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Math Projects: Arithmetic

with Robo Wunderkind Robotics Kit

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Key Information

Topic: Mathematics **Grades:** 1–2 **Group size:** 6–12 students

The Math Projects: Arithmetic are **story-based** activities linked by one theme **Robo communicating with other robots and encoding and decoding different ciphers, secret codes, and maps.** In this story, Robo is a small robot that wants to communicate with other robots by making and sending different signals in a way of ciphers, but it needs to learn some mathematical skills for that. Students will help Robo discover the world of mathematics and learn how to make and receive different ciphers. By doing so, they will **learn new concepts, consolidate their knowledge** in Mathematics, and **apply them to real-life situations.**

Implementation: The Math Projects can be used as **individual lessons** as well as an **additional activity** during math lessons. They are linked by one storyline but can be used separately as well.

Duration: 15-45 minutes (as an additional activity or an individual lesson).

Complexity: Each project includes the basic level as well as a possible modification – additional activity. This opens the possibility of adapting the complexity level of the project to the specific needs of your students.

Evaluation and supporting materials: Use either Activity cards #1-5 or Worksheets #1-5 to set challenges for students, track, and evaluate their progress. You might use printable modules and coding actions' images to make your teaching more visual.

Recommended Prior Knowledge:

- Prior knowledge in Mathematics such as Even and Odd numbers, Addition, Subtraction, Multiplication, Division, Orders of operations, Brackets;
- Basic understanding of Robo Wunderkind modules: Main Block, RGB Light, DC Motors;
- Basic understanding of the Robo Code App and its coding logic.

Materials Required:

- Robo Wunderkind robotics kit(s);
- Tablet(s);
- Some materials to customize robots and create an environment: Lego™ bricks, colored paper, cardboard, etc.
- Supporting materials: challenge cards, worksheets; Optional: printable modules' and coding actions' images.

Mathematical, Robotics, and Computer Science Concepts Covered in Math Projects

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Concepts	Project 1	Project 2	Project 3	Project 4	Project 5
Mathematics					
Even and odd numbers	+				
Addition		+			+
Subtraction		+			+
Multiplication			+		+
Division				+	+
Order of Operations *(Optional for more advanced students)*		+	+	+	+
Brackets *(Optional for more advanced students)*		+	+	+	+
Robotics					
Robotics, Engineering	+	+	+	+	+
Electricity	+	+	+	+	+
Design Thinking Process:					
• (Mechanical) Build Design	+	+	+	+	+
• Code Design	+	+	+	+	+
Outputs: Functions of modules					
1) Outputs: Sounds					+
2) Outputs: (RGB) Light	+	+			+
3) Outputs: DC Motors			+	+	+
Computer Science					
Programming, code	+	+	+	+	+
State-Machine Based Programming:					
1) Action		+	+	+	+
2) Connection		+	+	+	+
3) State					+
User input: Parameters	+	+	+	+	+
Digital literacy	+	+	+	+	+
Algorithm	+	+	+	+	+
Engineering Design Process	+	+	+	+	+

Learning Outcomes Which Correspond with the Elementary School Curriculum in Mathematics

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I. Number Sense, Numeration, Algebraic Thinking:

- I know and can use cardinal and ordinal **numbers up to 100;**
- I can identify numbers as **odd or even;**
- I can describe orally what makes a number either odd or even;
- I can compare orally odd and even numbers;
- I can analyze the given numbers to **find patterns** and **hypothesize orally** about what patterns are found;
- I can **write** about the **patterns** found;
- I can **count** by 1s, 2s, 5s, and 10s to 100;
- I can **compare** and **order** whole numbers to 100;
- I can model **addition and subtraction situations** by writing addition and subtraction number sentences;
- I can add and subtract using **mental strategies;**
- I can **formulate addition and subtraction stories;**
- I can solve addition and subtraction problems using basic facts;
- I can **recall the multiplication facts** to 10×10;
- I can recall all **division facts** to 100 using divisors up to 10;
- I can link multiplication and division as **inverse operations;**
- I can model **multiplication and division situations** by writing multiplication and division sentences;
- I can multiply and divide using **mental strategies** and write down the result;
- I can formulate **multiplication and division stories.**

