PhET Tips for Teachers

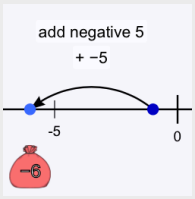
Number Line: Operations

The ***Number Line: Operations*** simulation builds on Number Line: Integers by allowing operations on signed integers. It uses net worth as a realistic context to build upon as students' understanding of operations on signed integers develops.

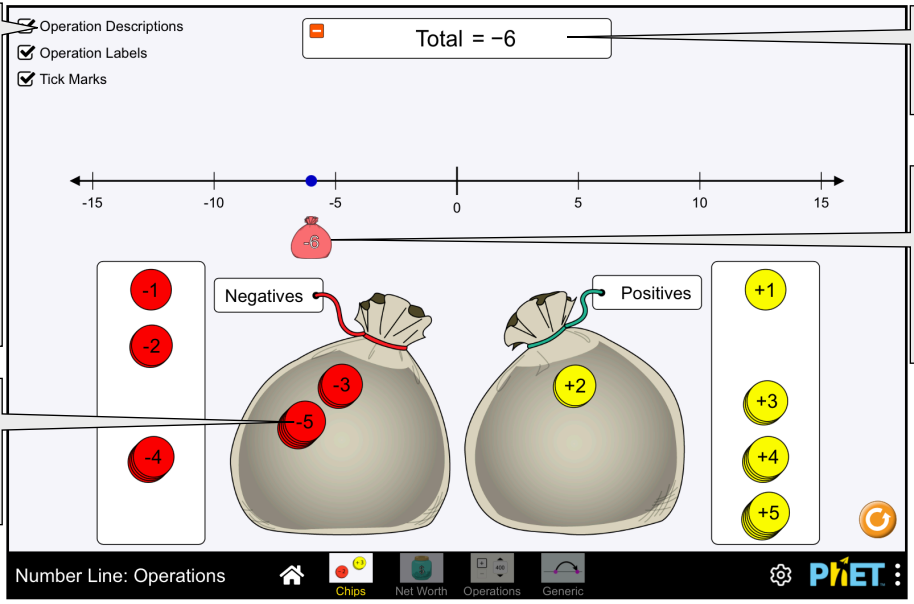
Chips Screen

In the Chips screen, students can play with adding and subtracting signed integers using a familiar chip model.

SEE the operation description



ADD OR SUBTRACT integers



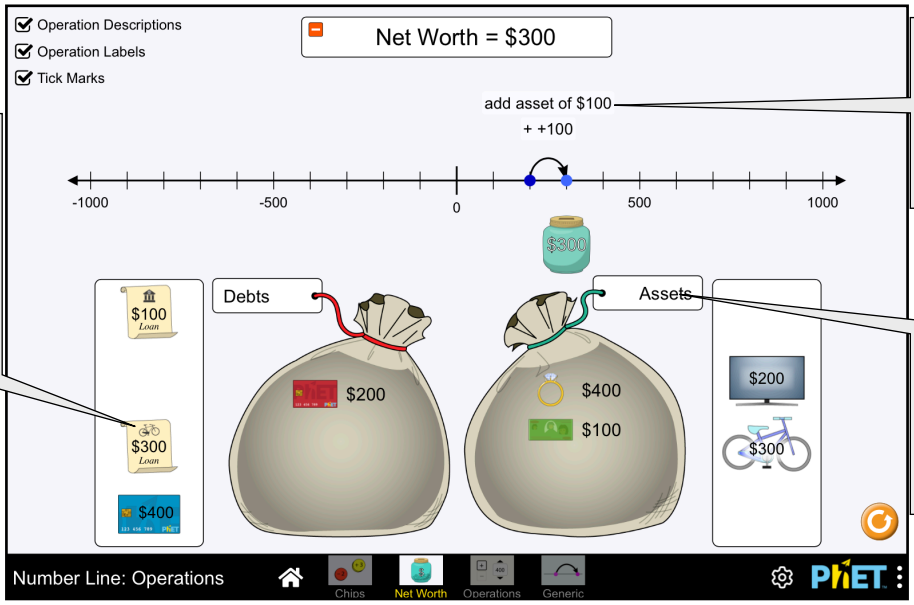
VIEW the net value of all chips

WATCH the net value change as chips are added or removed

Net Worth Screen

Here students can use a realistic context to solidify their understanding of operations with integers.

