YUMI DEADLY CENTRE
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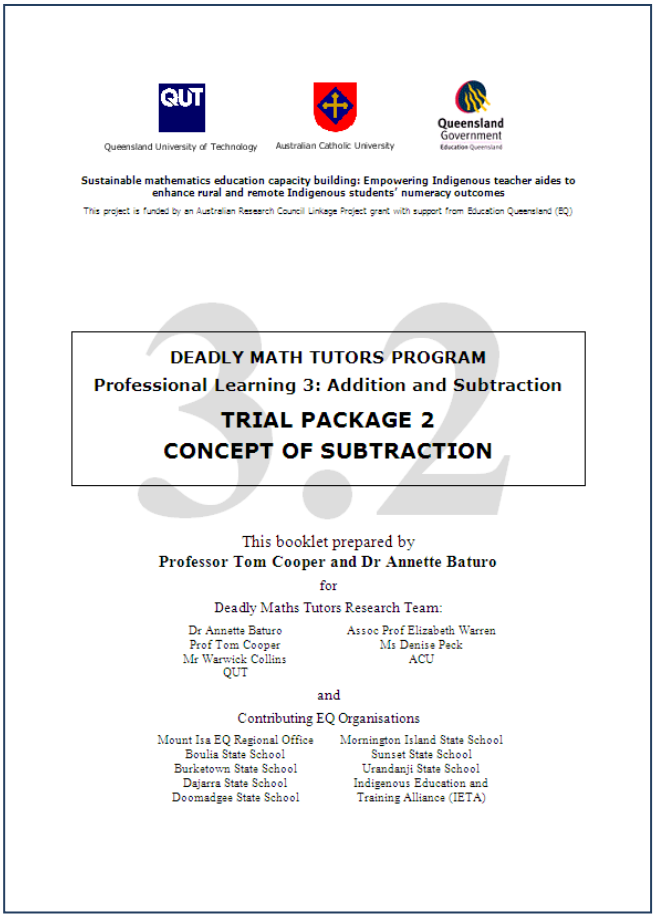
Professional Learning 3

Addition and Subtraction

Booklet 3.2: Concept of Subtraction



Queensland University of Technology Australian Catholic University Queensland Government

Sustainable mathematics education capacity building: Empowering Indigenous teacher aides to enhance rural and remote Indigenous students' numeracy outcomes

This project is funded by an Australian Research Council Linkage Project grant with support from Education Queensland (EQ)

3.2

DEADLY MATH TUTORS PROGRAM
Professional Learning 3: Addition and Subtraction
TRIAL PACKAGE 2
CONCEPT OF SUBTRACTION

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Burketown State School
Dajarra State School
Doomadgee State School
Mornington Island State School
Sunset State School
Urandanji State School
Indigenous Education and Training Alliance (IETA)

YuMi Deadly Maths
Past Project Resource

Acknowledgement

We acknowledge the traditional owners and custodians of the lands in which the mathematics ideas for this resource were developed, refined and presented in professional development sessions.

YuMi Deadly Centre

The YuMi Deadly Centre is a Research Centre within the Faculty of Education at Queensland University of Technology which aims to improve the mathematics learning, employment and life chances of Aboriginal and Torres Strait Islander and low socio-economic status students at early childhood, primary and secondary levels, in vocational education and training courses, and through a focus on community within schools and neighbourhoods. It grew out of a group that, at the time of this booklet, was called "Deadly Maths".

"YuMi" is a Torres Strait Islander word meaning "you and me" but is used here with permission from the Torres Strait Island Regional Educational Council to mean working together as a community for the betterment of education for all. "Deadly" is an Aboriginal word used widely across Australia to mean smart in terms of being the best one can be in learning and life.

YuMi Deadly Centre's motif was developed by Blacklines to depict learning, empowerment, and growth within country/community. The three key elements are the individual (represented by the inner seed), the community (represented by the leaf), and the journey/pathway of learning (represented by the curved line which winds around and up through the leaf). As such, the motif illustrates the YuMi Deadly Centre's vision: *Growing community through education*.

More information about the YuMi Deadly Centre can be found at http://ydc.qut.edu.au and staff can be contacted at ydc@qut.edu.au.

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Queensland University of Technology,
Australian Catholic University &
Education Queensland

Deadly Maths Tutor Program

PROFESSIONAL LEARNING 3: ADDITION & SUBTRACTION

BOOKLET 3.2

CONCEPT OF SUBTRACTION

2008

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Mount Isa EQ Regional Office	Mornington Island State School
Boulia State School	Sunset State School
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Dajarra State School	Indigenous Education and Training Alliance
Doomadgee State School	(IETA)

YuMi Deadly Centre
School of Mathematics, Science and Technology Education,
Faculty of Education, QUT

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CONTENTS

Page

OVERVIEW

Purpose 1

Directions 1

INTERVIEW

Interview schedule 2

Interview materials 4

Student Recording Sheet 6

ACTIVITIES

Subtraction concept

SC1: Subtraction problem ←→ set activities/drawing 7

SC2: Subtraction problem ←→ number line activities/drawing 13

SC3: Subtraction problem ←→ subtraction language 19

SC4: Subtraction problem ←→ subtraction symbols 25

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OVERVIEW

PURPOSE

These materials were designed to be used in conjunction with a Professional Learning program for teacher aides. The objective of this Professional Learning was to empower teacher aides to enhance rural and remote Indigenous students' numeracy outcomes. This document contains the materials of the second of five different booklets on addition and subtraction.

If your school would like to receive a YuMi Deadly Maths Professional Learning program please contact the YuMi Deadly Centre (YDC) on: 07 3138 0035 or ydc@qut.edu.au.

DIRECTIONS

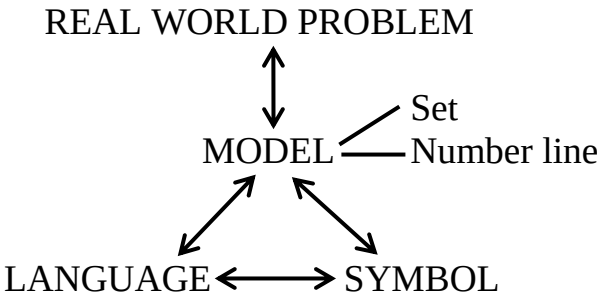
(1) Interviewing the students:

Pick one or more students who appear to be having trouble understanding addition. Interview these students using the interview schedule and the materials. Mark what they do and put their results on the Student Recording Sheet.

(2) Trialling the student activities:

Use the Recording Sheet to work out the activities the students need to do and trial these activities with the students (with each student one at a time or with a group of students). Keep a record of what happens and collect the students' work.

The activities SC1 to SC4 are based on the Rathmell Triangle Relationship below. The idea is to teach students to relate real world problems to set and number line models and to language and symbols and vice versa – switching from one representation to the other – in all directions.



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INTERVIEW

INTERVIEW SCHEDULE

MATERIALS

Unifix cubes, deck of playing cards, washable felt pen, pen, paper

Materials with this interview: cards, number tracks, number lines

Student recording sheet

DIRECTIONS

1. Photocopy and laminate attached card, number track and number line pages.
2. Gather other material.
3. Place material in front of students. Give students pen and paper to write with.
4. Tell the students you are trying to find out what they know. Say they are not expected to know it and you will teach what is not known.
5. Give the student directions slowly – read problems. Do not give hints. If student cannot do a question, pass on to the next question.
6. Allow students to use material and make drawings but only after they say they do not know how to do it with symbols alone.

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Concept of subtraction

S1

Show and read problem on Card 4

- Say: *Act out what the problem is doing with the Unifix cubes*.
- Say: *Draw what the problem is doing in some way. Use circles for fish*.

S2

Show and read Card 5

- Say: *What if I changed the problem to this?* [Read Card 5]
- Say: *Act out what this new problem is doing with the Number Track*.

S3

Say: *Say either problem using the words "subtract", "equals", "three" and "five"*.

S4

Say: *Write the problem in symbols.*

S5

Show Card 6

Say: *Read the number sentence (or sum).*

S6

- Say: *Draw what the number sentence is doing in some way using circles to show the numbers*.
- Say: *Act out what the problem is doing with counters.*

S7

Say: *Act out what the number sentence is doing with a Number Track.*

S8

Say: *Make up a story that says what the number sentence is doing*.

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INTERVIEW MATERIAL

CARDS

CARD 1

I caught 5 fish, I gave 2 fish away, how many fish do I have?

CARD 2

I walked 5 blocks, I walked 2 blocks back, how many blocks back still to walk?

CARD 3

$$\begin{array}{r} 6 \\ -\ 2 \\ \hline 4 \end{array}$$

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NUMBER TRACKS

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

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STUDENT RECORDING SHEET

Name: _____

School/Class: _____

Interview item	Result (✓, ✗)	Comments	Activities to be completed if incorrect
S1: subtraction problem → set activities/ drawing			SC1
S2: subtraction problem → number line activities/drawing			SC2
S3: subtraction problem → subtraction language			SC3
S4: subtraction problem → subtraction symbols			SC4
S5: subtraction symbols → subtraction problem			SC4
S6: subtraction language → subtraction problem			SC3
S7: number line activities/drawing → subtraction problem			SC2
S8: set activities/drawing → subtraction problem			SC1

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ACTIVITIES

ACTIVITY SC1

[Subtraction problem ←→ set activities/drawing]

Materials: Unifix, pen, paper, objects (pens, shells etc. – better if natural and local), material attached (worksheet, game directions, deck of cards, gameboard)

Directions:

1. Tell a story, acting it out as you go. *I have five (objects) and I take two away. How many (objects) do I have?*

2. Act out the story again for the students. Ask them to follow you with their counters. Ask: *How many (objects) did I start with?* State: *Show me these with your counters.* Ask: *How many (objects) did I take away?* State: *Show me these with your counters.* State: *Take away your counters as I take away my (objects).* Ask: *How many counters do you now have?*

3. Ask students to act out the story again with their counters. Ask: *How many in total did I start with? How many did I take away? How many left?*

4. Ask students to draw the activity with circles to show the numbers. If needed, ask: *What did we do with the counters? How can we draw this activity? What happens to the part that is taken away? How can we show this on the drawing?* Discuss the drawings. Ask: *Please tell me the story pointing to your drawing as you go.*

5. Tell a new story: *I have 7 (objects) and I take away 3. How many objects do I have?* Ask: *Act this out with your counters.* Ask: *Draw the counters.*

6. Show students worksheet. State: *The circles are objects. The cross means that they are taken away.* Ask: *Act this out with counters.* Ask: *Make up a story that this drawing is telling.*