II. Cognitive, Metacognitive, and Behavioral

- Can pay **attention** to the information needed to complete certain tasks (Sustained, Selective, Alternating, and Divided attention);
- Can maintain **concentration** during the time allotted for completing tasks / projects;
- Can **memorize** information for short-term tasks, as well as for long-term periods;
- Can use **spatial thinking** in order to assemble robots which work in each certain way;
- Can use the **logical and algorithmic thinking** in order to control and code the robot in a specific way;
- Can **solve the problem** using critical thinking skills: set a goal, plan, action, reflect, recreate, evaluate, accept criticism;
- Can use **imagination and creativity** to create own project;
- Can **work in pairs / small groups** and use **social skills** to create a common project;
- Can **present** the created project to the class; can receive and give **constructive feedback** on the project.

Projects' Overview

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Projects	Concepts	Complexity	Page
1. Robo sends light signals	Even and Odd numbers	☆	7
2. Robo decodes a secret message	Addition and/or Subtraction	☆	11
3. Robo decodes a secret map	Multiplication	☆☆	15
4. Robo travels to Robot City	Division	☆☆	19
5. Robo meets robots in Robot City	Addition, Subtraction, Multiplication, Division	☆☆☆	23

Project 1: Robo Sends Light Signals

Concepts: Even and Odd Numbers

Complexity: ★☆☆

Robo's Story:

Some robots can speak and some cannot, but there are many different types of communication between robots, such as different light signals, secret codes, or ciphers. Can our Robo speak? Can we teach it to make a cipher using the light signals?

Problem Situation:

Robo can make sounds but cannot really speak, so it wants to learn how to create a cipher by using light signals and also how to communicate with other robots.

Project goal:

Build a Robo-Encoder and program it to create a light signals cipher.

Project 1: Robo Sends Light Signals

Modules:


Main Block


RGB LED


Connector Block


Wheels


Connector

Program:


Visuals → Constant Light → Blink

Focus:

- **Mathematics:** Even and odd numbers;
- **Robotics:** Output – Main Block, RGB Light;
- **Computer Science:** User input – Action's settings, Sequential code, Parallel execution.

Objectives:

- To build a Robo-Encoder and create a simple program that includes different Sounds and Visuals, considering the knowledge about even and odd numbers, and set challenges.

Learning Outcomes:

- I can build a Robo-Encoder using the modules needed for a project: Main Block, RGB Light, and any of the functional modules;
- I can create a sequential logic program (or a program with parallel execution) that includes different Sounds, Visuals, and Connections between them, using the Robo Code App;
- I know the difference between the even and odd numbers and can use this knowledge to solve challenges.

Key vocabulary:

- Cipher, Even and odd numbers.

Additional Materials:

- Printable images: Main Block, RGB Light, Visuals;
- Activity card #1 or Worksheet #1;
- *Optional: Lego™ bricks, colored paper, and/or other materials.*

Project 1: Robo Sends Light Signals

Activity Stages:

Lead in *7 – 10 min*

1. **Tell Robo's Story** and together with the students identify the **problem situation** and come up with the **theoretical solution – project goal.**
2. **Ask:** Do you know what a secret code or a cipher is? Have you ever seen a cipher in a book or a movie? How do people make or encode a cipher? What are some ways to make a key for a cipher? Have you ever tried to make a cipher or a secret message for your friends? Who else uses codes?

Guided Activity *15 – 20 min*

Use Activity Card #1 or Worksheet #1 to go through the tasks together with your students.

3. **Plan:** Decide which **modules** you will need to build a Robo-Encoder and why.
   - **Main Block** – in order to make all other modules work and be able to program Robo;
   - **(RGB) Light** – so we can program light signals;
   - **Functional modules** – to modify and customize a Robo-Encoder.
4. **Build** any variation of the Robo-Encoder using the modules needed for a project.
5. **Set challenges** for students.
   - **Class discussion: Recall** the knowledge about even and odd numbers programming different **Visuals** in the Robo Code App.
   - **Pair work: Encode a message** programming different Visuals in Robo Code App.
   - **Pair or group work: Create your own cipher.** Ask students to create their **own key for a cipher using the even numbers only / the odd numbers only** and encode the messages as light signals in Robo Code App.
   - **Presentation: Share the ciphers or messages** you created with your class.

