 - 3 = 2, 5 - 2 = 3$$

6. Write the rest of the equations in the fact family.

a) $6 - 2 = 4,$ _____

b) $10 - 7 = 3,$ _____

7. Write the other subtraction equation from the same fact family.

a) $11 - 3 = 8$ b) $12 - 7 = 5$ c) $17 - 9 = 8$

$\underline{\quad 11 - 8 = 3 \quad}$ _____   _____

To find the missing number in $7 - \square = 4$, use $7 - 4 = \square$.

We know $7 - 4 = 3$, so $7 - \boxed{3} = 4$.

8. Write the other subtraction equation from the same fact family.
Find the number in the box.

a) $7 - \square = 5$

$\underline{\quad 7 - 5 \quad} = \boxed{2}$

b) $9 - \square = 4$

_____ $= \square$

c) $10 - \square = 2$

_____ $= \square$

d) $12 - \square = 5$

_____ $= \square$

e) $14 - \square = 6$

_____ $= \square$

f) $17 - \square = 10$

_____ $= \square$

g) $32 - \square = 25$

h) $26 = 54 - \square$

i) $17 = 97 - \square$

9. Solve the equation.

a) $\square - 33 = 32$

b) $42 - \square = 40$

c) $71 = \square - 14$

d) $80 = 90 - \square$

e) $\square = 36 - 28$

f) $78 - 29 = \square$

g) $34 = \square - 7$

h) $\square - 40 = 15$

i) $\square = 67 - 39$

BONUS ▶

j) $100 - \square = 51$

k) $71 = \square - 29$

l) $\square - 100 = 0$

PA3-19 Using Letters for Unknown Numbers

You can use a letter to stand for the number you do not know.

Instead of $\boxed{}$ + 5 = 8, you can write $x + 5 = 8$ or $a + 5 = 8$.

1. Use x instead of the box. Rewrite the equation.

a) $\boxed{}$ + 35 = 70

b) 24 = $\boxed{}$ − 6

c) $\boxed{}$ = 7 + 59

_____   _____   _____

2. Use y instead of the box. Rewrite the equation.

a) 45 = 90 − $\boxed{}$

b) 102 = $\boxed{}$ + 6

c) 97 − 69 = $\boxed{}$

_____   _____   _____

REMINDER ▶ You can use addition to find the missing total.

$x - 5 = 1$

$5 + 1 = 6$

$x = 6$

You can use subtraction to find the missing part.

$6 - a = 4$ $2 + y = 8$

$6 - 4 = 2$ $8 - 2 = 6$

$a = 2$ $y = 6$

3. Solve the equation.

a) $44 - x = 20$

$\underline{\quad 44 - 20 = 24 \quad}$

$x = \underline{\ 24\ }$

b) $24 - 6 = n$

_____

$n = \underline{\qquad}$

c) $15 = 7 + m$

_____

$m = \underline{\qquad}$

d) $y - 28 = 10$

_____

$y = \underline{\qquad}$

e) $24 = 6 + b$

_____

$b = \underline{\qquad}$

f) $35 = x - 7$

_____

$x = \underline{\qquad}$

4. How many numbers can you find that solve the equation $\boxed{}$ + 5 = 12? Explain.

_____

_____

5. Rewrite the equation so there is only one operation. Solve the equation.

a) $25 + 3 = 15 + y$

$28 = 15 + y$

$28 - 15 = 13$

$y = 13$

b) $4 + 24 + n = 70$

c) $x - 10 = 35 + 4$

d) $35 - 10 = b - 15$

e) $p + 12 = 33 - 5$

BONUS ▶ $40 - a = 5 \times 4$

> You can also use symbols, such as ☺ or ?, to stand for unknown numbers.
> Instead of $\square - 5 = 8$ or $x - 5 = 8$, you can write ☺ $- 5 = 8$ or $? - 5 = 8$.

6. Use ☺ instead of a. Rewrite the equation.

a) $44 - a = 20$

b) $25 - 6 = a$

c) $35 = 7 + a$

_____   _____   _____

7. Solve the equation.

a) $? - 8 = 10$

b) $13 = 8 + ☆$

c) $11 = ☺ - 7$

_____   _____   _____

$? = $ _____

$☆ = $ _____

$☺ = $ _____

d) $29 - ? = 19$

e) $50 = ⟨\!⟨ + 25$

BONUS ▶ $75 = ▽ + 75$

_____   _____   _____

$? = $ _____

$⟨\!⟨ = $ _____

$▽ = $ _____

BONUS ▶ Use the same number instead of ☺. Can you find more than one solution to the equation ☺ $+ 0 = $ ☺? Explain.