7. Repeat step 6 for the second drawing on worksheet.

8. Complete Game *Subtraction "Noughts and Crosses"*

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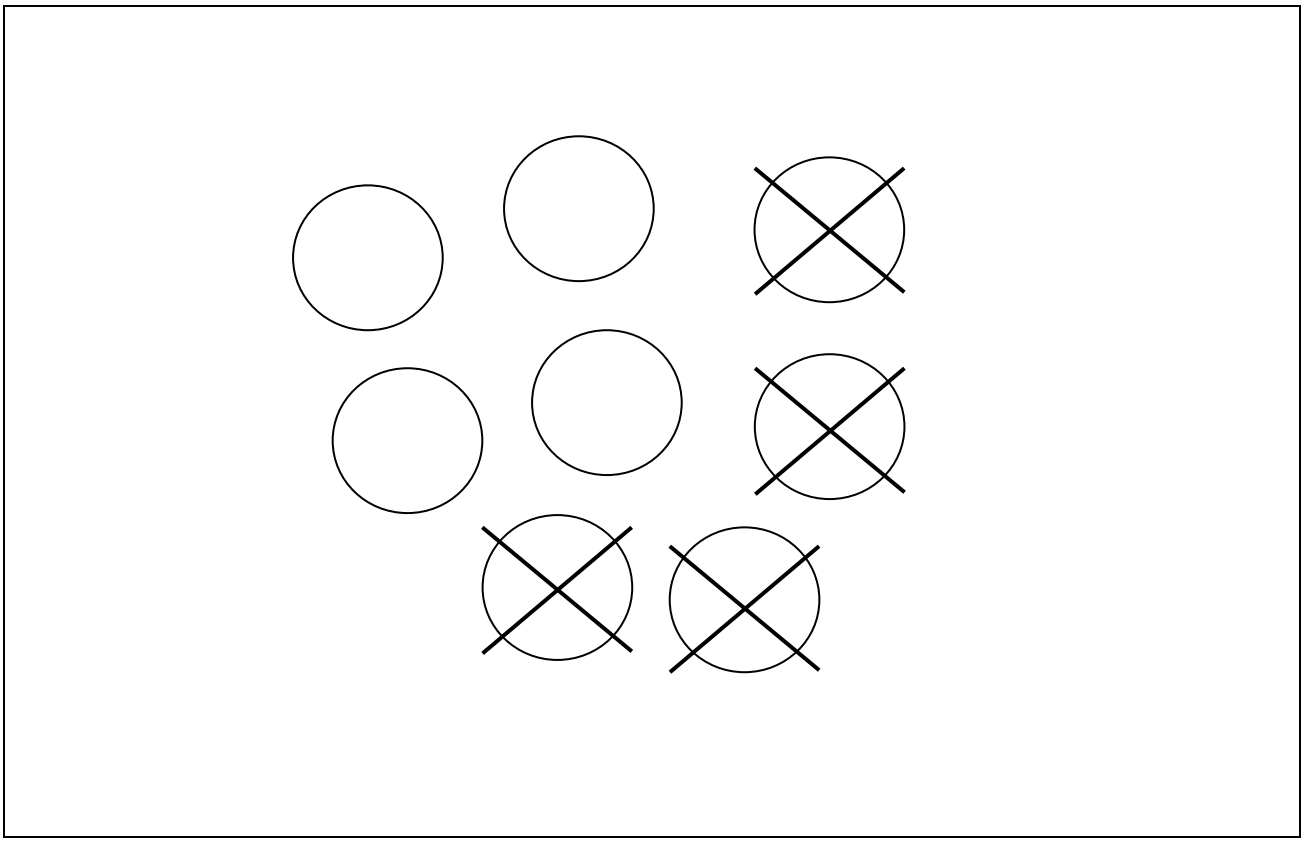
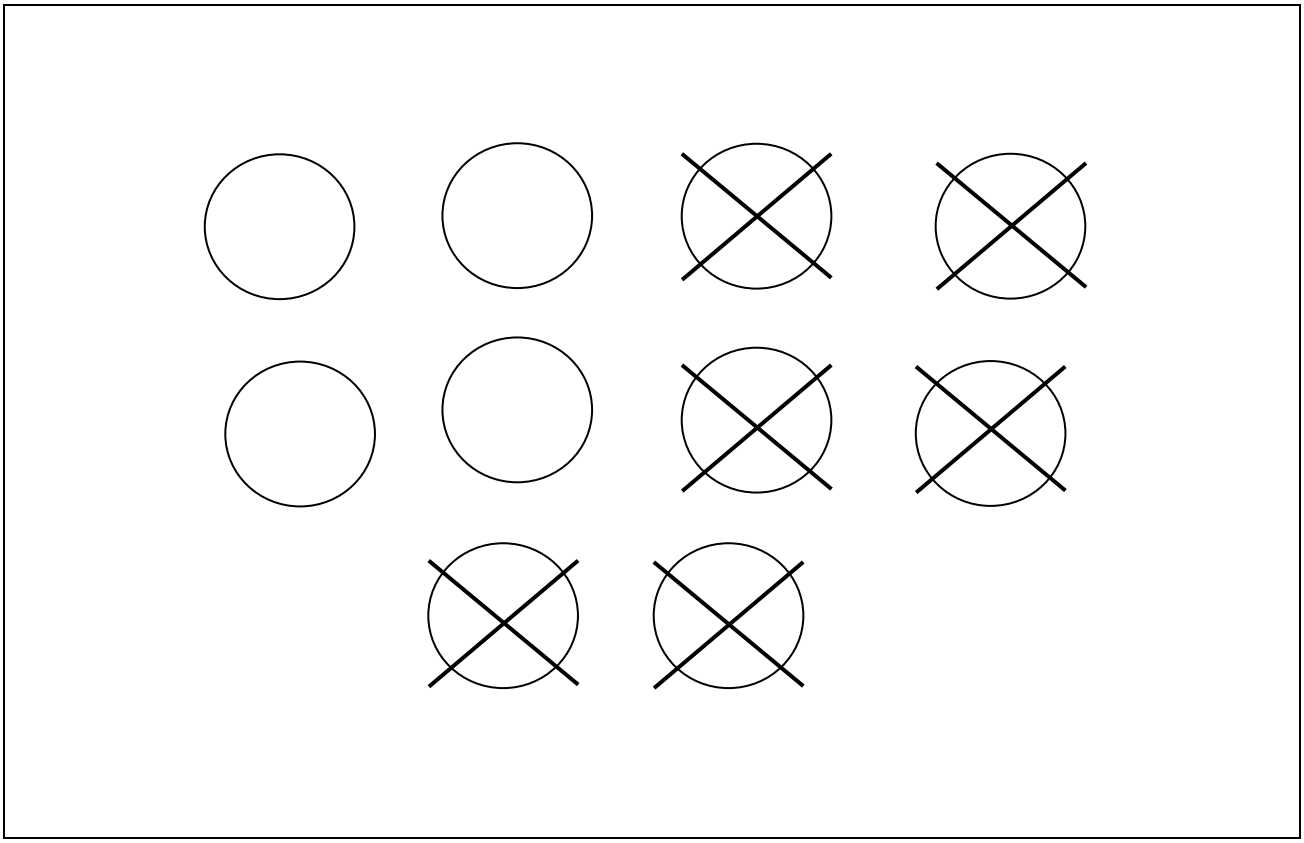
SC1 – Worksheet





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SC1 – Game: Subtraction "Noughts and Crosses"

Materials: Card deck with 0, 1, 2, 3, 4, 5, 6, 7, 8 & 9; Subtraction "Noughts and Crosses" Board; counters

Number of players: 2-4

Directions:

1) Players in turn pick 2 cards each.
2) Players cover with unifix the number which is the subtraction of the numbers on the two cards.
3) If this number is already covered by an opponent, then players place unifix on top of opponent's unifix.
4) Winner is first with 3 in a row (across, down, or diagonal) – like noughts and crosses

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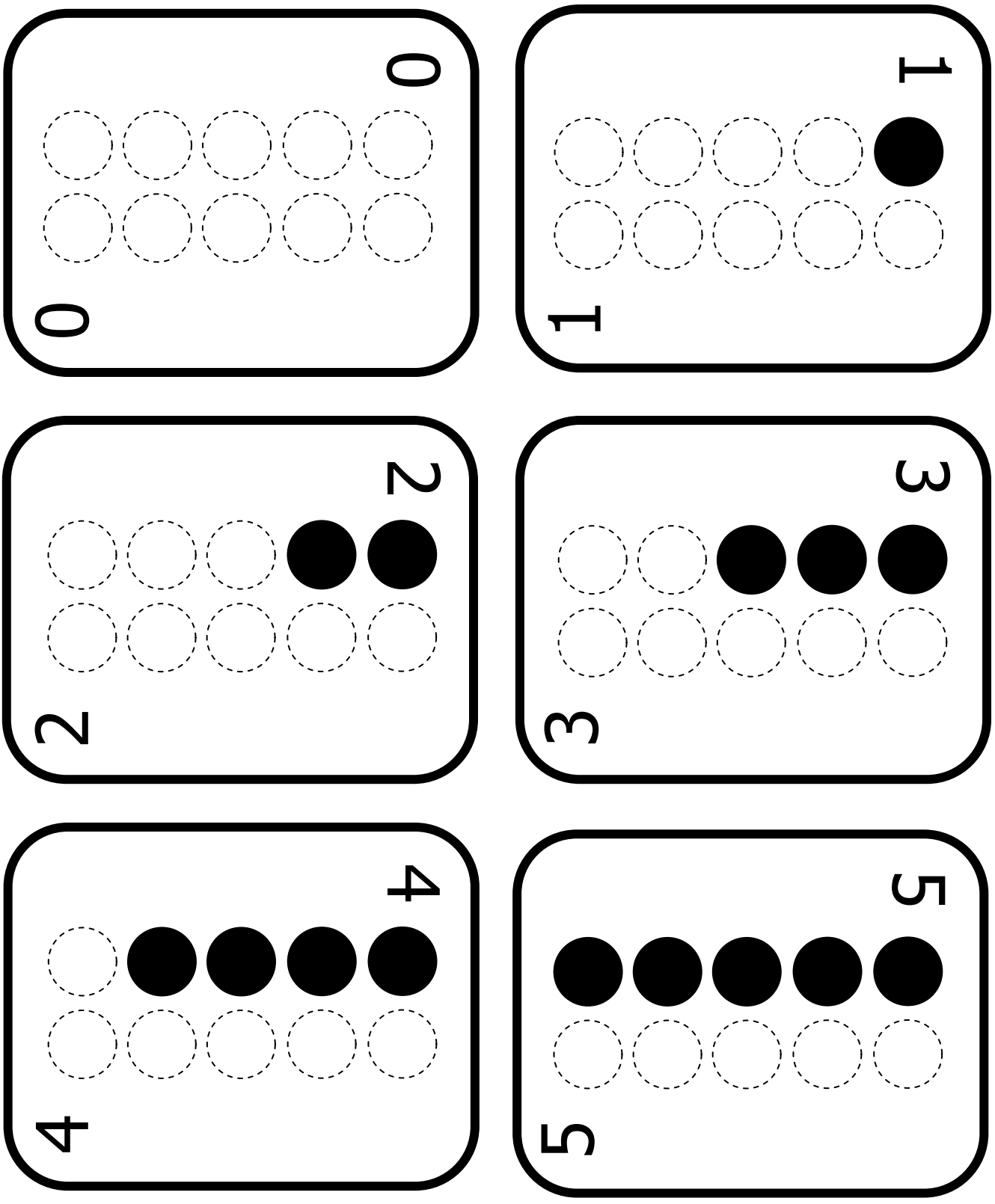
SC1 – Card Deck