   OR

   - **Competition:** Organize a short competition in which students need to **decode the messages** of their classmates.
6. **Sum up: What is an even / odd number?** How do you **identify** if a number is even or odd? How did we use **even and odd numbers** to encode a cipher?

Reflexion & Feedback *5 – 7 min*

7. **Reflect** on what you have learned or practiced.
   Receive feedback: Were there any difficult moments during the building process or while solving the problem?

Project 1: Robo Sends Light Signals

Challenges and Answers

Hand-outs:

Worksheet #1

or

Activity card #1

1 **Class discussion: Recall** the knowledge about even and odd numbers programming **Constant Light and Blink actions** in the Robo Code App.

- Program **Constant Light action(s)** with the Lifespans **2,4,6,8,10 seconds.** What do all these numbers have in common? => They are even numbers.
- Program **Blink action(s)** with the Lifespans **1,3,5,7, 9 seconds.** What do all these numbers have in common? => They are odd numbers.
- Program 2-4 **Constant Light actions** with the Lifespans to be equal to **only even numbers.** Arrange the numbers in **ascending / descending order.**
- Program 2-4 **Blink actions** with the Lifespans to be equal to **only odd numbers**. Arrange the numbers in **ascending / descending order.**
- **Change the code,** so all Constant Light actions equal odd numbers and all Blink actions equal even numbers.
  How did you do that? Program the **Lifespans of all red and blue Visuals to be equal to odd numbers** and then the **Lifespans of all yellow and green Visuals – even numbers.**

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2 **Pair work: Encode a message.**

- Give students the special **Cipher Key** to encode a cipher.
- **Ask:** What type of messages are even numbers / odd numbers? **Conclude:** Even numbers – statements; odd numbers – questions.
- Students work in pairs to **encode the messages** programming Visuals in the Robo Code App. **Check** the right code(s) together.
- Ask students to **create their own messages** using the same cipher key. **Share and discuss** the codes they created.
- Students can work in **small groups** and program their robots to talk to each other.

Cipher Key: See the Activity card #1 or Worksheet #1.

Messages:		**Answers (number of blinks):**
1) “Hi! I am Robo! What is your name?”	→	2, 4, 3
2) “How are you? What is your name? I want to play together! Do you want to learn math?”	→	1, 3, 8, 9
3) “I am a very friendly robot. I want to be friends with you! Do you want to play together?	→	10, 6, 5
4) “I am Robo. I am a very friendly robot. What is your name? What kind of robot are you?	→	4, 10, 3, 7

Project 2: Robo Decodes a Secret Message

Concepts: Addition and/or Subtraction

Complexity: ★☆☆

Robo's Story:

Robo received a cipher – a message from the other robots. There is a key for decoding it but Robo will need our help to do it.

Problem Situation:

Robo needs to decode a message using a special key.

Project goal:

Build a Robo-Decoder and program different Visuals and Sounds using the key in order to decode a cipher-message.

Project 2: Robo Decodes a Secret Message

Modules:


Main Block


RGB LED


Connector Block


Wheels


Connector


Wired Connector

Program:


Visuals → Constant Light → Blink

Focus:

- **Mathematics:** Addition and/or Subtraction;
- **Robotics:** Output – Main Block, RGB Light;
- **Computer Science:** User input – Action's settings, Sequential code, Parallel execution.

Objectives:

- To build a Robo-decoder and create a simple program that includes different Sounds and Visuals considering the knowledge about addition or/and subtraction, and set challenges.

Learning Outcomes:

- I can build a Robo-Decoder using the modules needed for a project: Main Block, RGB Light and any of the functional modules;
- I can create a sequential logic program (or a program with parallel execution) that includes Sounds, Visuals, and the Connections between them using the Robo Code App;
- I know the principles and rules of Addition and/or Subtraction and can use them to solve challenges.

Key vocabulary:

- Addition and/or Subtraction.

