PhET Tips for Teachers

Equality Explorer

The ***Equality Explorer*** simulation allows students to explore the conditions that result in equality and inequality, the effect of applying operations to an equality or inequality, and solve simple equations.

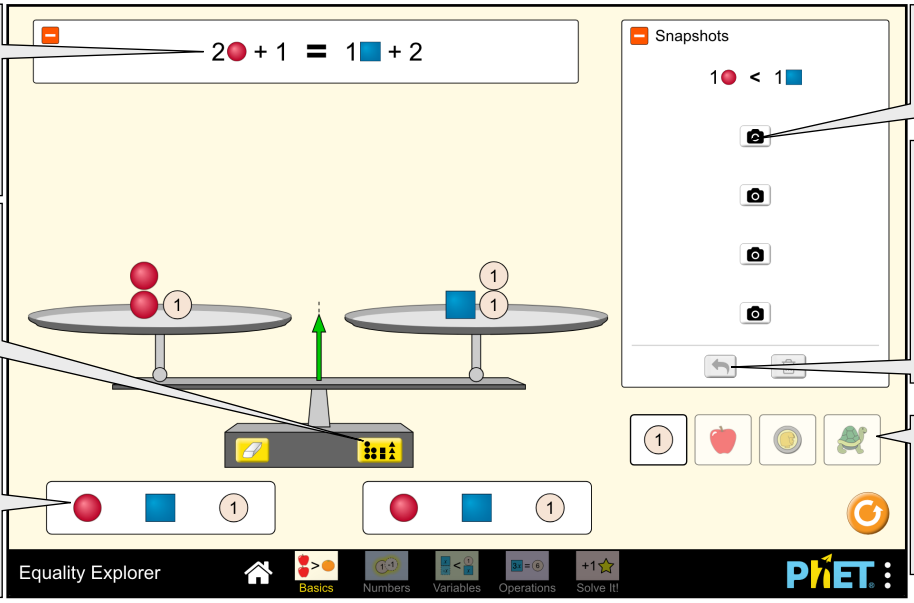
Basics Screen

In the Basics screen, students can discover equality relationships and create functional definitions of equality and inequality.

OBSERVE the statement reflecting what is on the balance

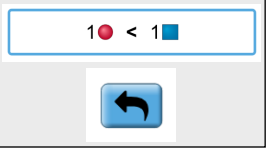
ORGANIZE objects on the balance

BUILD an equality by dragging objects on and off the balance



SAVE snapshots of the balance

RELOAD a snapshot



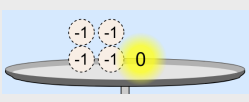
EXPLORE different sets of objects

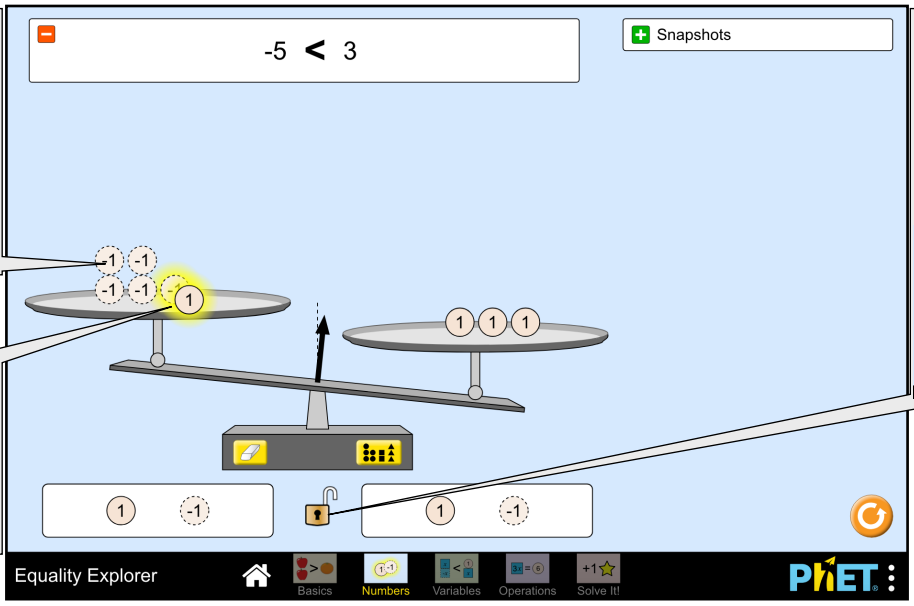
Numbers Screen

In the Numbers screen, students can turn on the lock to perform the same operation to both sides of the balance and explore what happens to the state of equality.