(Photocopy two pages 4 times on different coloured paper to make 48 cards in total – 4 "suits" of 12 cards each)



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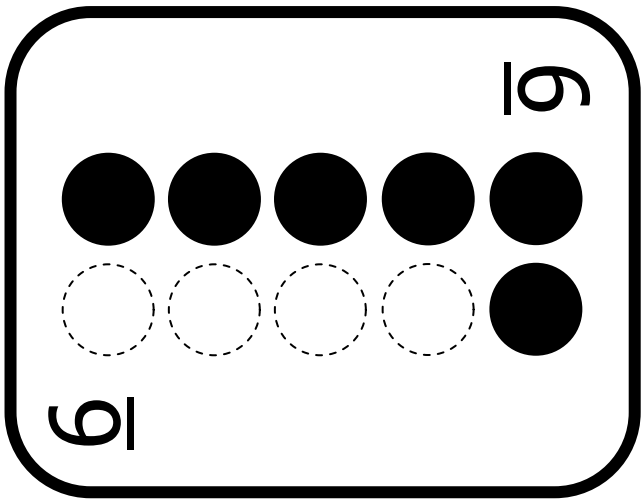

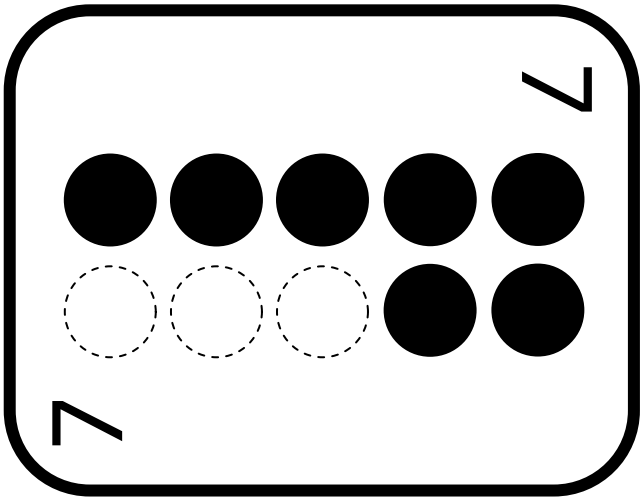

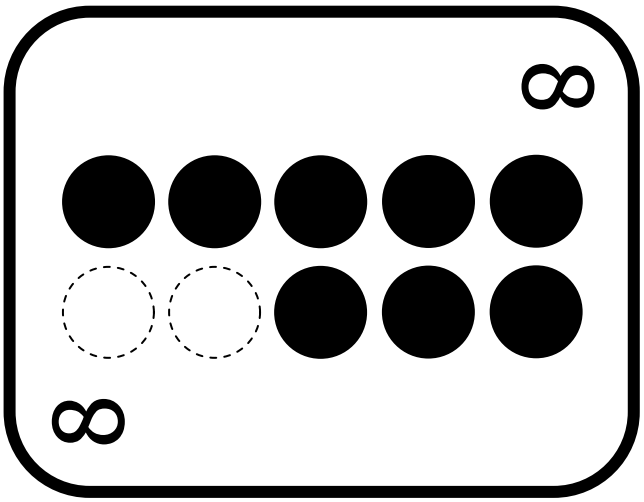

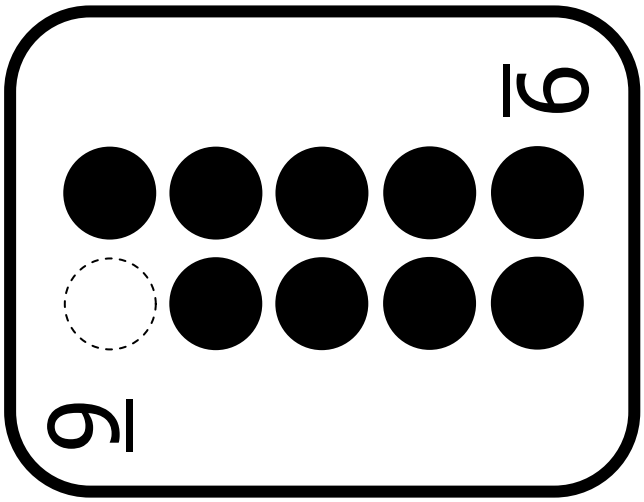

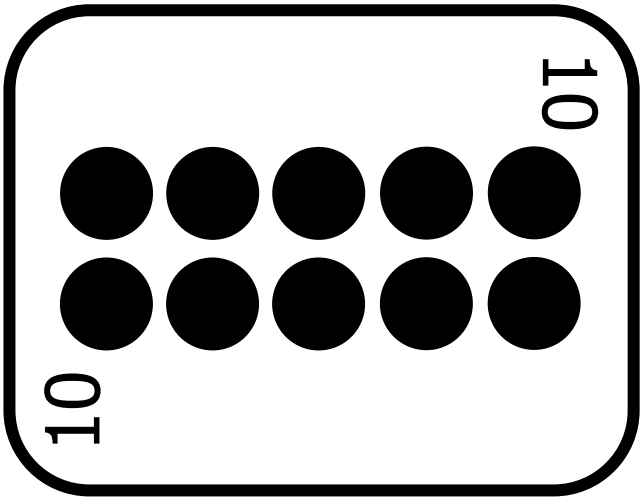

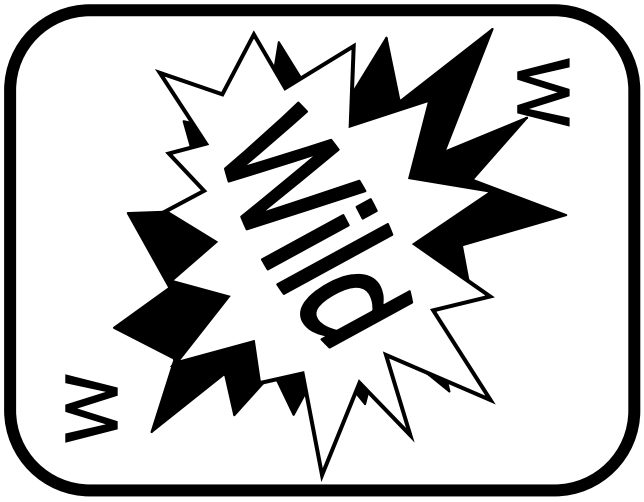

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SC1 – Subtraction "Noughts and Crosses" Board

5	0	1
7	4	3
2	8	6

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ACTIVITY SC2

[Subtraction problem ←→ number line activities/drawing]

Materials: Large number track on floor, pen, paper, materials attached (worksheet, number tracks, game directions, two gameboards)

Directions:

1. Make up a large number track. Put each number 1 to 12 on a sheet of A4 paper. Lay the numbers out on floor so children can walk beside them counting as they go.

2. Tell a story: acting it out as you go. *I ran five blocks and then I ran two blocks back towards home. How many more blocks do I need to run to get home?*

3. Act out the story again for the students on the large number track. Ask: *How many blocks did I run first?* [5] State: *Step this out.* Ask: *How many blocks did I run back?* [2] State: *Step this backwards from 5.* Ask: *How many blocks have I left to run?* [3]

4. Ask students to "walk" the story on a small number track. Ask: *How far did I walk first? How many did I walk back? How many still to walk?*

5. Ask students to draw the activity with a number line to show the problem. If needed, ask: *What did we do first? Second? How can we draw these distances or steps? What happens to the second run? How can we show this on the drawing?* Discuss the drawing. Ask: *Please tell me the story pointing to your drawing as you go.*

6. Tell a new story: *I walk 7 blocks and then 3 backwards. How many left to go?* Ask: *Act this out with a number track.* Ask: *Draw the walk.*

7. Show students worksheet 1. State: *The arrows show the blocks run. The arrow backwards means these blocks have been run back and can be "removed".* Ask: *Act this out on the large number track.* Ask: *Make up a story that this drawing is telling.*

8. Repeat step 6 for the second drawing on worksheet 1.

9. Complete Games *Subtraction Racetrack 1 and 2*

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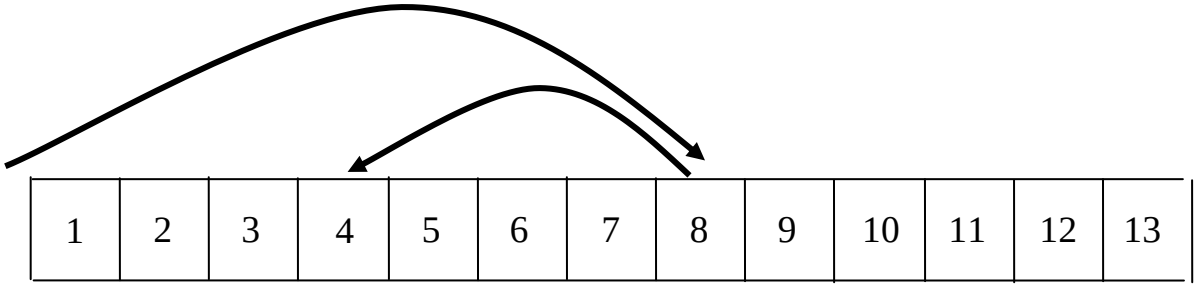
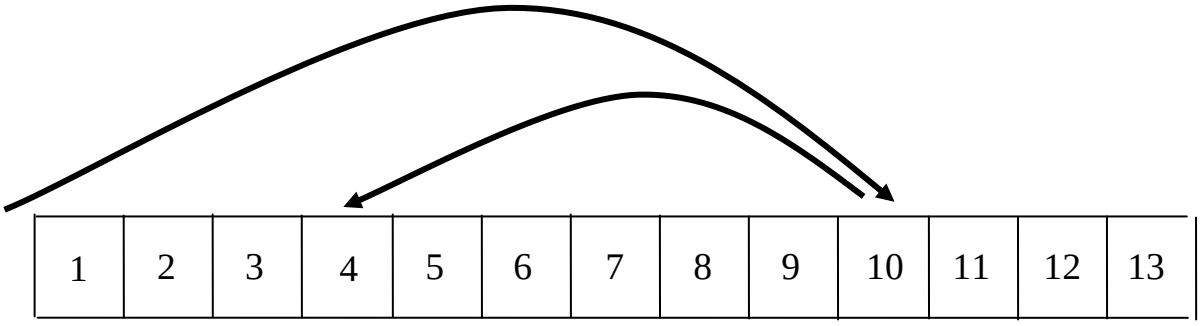
SC2 – Worksheet





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SC2 – Number Tracks

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

1	2	3	4	5	6	7	8	9	10	11	12	13

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SC2 – Game: Subtraction Racetrack 1

Materials: Subtraction Racetrack Board, 1 die

Number of players: 2-4

Directions:

1) Throw die and move backward amount shown
2) If land on star move forward 2.
3) First to the end, wins