Additional Materials:

- Printable images: Main Block, RGB Light, Functional modules, Visuals, Sounds;
- Activity card #2 or Worksheet #2;
- *Optional: Lego™ bricks, colored paper, and/or other materials.*

Project 2: Robo Decodes a Secret Message

Activity Stages:

Lead in *7 – 10 min*

1. **Tell Robo's Story** and together with the students identify the **problem situation** and come up with the **theoretical solution – project goal.**
2. **Ask:** Do you know what a secret code or cipher is? What does it mean to "decode" a cipher? Have you ever tried to decode a cipher or secret message? Who else uses secret codes?*(Optional: Recall the previous Math Project with Robo.)*

Guided Activity *15 – 20 min*

Use Activity Card #2 or Worksheet #2 to go through the tasks together with your students.

3. **Plan:** Decide which modules you will need to build a Robo-Decoder and why:
   - **Main Block** – in order to make all other modules work and be able to program Robo;
   - **(RGB) Light** – so we can program light signals;
   - **Functional modules** – to modify and customize a Robo-Encoder.
4. **Set challenges** for students.
   - **Class discussion: Recall** the knowledge about **Addition and/or Subtraction** programming different **Visuals** in the Robo Code App.
   - **Pair work: Decode a message** programming different Visuals in the Robo Code App.
   - **Pair or group work: Create your own cipher.** Ask students to create their **own key for a cipher** using **Addition and/or Subtraction** and decode the messages programming light signals in the Robo Code App.
   - **Presentation: Share the ciphers or messages** you created with your class.

   OR
   - **Competition:** Organize a short competition in which students **decode the messages of their classmates.**
5. **Sum up:** The rules of **Addition and/or Subtraction.** How did it help us to decode the message?

Reflexion & Feedback *5 – 7 min*

6. **Reflect** on what you have learned or practiced.

   Receive feedback: Were there any difficult moments during the building process or while solving the problem?

Project 2: Robo Decodes a Secret Message

Challenges and Answers

Hand-outs:

Worksheet #2

or

Activity card #2

1 **Class discussion: Recall** the knowledge about **Addition and/or Subtraction** programming different **Visuals** in the Robo Code App.

- Program **Blink actions –** calculate the number of blinks: 1 + 3, 2 + 3, 7 + 1, 4 + 2; 10 − 1; 9 − 3; 2 − 1; 7 − 4 etc.
- **Calculate and program** Blink actions with the Lifespans: 4 times + 2 times + 1 time + 3 times
- **Calculate and program** Constant Light actions with the Lifespans: 10 sec − 3 sec − 2 sec − 2 sec
- **Calculate and program** Constant Light and Blink actions with the Lifespans: 4 times + 1 time − 2 times + 5 times + 2 times − 5 times; etc.
- **Calculate and program** 5 Blink actions: the Lifespans of each Action is 2 sec longer than the previous one. What are the Lifespans?
- **Calculate and program** 5 Constant Light actions: the Lifespans of each Action is 2 sec shorter than the previous one. What are the Lifespans?

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2 **Pair work: Encode a message.**

- Give students the special **Cipher Key** to decode a cipher – **Addition and/or Subtraction sentences.**
- Students work in pairs to **decode the messages** programming Visuals in the Robo Code App. **Check** the right code(s) together.
- Ask students to **create their own messages** using the same cipher key. **Share and discuss** the codes they created.
- Students can work in **small groups** and program their robots to talk to each other.

Cipher Key: See Activity card #2 or Worksheet #2.

Ciphers – Addition and/or Subtraction sentences		**Answers**		**Messages:**
1) 2 + 3; 1 + 1; 6 − 5	→	5, 2, 1	→	Hello Robo! We are friendly robots. We live in Robot City.
2) 3 + 4; 10 − 7; 3 + 3	→	7, 3, 6	→	We want to be your new friends. Do you want to be our new friend? Visit us in Robot City!
3) 10 − 7 + 1; 3 + 4 − 1; 10 − 1 − 1	→	4, 6, 8	→	Do you like traveling? Visit us in Robot City! Can you drive?
4) 2 + 2 − 2; 1 + 1 + 8; 5 − 1 + 5	→	2, 10, 9	→	We are friendly robots. Do you know other robots? We hope to see you soon!