ADD OR REMOVE assets (cash, TV, bike, jewelry) and debts (loans and credit card debts)



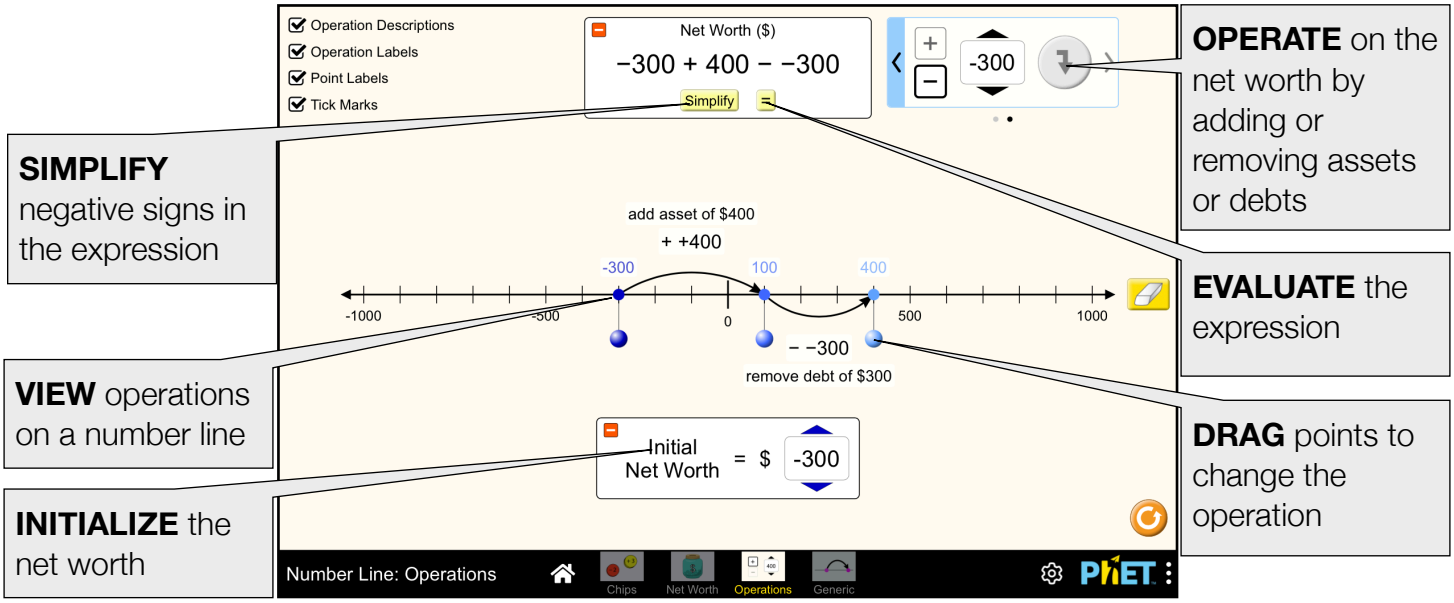
DESCRIBE the operation in the context of net worth