SC2 – Game: Subtraction Racetrack 2

Materials: Addition Racetrack Board, 1 die, 1 deck of cards (1-9 only)

Number of players: 2-4

Directions:

1) Throw die and select a card.
2) Move forward the amount on card and backward the amount on die (only go back to start).
3) If land on star, go back twice amount on die
3) First to the end, wins

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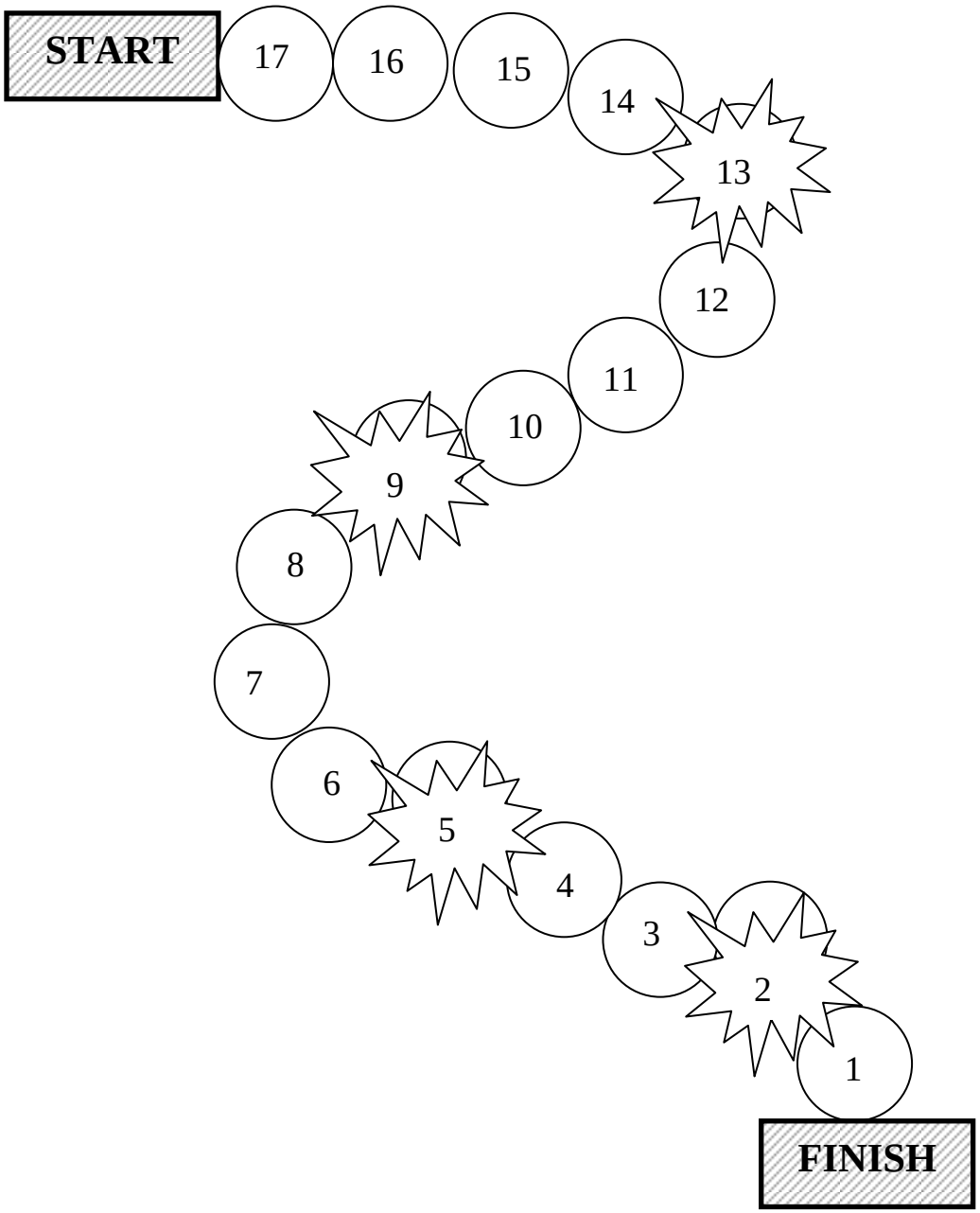
SC2 – Subtraction Racetrack Board



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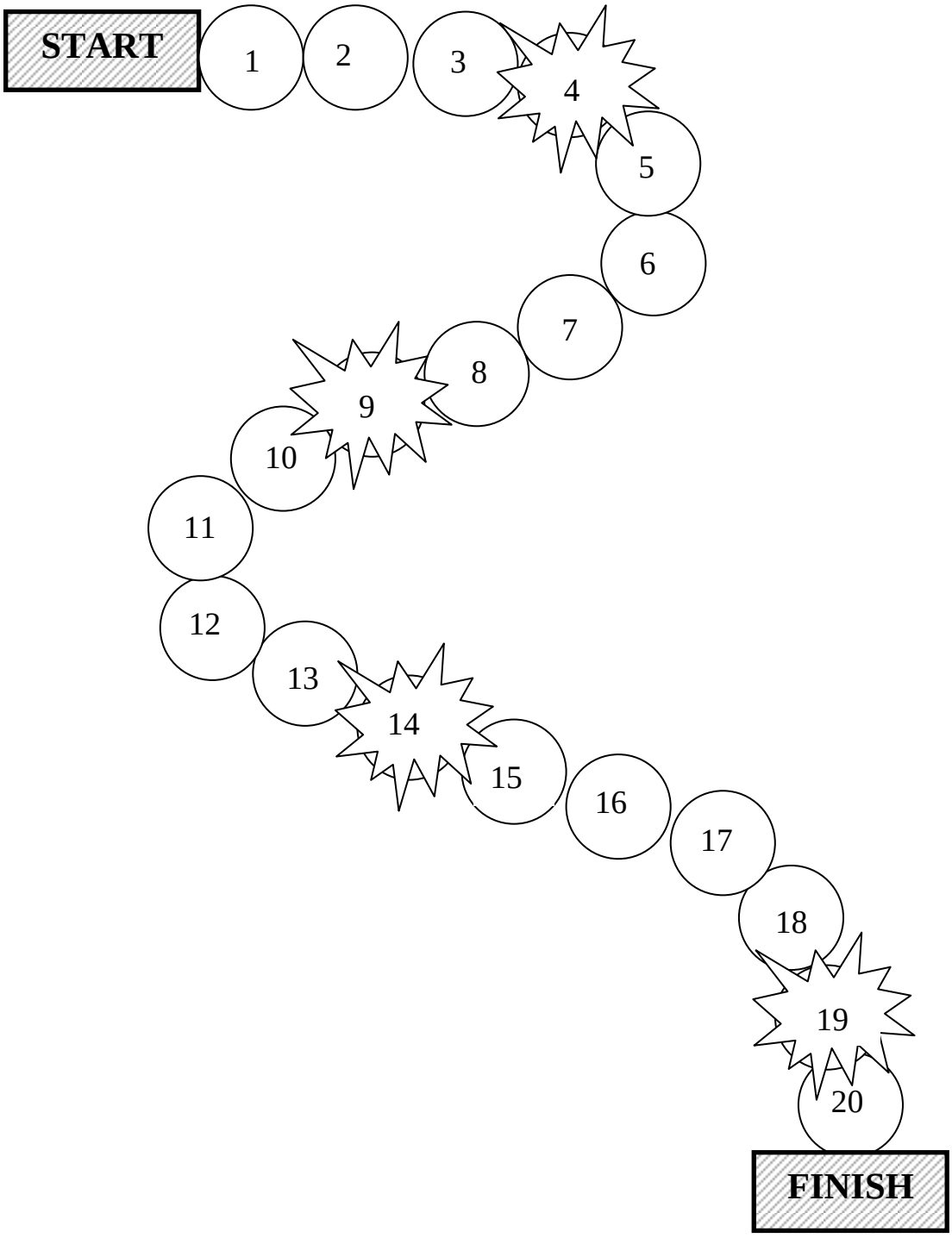
SC2 – Addition Racetrack Board



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ACTIVITY SC3

[Subtraction problem ←→ subtraction language]

Materials: Counters, pen, paper, 8 objects (pens, shells, etc.), Number Tracks (see SC2), attachments (game directions, gameboard, Subtraction cards)

Directions:

1. Tell a story: acting it out with imaginary people as you go. *Jack had 9 (objects), Fred took 4 of them. How many does Jack have now?*

2. Recap how to act this out with counters and to draw it with circles or other shapes. Ask as they do this: *How many did Jack have? How many did Fred take? How many does Jack have now?* Then move on to: *What was Jack's total? What was Fred's part? How many in the part that was left?*

3. Ask students to state the story in language. If difficulty, ask: *How many did Jack have?* [nine] *How many did Fred take?* [four] *What do we call taking away?* [subtract] *How many at the end?* [five] *What do we call finding the amount left?* [equals] Say this*: Nine subtract four equals five.* Get students to point at the counters as they say the language.

4. Tell a new story: *Jack walked 8 blocks. Then he walked 6 blocks back. How many blocks does Jack still have to walk?* Ask students to act it out with a number track (get track from SC2). Ask the students to say this with language.

5. Say: *Eleven subtract seven equals four*. Act this out with unifix and draw a drawing for it. Ask: *Make up a story that this gives this sum.*

6. Repeat this for: *Twelve subtract 3 equals 9*, but use a number track not unifix to act it out (get track from SC2). Again, ask: *Make up a story that gives this sum.*

7. Play the attached subtraction card games – Subtraction Big and Small, Subtraction Snap, Subtraction Rummy.

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SC3 – Subtraction Card Games

Subtraction Big and Small

Materials: Deck of cards numbers 1, 2 & 3, Deck of cards numbers 7, 8 & 9 (use cards from SC1 printed in 4 different colours, to make 4 "suits") Racetrack Board, unifix cubes (one to a player)

Number of players: 2-3

Directions:

1) Shuffle both card decks. Players in turn, select one card from each deck and subtract the numbers.
2) Players score points as per table on right and move the number of points scored on Racetrack Board (use unifix as counters).
3) First player to finish wins.

DIFFERENCE.	SCORE
4	1 point
5	2 points
6	3 points
7	2 points
8	1 point

Subtraction Snap

Materials: Deck of subtraction cards, (1 to 9 cards only – no 0 or 10 cards)

Number of players: 2

Directions:

1) Shuffle the operation cards. Deal out all cards.
2) In turn play cards. First to call snap when two cards show the same operation wins a point.
3) The player with the most points wins when all cards played.

Subtraction Rummy

Materials: Deck of subtraction cards (without symbol cards)

Number of players: 2-4

Directions:

1) Shuffle the operation cards. Deal out 7 cards to each player. Put remaining cards face down in middle with one card face-up beside deck. Players put out any doubles or triples.
2) Players in turn pick up a card (either the top face-up card or face-down card) and place a card face-up on the face-up pile. Doubles and triples are put out as they are formed.
3) The winner is the first player to put out all their cards as doubles and triples.
4) Note: Can introduce other gin rummy rules.