Project 3: Robo Decodes a Secret Map

Concepts: Multiplication

Complexity: ★★☆

Robo's Story:

Robo received a secret message from the other robots – it's a map to Robot City. It is written in a special cipher and Robo needs to decode it.

Problem Situation:

Robo needs to decode a map.

Project goal:

Build a Robo-vehicle and code different Movements to decode the secret map.

Project 3: Robo Decodes a Secret Map

Modules:


Main Block


DC Motors x2


Wheels x2


Small Wheel


Connector x2

Program:


Movement → Drive → Turn

Focus:

- **Mathematics:** Multiplication;
- **Robotics:** Output – Main Block, DC Motors;
- **Computer Science:** User input – Action's settings, Sequential code, Parallel execution.

Objectives:

- To build a Robo-vehicle and to create a simple program that includes different Sounds and Movements, considering the knowledge about Multiplication, and set challenges.

Learning Outcomes:

- I can build a Robo-vehicle using the modules needed for a project: Main Block, DC Motors, and any of the functional modules;
- I can create a sequential logic program (or a program with Parallel execution) that includes different Sounds, Movements and Connections between them using the Robo Code App;
- I know the principles and rules of Multiplication and can use it to solve challenges.

Key vocabulary:

- Multiplication.

Additional Materials:

- Printable images: Main Block, RGB Light, Functional modules, Visuals, Sounds;
- Activity card #3 or Worksheet #3;
- *Optional: Lego™ bricks, colored paper, and/or other materials.*

Project 3: Robo Decodes a Secret Map

Activity Stages:

Lead in *7 – 10 min*

1. **Tell Robo's Story** and together with the students identify the **problem situation** and come up with the **theoretical solution – project goal.**
2. **Ask:** What is a secret code or secret map? What does it mean to "decode" a map? Have you ever tried to decode a cipher or secret map? Who else uses secret codes or maps? *(Optional: Recall the previous Math Project (s) with Robo.)*

Guided Activity *15 – 20 min*

Use Activity card #3 or Worksheet #3 to go through the tasks together with your students.

3. **Plan:** Decide which modules you will need to build a Robo-Decoder and why:
   - **Main Block** – in order to make all other modules work and to be able to program Robo;
   - **(DC) Motors –** so we can program Robo-vehicle to drive;
   - **Functional modules** – to modify and customize a Robo-vehicle.
4. **Set challenges** for students.
   - **Class discussion: Recall** the knowledge about **Multiplication** programming different **Movement** in the Robo Code App.
   - **Pair work: Decode a map** programming different Visuals in the Robo Code App.
   - **Pair or group work: Create your own secret map.** Ask students to create their **own key for a cipher** using **the Multiplication sentences** and create a **secret map** programming different **Movement** in Robo Code App.
   - **Presentation: Share the cipher key and the map** you created with your class.

   OR
   - **Competition:** Organize a short competition in which students need to **decode the maps of their classmates.**
5. **Sum up:** The rules of **Multiplication.** How did it help us to decode the map?

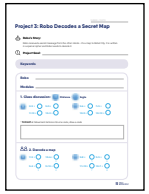
Reflexion & Feedback *5 – 7 min*

6. **Reflect** on what you have learned or practiced.
   Receive feedback: Were there any difficult moments during the building process or while solving the problem?

Project 3: Robo Decodes a Secret Map

Challenges and Answers

Hand-outs:



Worksheet #3

or

Activity card #3

1 **Class discussion: Recall** the knowledge about **Multiplication** programming different **Movement** in the Robo Code App.

- Program **Drive actions – calculate the Distance:** 3×5, 7×10, 5×5, 10×3;
- Program **Turn actions – calculate the Angle:** 5×6, 10×9, 7×5, 10×10;
- Connect all Movement Actions into one code.

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2 **Pair work: Encode a message.**

- Give students the special **Cipher Key** to decode a map – **Multiplication sentences**.
- Students work in pairs to **decode the map** programming Movement in the Robo Code App. **Check** the right code(s) together.
- Ask students to **add their own Movement into the secret map** using the Multiplication sentences. **Share and discuss** the codes they created.
- Students can work in **small groups** and program their robots to talk to each other.