CONSIDER what net worth means if you have both assets and debts

McGarry, January 2024

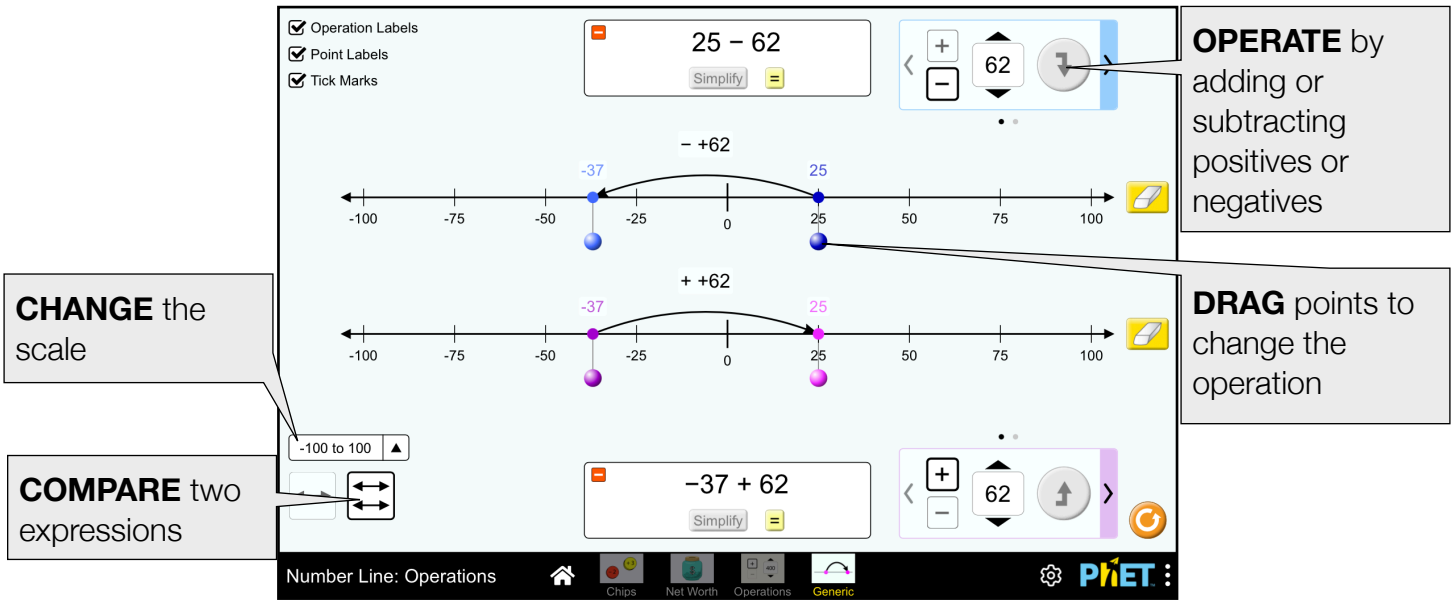
Operations Screen

The Operations screen builds on Net Worth so students can assume an initial net worth, then perform operations on it. This is a great screen for telling a story about changes to net worth.



Generic Screen

The Generic screen affords the most flexibility for using a number line to model operations with integers, tell a story with values up to 100, and solidify a more abstract understanding of operations.



McGarry, January 2024

Customization Options

Query parameters allow for customization of the simulation, and can be added by appending a '?' to the sim URL, and separating each query parameter with a '&'. The general URL pattern is:
`…html?queryParameter1&queryParameter2&queryParameter3`

For example, in Number Line: Operations, if you only want to include the 1st and 2nd screens (`screens=1,2`), with the 2nd screen open by default (`initialScreen=2`) use:
https://phet.colorado.edu/sims/html/number-line-operations/latest/number-line-operations_all.html?screens=1,2&initialScreen=2

To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/number-line-operations/latest/number-line-operations_all.html?locale=es&screens=1,2&initialScreen=2

⚙ Indicates this customization can be accessed from the Preferences menu within the simulation.

Query Parameter and Description	Example Links

`screens` - specifies which screens are included in the sim and their order. Each screen should be separated by a comma. For more information, visit the Help Center.	`screens=1`
	
	`screens=2,1`

`initialScreen` - opens the sim directly to the specified screen, bypassing the home screen.	`initialScreen=1` `initialScreen=3`
⚙ `locale` - specify the language of the simulation using ISO 639-1 codes. Available locales can be found on the simulation page on the Translations tab. Note: this only works if the simulation URL ends in "_all.html".	`locale=es` (Spanish) `locale=fr` (French)
`allowLinks` - when `false`, disables links that take students to an external URL. Default is `true`.	`allowLinks=false`
`supportsPanAndZoom` - when `false`, disables panning and zooming using pinch-to-zoom or browser zoom controls. Default is `true`.	`supportsPanAndZoom=false`

Insights into Student Use

- On the Net Worth screen, students may think of assets as "buying something" and debts as how they pay for it. Teachers can help students by introducing the lesson with an exploration of net worth of students' favorite celebrities, and discuss what that means for the celebrity. Teachers can ask questions such as, "Is that how much money the celebrity makes? How can one have a net worth of $25 million but make $50 million in a month?"
- Students might continue to think about money and net worth when they get to the Generic screen, so it can help to ask them what else those numbers could represent, and provide new contexts as the lesson progresses.

Suggestions for Use

- After playing with Net Worth, ask students to try to define asset, debt, and net worth. Collect responses and use student thinking to prove a collective definition for the class so that they are all using the same definitions when they move on to the Operations screen. Sample definitions could be:
  - ✦Asset: stuff a person owns that has a value
  - ✦Debt: money a person owes
  - ✦Net worth: all the assets and debts added together
- Use the Operations screen to tell a story. Suppose someone starts with a net worth of $200. What does that mean? Have students come up with different scenarios that could result in an initial net worth of $200. Then decide if they are adding or removing and asset or a debt and predict how to enter that as an operation before using the sim to operate.

Sample Challenge Prompts

- What must be true if someone has a positive net worth?
- What must be true if someone has a negative net worth?
- How can someone have a net worth of $0?
- Use the Generic screen to make two different number statements that end at the same integer.
- What are two different ways to make a jump to the right on a number line?
- What are two different ways to make a jump to the left on a number line?

See all published activities for Number Line: Operations here.
For more tips on using PhET sims with your students, see Tips for Using PhET.