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SC3 – Subtraction Big and Small Racetrack Board

Start	Start	Start
Finish	Finish	Finish

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SC3 – Subtraction Cards (language)

6 take 1	3 minus 1	5 take away 4
8 subtract 5	4 less 2	7 minus 5
7 take away 4	9 less 3	4 take away 1
9 reduced by 2	6 minus 4	6 take away 3

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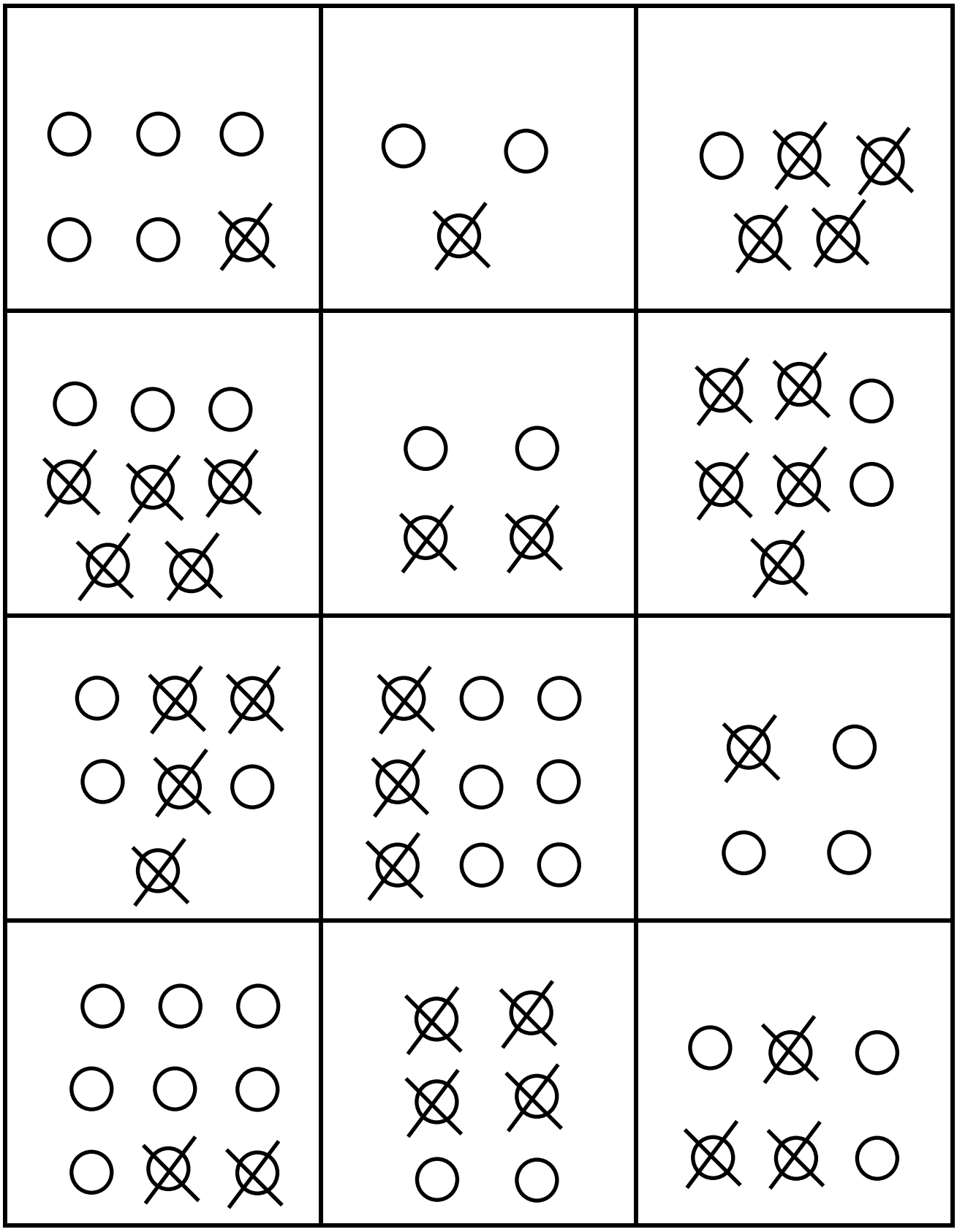
SC3 – Subtraction Cards (set model)



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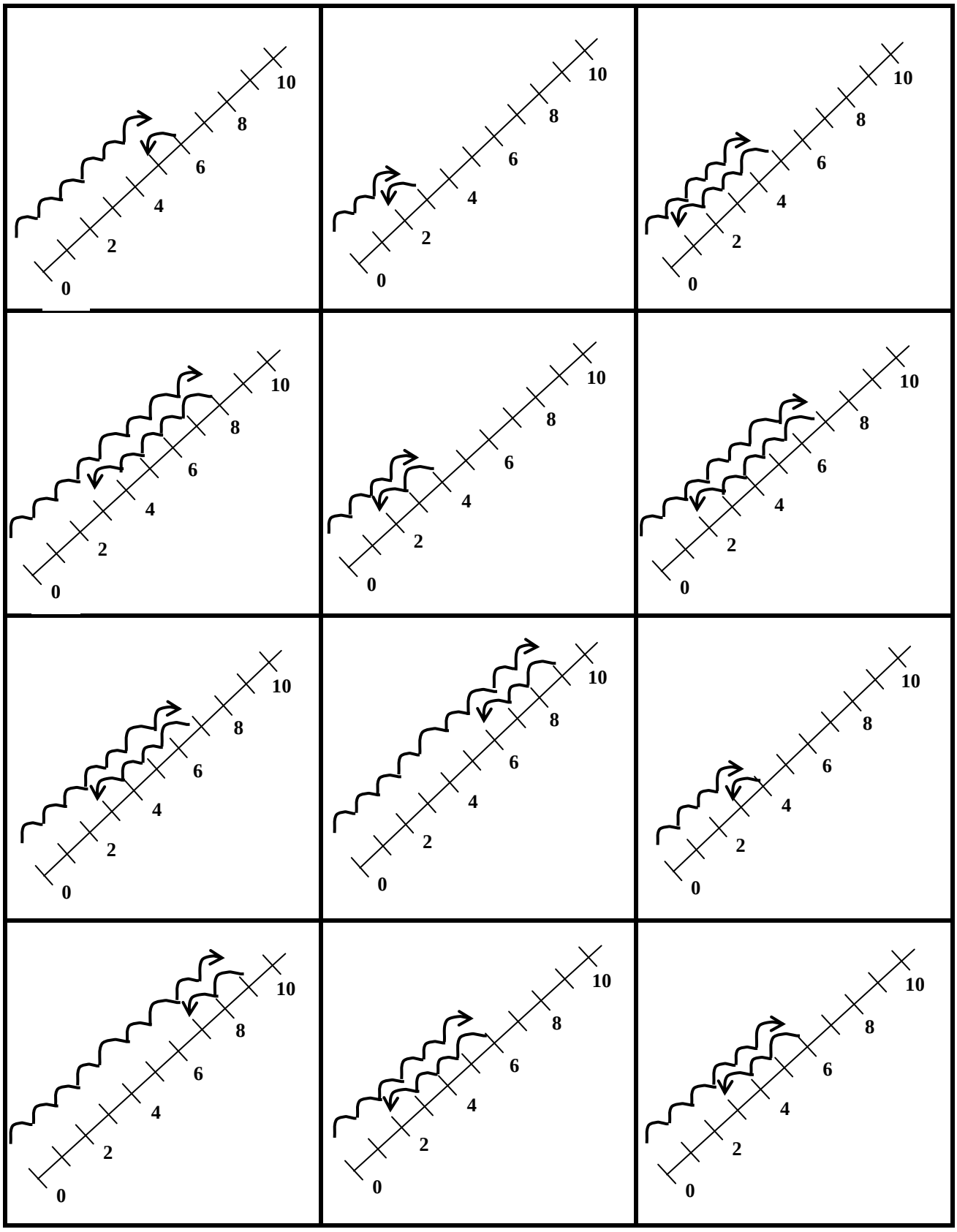
SC3 – Subtraction Cards (number line model)



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ACTIVITY SC4

[Subtraction problem ←→ subtraction symbols]

Materials: Counters, pen, paper, 8 objects (pens, shells etc.), attachments (game directions, subtraction cards, mix & match cards, "cover the board" boards and cards, bingo boards and flash cards)

Directions:

1. Tell a story: acting it out with imaginary people as you go. *Jack had 8 (objects), Fred took 5 away. How many does Jack have now?*

2. Recap how to act this out with counters, draw it with circles or other shapes, and say it with language.

3. Ask the students to write the story in symbols. If difficulty, ask: *How many did Jack have?* [8] *Write this number down.* Ask: *How many did Fred take away?* [5]. *Write this number under the 8.* Ask: *How do we write that numbers are taken away?* [−]. *Write this symbol beside (on left of) the 5.* Ask: *How many left?* [3] *Put a line under the 5 and then the 3 under that line.* Point where the line and the 3 are to go.

4. Tell a new story: *Jack walked 10 blocks. Then he walked 3 blocks back. How many more blocks does Jack have to walk?* Recap how to act it on a number track, draw it, and say it with language. Ask the students to write the story in symbols.

5. Show a subtraction in symbols. Act this out with unifix and draw a drawing for it. Ask: *Make up a story that gives this sum.*

$$\begin{array}{r} 7 \\ -\ 1 \\ \hline 6 \end{array}$$

6. Repeat this but use a number track not unifix to act it out (get track from SC2). Again, ask: *Make up a story that gives this sum.*

$$\begin{array}{r} 11 \\ -\ 8 \\ \hline 3 \end{array}$$

7. Play the attached subtraction activities and games
   - Subtraction Snap and Subtraction Rummy (see SC3) – extra symbol cards added so can have quadruples as well as doubles/triples (and cannot allow doubles, if wish)
   - Subtraction Mix & Match
   - Subtraction Cover the Board
   - Subtraction Bingo

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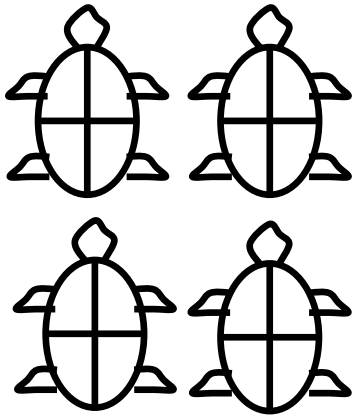
8. Make up and play these games:



a) Cover the turtle:

A4 sheets with 4 turtles divided into 4 parts. Each part has an operation in language, set and length form. Flash cards with symbols are shown and operations covered on turtle sheet similar to 'bingo'. First one with a whole turtle covered wins.

b) "Hoy" addition and subtraction:

Set of cards – symbols, language, set model, length model – similar to 'cover the board' cards.

Dealer deals 6 cards face up to each player. 3 players maximum.

Dealer shows remaining cards one at a time. Players turn over cards of the same operation. Player who turns over all cards first wins.