Cipher Key: See Activity card #3 or Worksheet #3.

Map Cipher: Multiplication sentences = Answers – Movement

↑ (1) 7 × 5 = 35	(2) 10 × 6 = 60	(4) 5 × 4 = 20	(3) 9 × 10 = 90
↻ (5) 5 × 8 = 40	(6) 9 × 5 = 45	(7) 11 × 10 = 110	(8) 10 × 7 = 70

Map Code in the right order

(1) → (8) → (2) → (4) → (7) → (6) → (5) → (3)

↑ 35 → ↻ 70 → ↑ 60 → ↑ 90 → ↻ 110 → ↻ 45 → ↻ 40 → ↑ 20

Project 4: Robo Travels to Robot City

Concepts: Division

Complexity: ★★☆

Robo's Story:

Last time Robo decoded a secret map. Now it is ready to travel to Robot City and meet other robots.

Problem Situation:

Robo needs to travel to Robot City.

Project goal:

Build a Robo-traveller and code different Movement to travel to Robot City.

Project 4: Robo Travels to Robot City

Modules:


Main Block

DC Motors


RGB LED

Wheels


Small Wheel

Connector

Program:


Visuals


Constant Light


Blink


Movement


Drive


Turn

Focus:

- **Mathematics:** Division;
- **Robotics:** Output – Main Block, DC Motors;
- **Computer Science:** User input – Action's settings, Sequential code, Parallel execution.

Objectives:

- To build a Robo-vehicle and create a simple logic program that includes different Sounds and Movement, considering the knowledge about Multiplication, and set challenges.

Learning Outcomes:

- I can build a Robo-vehicle using the modules needed for a project: Main Block, DC Motors, and any of the functional modules;
- I can create a sequential logic program (or a program with Parallel execution) that includes different Sounds, Movement and Connections between them using the Robo Code App;
- I know the principles and rules of Division and can use it to solve challenges.

Key vocabulary:

- Division.

Additional Materials:

- Printable images: Main Block, RGB Light, Functional Modules, Visuals, Sounds;
- Activity card #4 or Worksheet #4;
- *Optional: Lego™ bricks, colored paper, and/or other materials.*

Project 4: Robo Travels to Robot City

Activity Stages:

Lead in *7 – 10 min*

1. **Tell Robo's Story** and together with the students identify the **problem situation** and come up with the **theoretical solution – project goal.**
2. **Ask:** What is a secret code or secret map? What does it mean to "decode" a map? Have you ever tried to decode a cipher or secret map? Who else uses secret codes or maps? *(Optional: Recall the previous Math Project(s) with Robo.)*

Guided Activity *15 – 20 min*

Use Activity card #4 or Worksheet #4 to go through the tasks together with your students..

3. **Plan:** Decide which modules you will need to build a Robo-traveller and why:
   - **Main Block** – in order to make all other modules work and be able to program Robo;
   - **(DC) Motors** – so we can program Robo-Robo-traveller to drive;
   - **Functional Modules** – to modify and customize a Robo-vehicle.
   - ***Optional:*** *Add RGB Light and program different Visuals.*
4. **Set challenges** for students.
   - **Class discussion: Recall** the knowledge about **Division** programming different **Movement** in the Robo Code App.
   - **Pair work: Decode a map and travel** programming different Movement in the Robo Code App.
   - **Pair or group work: Create your own secret map.** Ask students to create their **own key for a cipher** using the **Division sentences** and create a **secret map** programming different **Movement** in Robo Code App.
   - **Presentation: Share the cipher key and the map** you created with your class.

   OR
   - **Competition:** Organize a short competition in which students need to **decode the maps of their classmates.**
5. **Sum up:** The rules of **Division.** How did it help us to decode the map?

Reflexion & Feedback *5 – 7 min*

6. **Reflect** on what you have learned or practiced.
   Receive feedback: Were there any difficult moments during the building process or while solving the problem?

Project 4: Robo Travels to Robot City

Challenges and Answers

Hand-outs:

Worksheet #4

or

Activity card #4

1 **Class discussion: Recall** the knowledge about **Division** programming different **Movement** in the Robo Code App.
Use the given examples or come up with your own sentences depending on your students' needs.