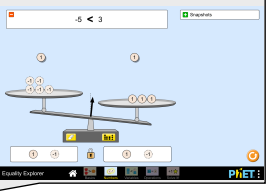
DISCOVER the impact a positive or a negative number has on an equality or inequality

COMBINE zero pairs





LOCK the balance so that an operation occurs on both sides



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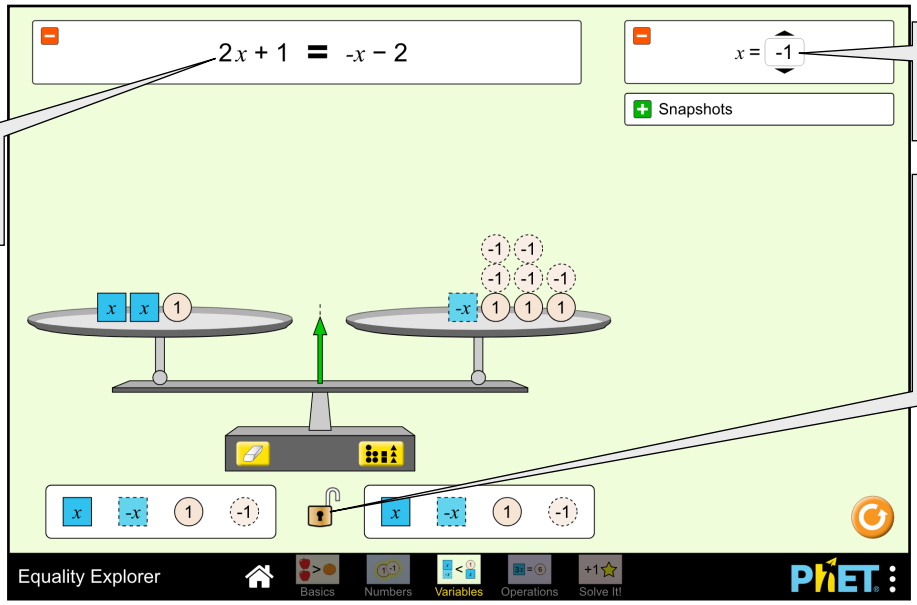
Variables Screen

In the Variables screen, students explore how different values for a variable impact the state of equality.



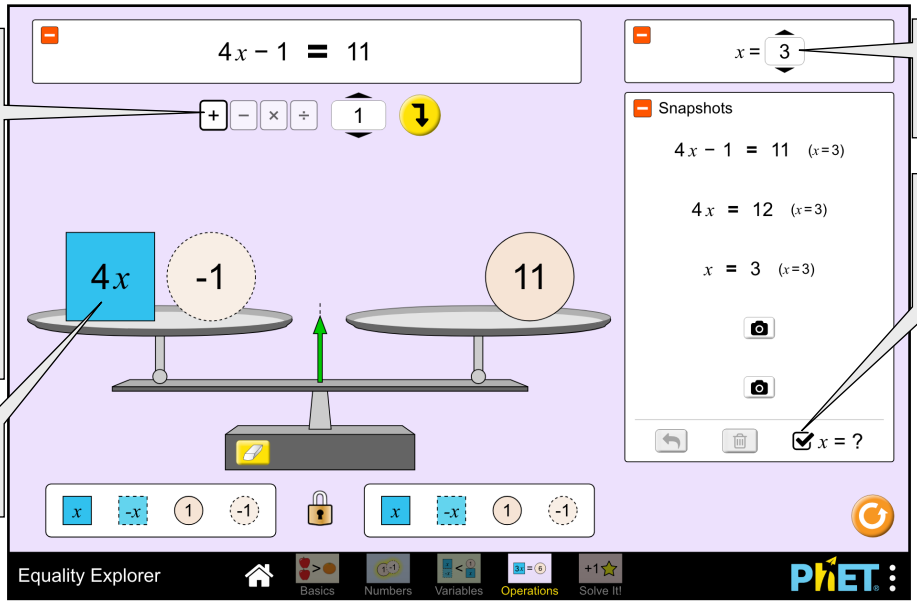
VIEW simplified equation

CONTROL the variable value

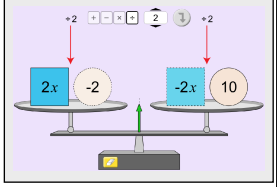
LOCK the balance so that an operation occurs on both sides

Operations Screen

In the Operations screen, students can build an inequality or equation and apply universal operations to explore what happens to each term, and discover how to undo an operation.