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SC4 – Subtraction Cards (symbols)

$\begin{array}{r} 6 \\ -\ 1 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -\ 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -\ 4 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ -\ 5 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -\ 2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -\ 5 \\ \hline \end{array}$
$\begin{array}{r} 7 \\ -\ 4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -\ 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -\ 1 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ -\ 2 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -\ 4 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -\ 3 \\ \hline \end{array}$

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SC4 – Subtraction Mix & Match Cards

Materials: For each operation, 5 sets of cards
(Print all cards the same colour).

Directions:

1) Cut cards along lines into pieces

2) Mix pieces together

3) Students put pieces back together to form cards.

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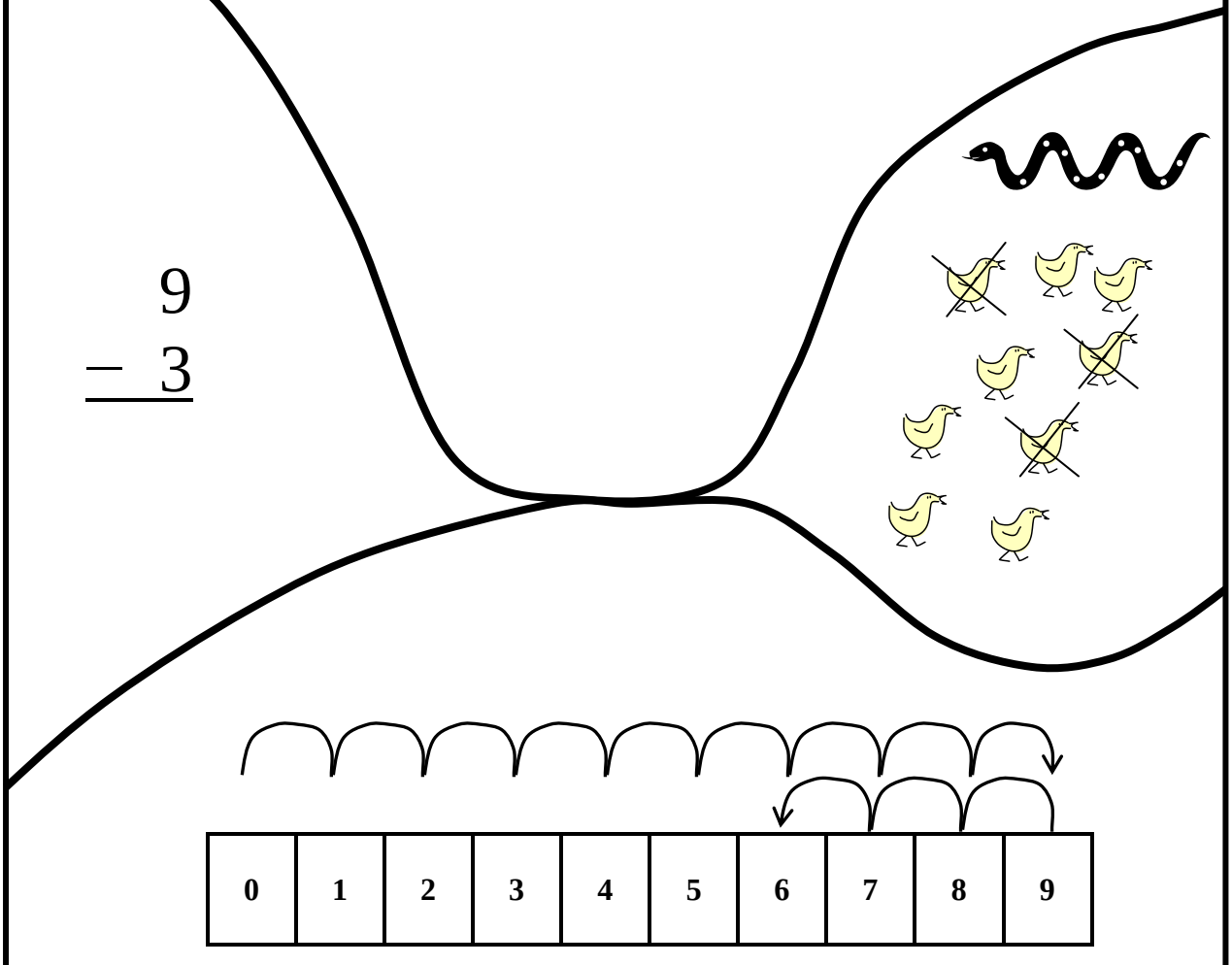
I had 9 chicks in the hen house. A carpet snake took three. What number of chicks is left?

$$\begin{array}{r} 9 \\ -\ 3 \\ \hline \end{array}$$



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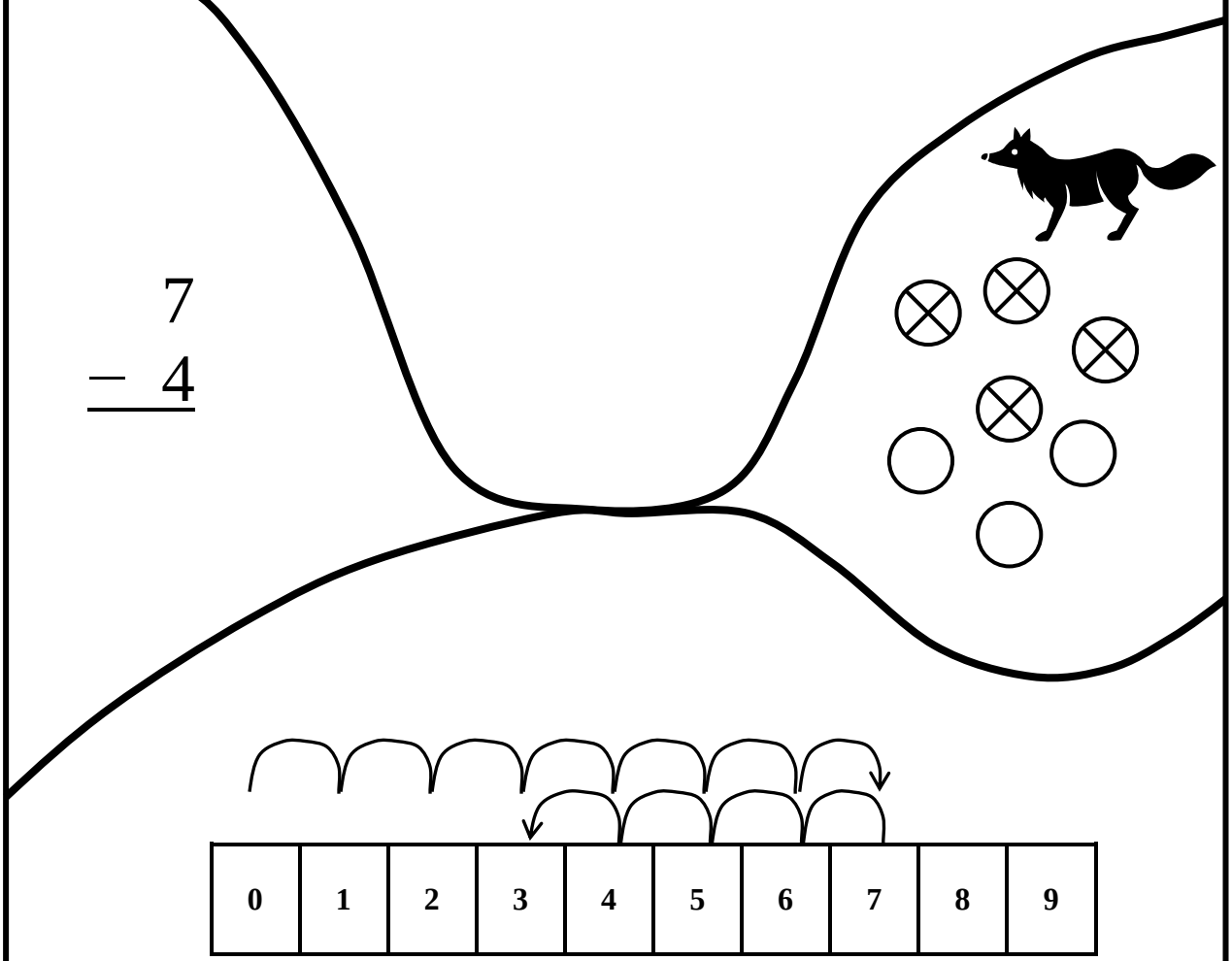
There were 7 emu eggs in the nest. A fox stole 4 eggs. How many eggs are left to hatch?

$$\begin{array}{r} 7 \\ -\ 4 \\ \hline \end{array}$$



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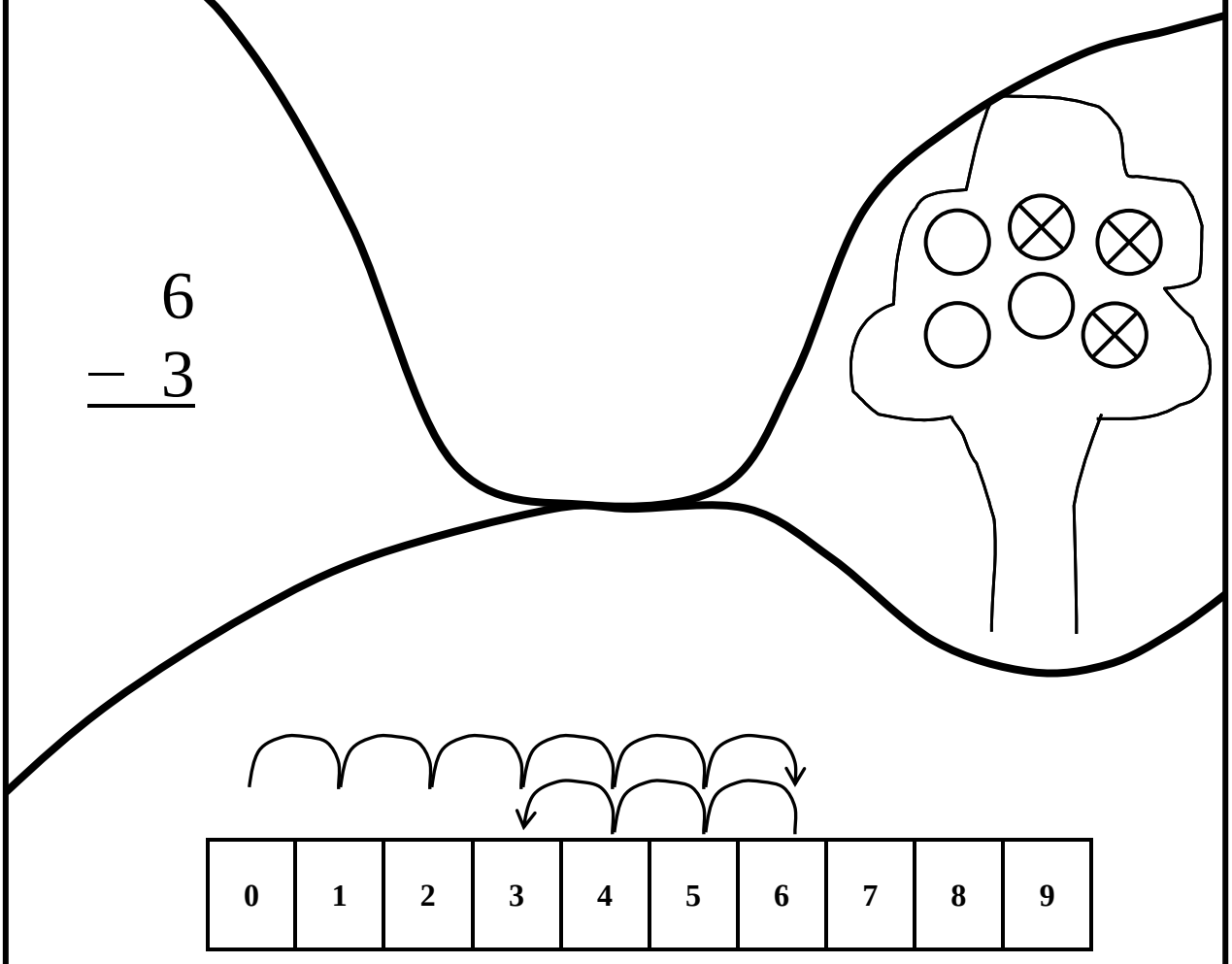
I picked 6 mangoes from the tree. 3 weren't quite ripe. How many could I eat?