- Program **Drive actions – calculate the Distance:** 80 ÷ 2, 100 ÷ 5, 180 ÷ 3, 1200 ÷ 60;
- Program **Turn actions – calculate the Angle:** 90 ÷ 3, 180 ÷ 2, 280 ÷ 4, 6000 ÷ 20;
- **Connect** all Movement Actions into one code.

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2 **Pair work: Decode a map and travel.**

- Give students the special **Cipher Key to decode a map** and **travel to Robot City – Division sentences.**
- Students work in pairs to **decode the map** and **travel to Robot City** programming Movement (Optional: Visuals) in the Robo Code App. **Check** the right code(s) together.
- Ask students to add **their own Movement into the Robo's journey** using the Division sentences. **Share and discuss** the codes they created.
- Students can work in **small groups** and program their robots to talk to each other.

Cipher Key: See Activity card #4 or Worksheet #4.

Map Cipher: Division sentences = Answers – Movement

↑	① 70 ÷ 2 = 35	② 100 ÷ 4 = 20	③ 1400 ÷ 20 = 75	④ 9000 ÷ 100 = 90
↻	⑤ 80 ÷ 8 = 10	⑥ 90 ÷ 2 = 110	⑦ 1800 ÷ 30 = 60	⑧ 1000 ÷ 10 = 100

Map Code in the right order

④ → ⑤ → ⑦ → ③ → ⑥ → ① → ⑧ → ②

↑ 90 → ↻ 10 → ↻ 60 → ↑ 75 → ↻ 110 → ↑ 35 → ↻ 100 → ↑ 20

Project 5: Robo in Robot City Communicates with Other Robots

Concepts: Addition, Subtraction, Multiplication, Division

Complexity: ★★★

Robo's Story:

Robo arrives in Robot City, ready to meet other robots. It will need to make different light signals, sounds, and movements to decode and encode ciphers and communicate with other robots.

Problem Situation:

Robo needs to send and receive messages and communicate with other robots.

Project goal:

Build a Robo-creature and code different Movement, Visuals, and Sounds to encode and decode different messages in order to communicate with other robots.

Project 5: Robo in Robot City Communicates with Other Robots

Modules:


Main Block

DC Motors


RGB LED

Wheels


Small Wheel

Connector

Program:


Visuals


Constant Light


Blink


Movement


Drive


Turn


Sounds

Focus:

- **Mathematics:** Even/Odd numbers, Addition, Subtraction, Multiplication, Division;
- **Robotics:** Output – Main Block, RGB Light, DC Motors;
- **Computer Science:** User input – Action's settings, Sequential code, Parallel execution.

Objectives:

- To build a Robo-vehicle and create a simple logic program that includes different Sounds, Visuals, and Movement considering the knowledge about Even/Odd numbers, Addition, Subtraction, Multiplication, Division, and set challenges.

Learning Outcomes:

- I can build a Robo-creature using the modules needed for a project: Main Block, RGB Light, DC Motors, and any of the functional modules;
- I can create a sequential logic program (or a program with Parallel execution) that includes different Sounds, Visuals, Movement and Connections between them using the Robo Code App;
- I know the principles and rules of Even/Odd numbers, Addition, Subtraction, Multiplication, Division and can use this knowledge to solve challenges.

Key vocabulary:

- Even and Odd numbers, Addition, Subtraction, Multiplication, Division.

Additional Materials:

- Printable images: Main Block, RGB Light, Functional modules, Visuals, Sounds;
- Activity card #5 or Worksheet #5;
- *Optional: Lego™ bricks, colored paper, and/or other materials.*

Project 5: Robo in Robot City Communicates with Other Robots

Activity Stages:

Lead in
7 – 10 min

1. **Tell Robo's Story** and together with the students identify the **problem situation** and come up with the **theoretical solution – project goal.**
2. **Ask:** What does it mean to decode a secret message? Have you ever tried to decode a cipher?
(Optional: Recall the previous Math Project (s) with Robo.)

Guided Activity
15 – 20 min

Use Activity card #5 or Worksheet #5 to go through the tasks together with your students.