APPLY operations to both sides of the balance



COMBINE like terms

CONTROL the variable value

SHOW/HIDE the variable value for each snapshot

Insights into Student Use

- Students naturally want to find balanced situations. Encourage them to find as many as possible.
- Students enjoy applying operations to create the largest or smallest numbers.
- Students might realize that an operation is “unproductive” or doesn’t do exactly what they want. Challenge them to find the operation that will “undo” their last one.

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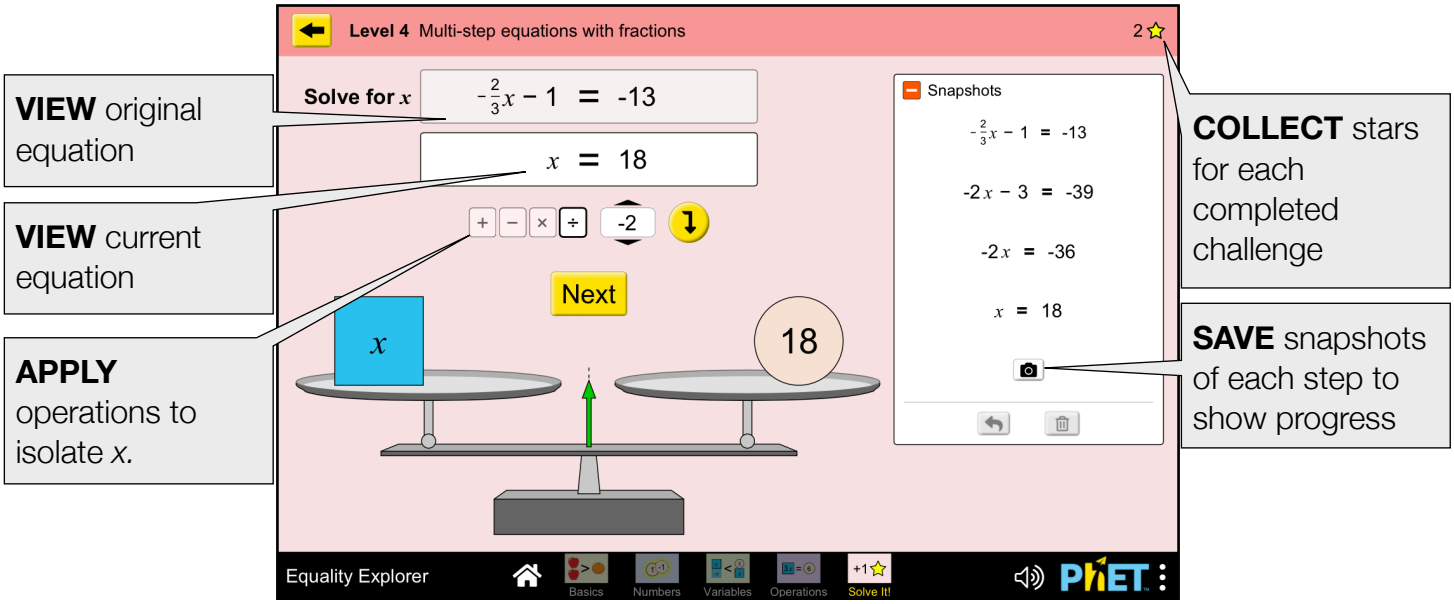
Solve It! Screen

In the Game, students solve equations using the universal operation control to isolate the variable.

- **Level 1:** one-step equations
- **Level 2:** one-step equations with negative coefficients
- **Level 3:** two-step equations
- **Level 4:** multi-step equations with fractions
- **Level 5:** multi-step equations with variables on both sides of the equation



Suggestions for Use

- Explore proportional relationships on the Basics screen.
- Using the Variables screen, set up a balanced equation and minimize the variable value. Trade computers with a partner and figure out the value of x.

Sample Challenge Prompts

- Find as many equations as possible using the objects on the Basics screen.
- What happens to an equation or inequality if you add 1 to both sides with the lock on? What happens if you add -1 to both sides with the lock on?
- Explain what happens to an equation if you try to remove 1 from both sides (with the lock on) and you don't have a 1 available. Why does this happen?

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 Equality Explorer, 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/equality-explorer/latest/equality-explorer_all.html?screens=1,2&initialScreen=2

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To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/equality-explorer/latest/equality-explorer_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
`gameLevels` - specifies which levels appear in the game.	`gameLevels=1,2,3`
`rewardScore` - sets the number of challenges that must be solved before being prompted to try another level (default is 10).	`rewardScore=5`

`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)
⚙ `audio` - if muted, audio is muted by default. If disabled, all audio is permanently turned off.	`audio=muted` `audio=disabled`
`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`

See all published activities for Equality Explorer here.
For more tips on using PhET sims with your students, see Tips for Using PhET.