$$\begin{array}{r} 6 \\ -\ 3 \\ \hline \end{array}$$



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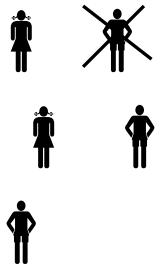
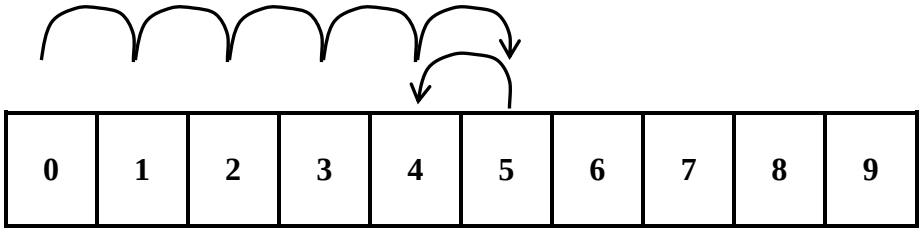
5 kids went to town for the day. 1 stayed at his aunt's place. How many kids came back?

$$\begin{array}{r} 5 \\ -\ 1 \\ \hline \end{array}$$





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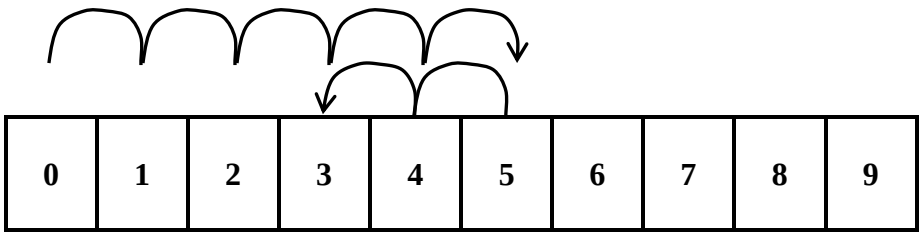
5 girls were swimming at the water. Two went home because it was cold. How many girls are left?

$$\begin{array}{r} 5 \\ -\ 2 \\ \hline \end{array}$$



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SC4 – Subtraction Cover the Board

Materials: For each operation – 1 base board, 3 sets of 12 cards
(Print in different colours)

Number of players: 2-3

Directions:

1) Use the symbols as a base board

2) Cut the other pages into 12 cards each

3) 3 players each get a set of cards (all the same type or colour)

4) In turn, each player places a card correctly on base board (card and board have to have same operation) or on top of another card already placed.

5) At the end, player with most cards on top wins.

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SC4 – Subtraction Cover the Board Baseboard

$\begin{array}{r} 6 \\ -\ 1 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -\ 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -\ 4 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ -\ 5 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -\ 2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -\ 5 \\ \hline \end{array}$
$\begin{array}{r} 7 \\ -\ 4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -\ 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -\ 1 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ -\ 2 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -\ 4 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -\ 3 \\ \hline \end{array}$

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SC4 – Subtraction Cover the Board Cards

6 take 1	3 minus 1	5 take away 4
8 subtract 5	4 less 2	7 minus 5
7 take away 4	9 less 3	4 take away 1
9 reduced by 2	6 minus 4	6 take away 3

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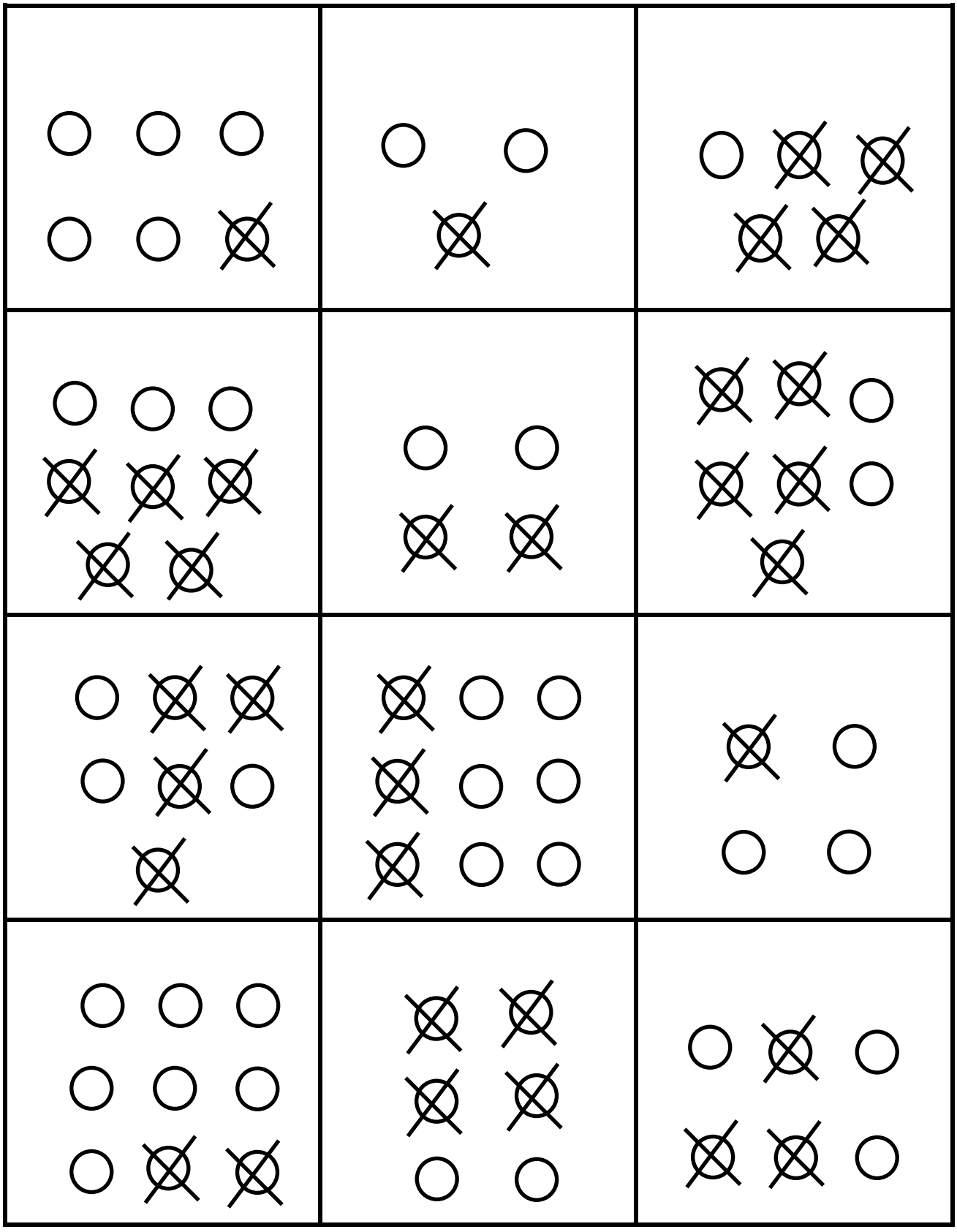
SC4 – Subtraction Cover the Board Cards



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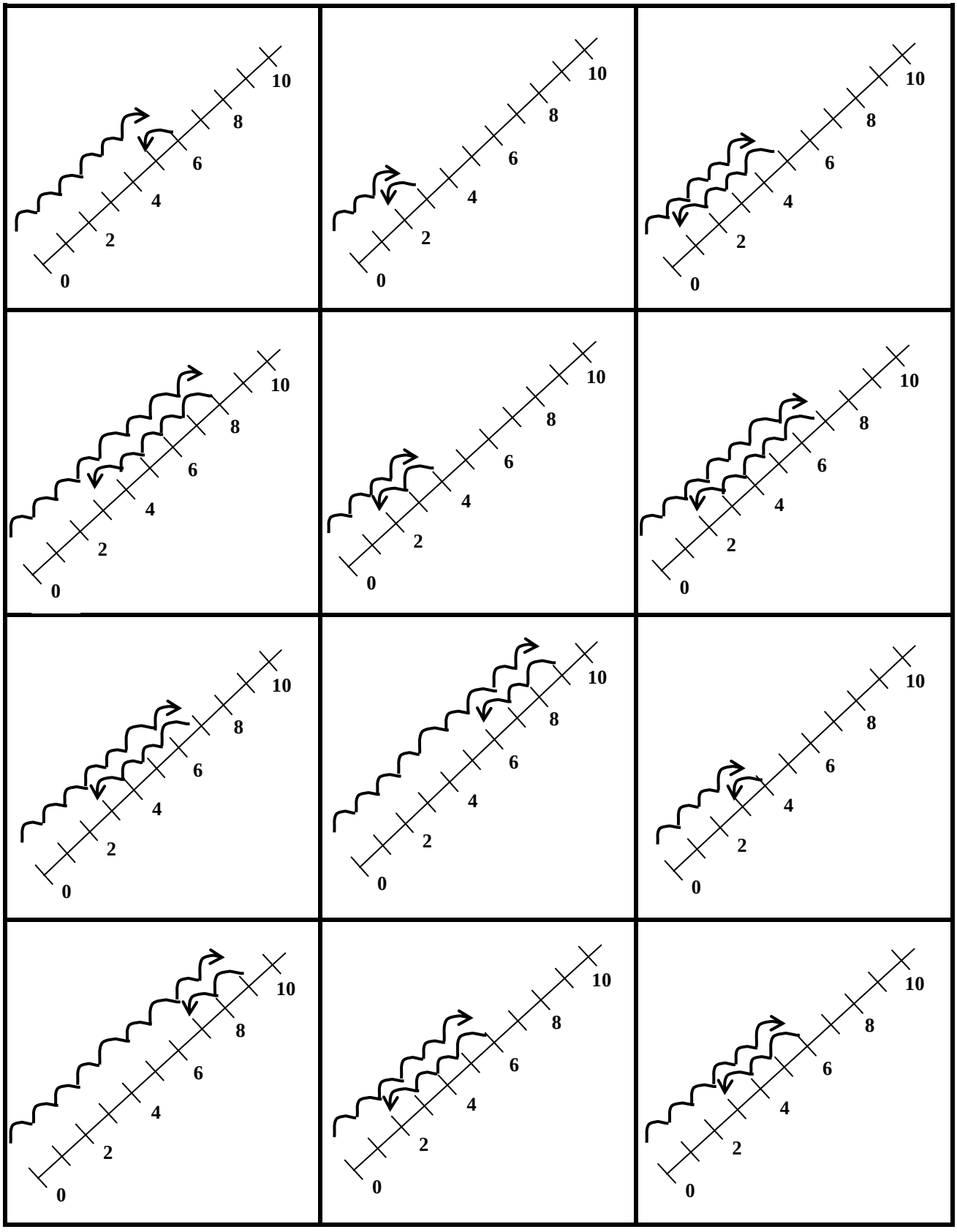
SC4 – Subtraction Cover the Board Cards



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SC4 – Subtraction Bingo

Materials: Three boards (12 squares on each A4 page), counters
Flash cards (2 on each A4 page)

Number of players: 2-3

Directions:

1) Cut up flash cards and shuffle

2) Displayer shows cards one at a time

3) Players cover same operation on board with counter

4) First player to get 3 in a row (across, down or diagonal) is the winner.