3. **Plan:** Decide which modules you will need to build a Robo-traveller and why:
   - **Main Block** – in order to make all other modules work and be able to program Robo;
   - **(DC) Motors** – so we can program Robo-traveller to drive;
   - **(RGB) Light** – so we can program Robo to send light signalss;
   - **Functional modules** – to modify and customize a Robo-vehicle.
   - *Optional:* Create an **environment** – Robot City using different materials.
4. **Set challenges** for students.
   - **Class discussion: Recall** the knowledge about **Addition, Subtraction, Multiplication, Division** programming different **Sounds, Visuals, Movement, and Special** in the Robo Code App.
   - **Pair work: Solve the tasks** and communicate with other Robots in Robot City.
   - **Pair or group work: Create your Robot City** and program Robo to move and communicate with other robots. Ask students to create their **own key for a cipher** using the **Addition, Subtraction, Multiplication,** or **Division sentences** and write them down; create a list of tasks for Robo in Robot City.
   - **Presentation: Share the cipher key(s) and Robo challenges** you created with your class. **OR**
   - **Competition:** Organize a short competition in which students need to **solve challenges of their classmates.**

Sum up: The rules of **Addition, Subtraction, Multiplication, Division.** How did they help us to solve different challenges?

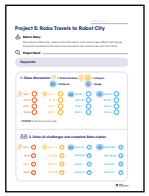
Reflexion & Feedback
5 – 7 min

6. **Reflect** on what you have learned or practiced.
Receive feedback: Were there any difficult moments during the building process or while solving the problem?

Project 5: Robo in Robot City Communicates with Other Robots

Challenges and Answers

Hand-outs:



Worksheet #5

or

Activity card #5

1 **Class discussion: Recall** the knowledge about **Addition, Subtraction, Multiplication, Division** programming different **Sounds, Visuals, Movement and Special** in the Robo Code App.

- Program **Sounds** — calculate the **ordinal number of a Sound**: 3 + 4, 15 − 6, 2 × 2, 15 ÷ 5
- Program **Constant Light or Blink actions** — calculate their **Lifespans**: 7 + 1, 18 − 17, 3 × 3, 45 ÷ 7
- Program **Drive actions** — calculate the **Distance**: 50 + 30, 100 − 40, 11 × 5, 90 ÷ 9
- Program **Turn actions** — calculate the **Angle**: 10 + 60, 90 − 75, 10 × 10, 150 ÷ 3
- **Connect** all Movement Actions into one code.

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2 **Pair work: Solve the tasks** and communicate with other Robots in Robot City.

- Give students the special **Cipher Key to solve the challenges — Addition, Subtraction, Multiplication, Division sentences.**
- Students work in pairs to **solve the challenges** and **explore Robot City** programming Sounds, Visuals and Movement in the Robo Code App. **Check** the right code(s) together.
- Ask students to **add their own challenges for Robot** using Addition, Subtraction, Multiplication and Division sentences. **Share and discuss** the codes they created.
- Students can work in **small groups** and program their robots to talk to each other.

Cipher Key: See Activity card #5 or Worksheet #5.

Map Cipher: Division sentences = Answers – Movement

① 6 + 1 = 7	⑤ 6 + 4 − 1 = 9	⑨ 90 − 5 − 5 = 80	⑬ 50 + 20 + 20 = 90
② 10 − 5 = 5	⑥ 3 − 2 + 6 = 7	⑩ 45 + 5 + 25 = 75	⑭ 300 — 40 + 20 = 280
③ 1 × 1 = 1	⑦ 2 × 2 × 2 = 8	⑪ 4 × 5 × 2 = 40	⑮ 12 / 2 * 10 = 60
④ 16 ÷ 2 = 8	⑧ 90 ÷ 3 ÷ 10 = 3	⑫ 600 ÷ 3 ÷ 2 = 100	⑯ 150 * 2 / 3 = 100

Robo's Code in the right order

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

80 → 90 → 9 → 60 → #5 → 100 → 3 → #8 → 100 → 40 → #1 → #7 → 8 → 75 → 280 → 7

Supporting Materials

robo™ wunderkind

- Worksheets for Students 1–5 15

- Actvity Cards 1–5 20