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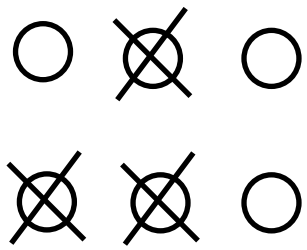
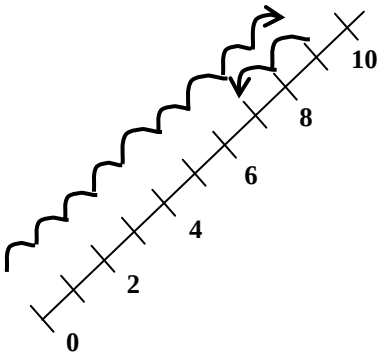
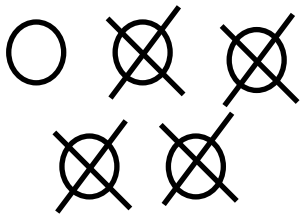
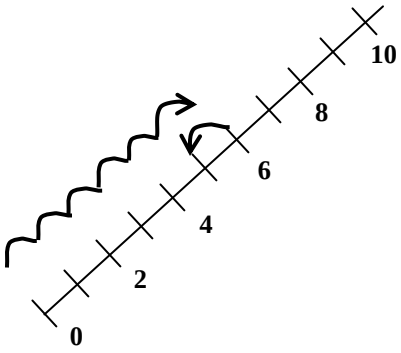
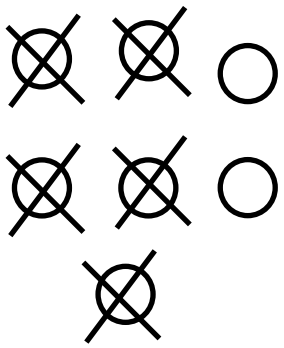
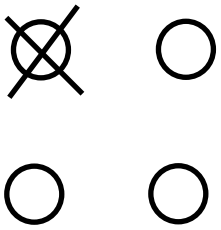
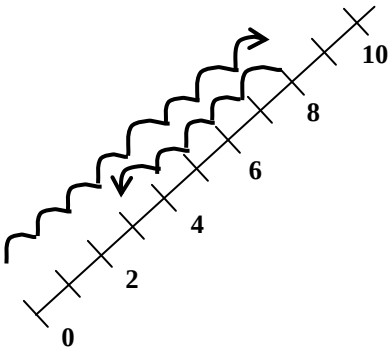
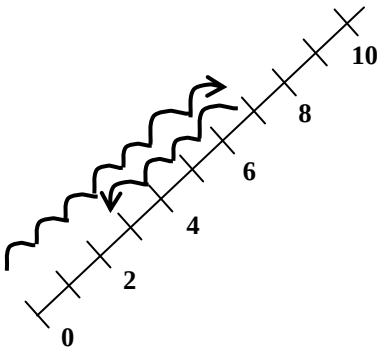
SC4 – Subtraction Bingo Cards

	4 subtract 2	
		
9 minus 3	3 take 1	
	6 subtract 4	

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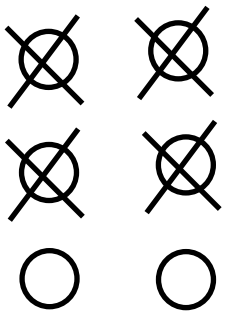
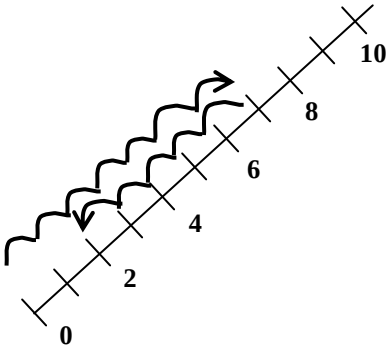
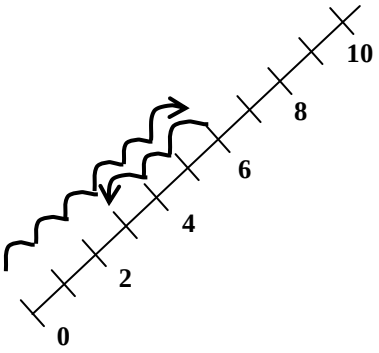
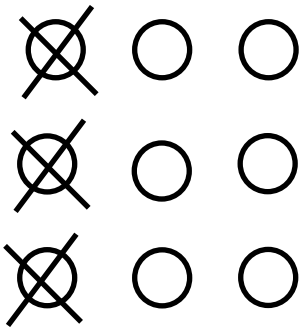
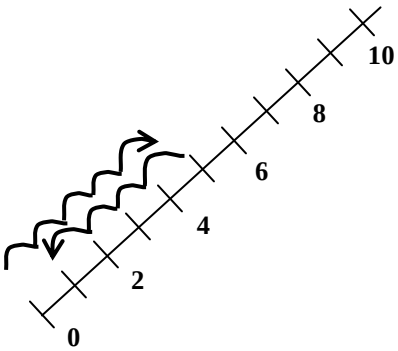
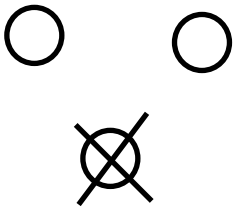
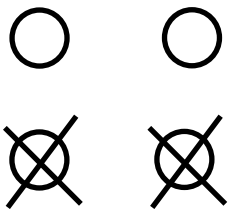
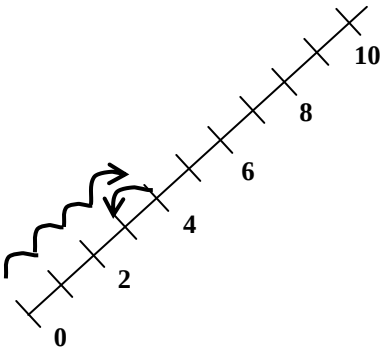
		9 take 2
	6 subtract 1	
7 minus 4		
8 take 5		

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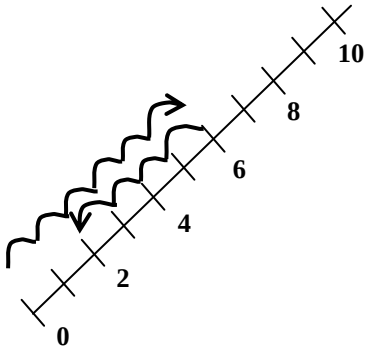
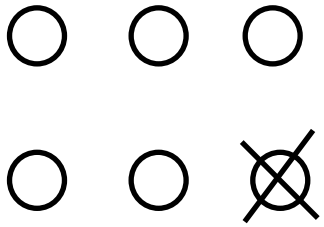
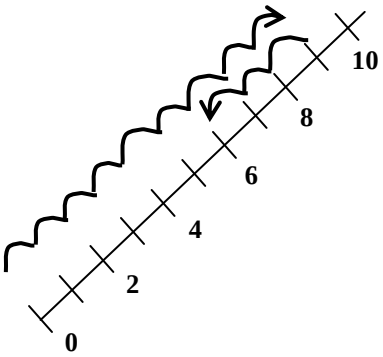
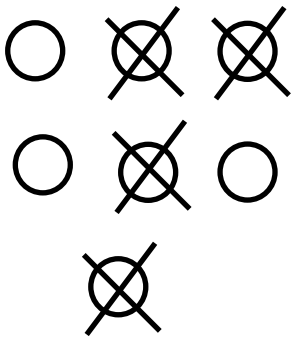
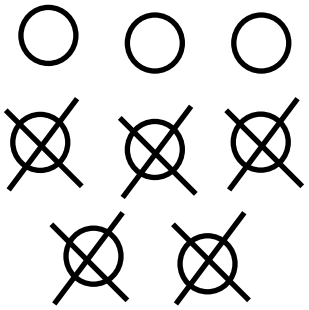
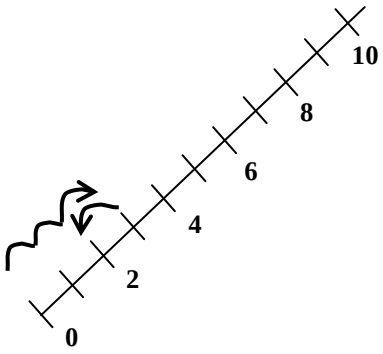
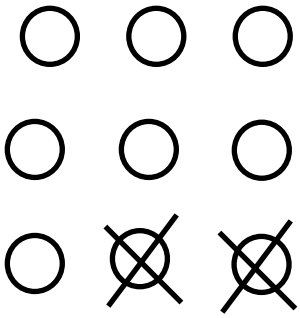
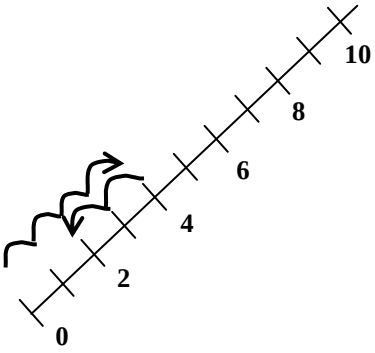
		
7 minus 5		5 subtract 4
		6 take 3
	4 subtract 1	

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$$\begin{array}{r} 6 \\ -\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ -\ 3 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ -\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -\ 2 \\ \hline \end{array}$$

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$$\begin{array}{r} 7 \\ -\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -\ 3 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ -\ 2 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ -\ 5 \\ \hline \end{array}$$

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$$\begin{array}{r} 6 \\ -\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ -\ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ -\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ -\ 5 \\ \hline \end{array}$$