

Prime Mining

PLAYER AND EDUCATOR MANUAL | VERSION 1.0



Strike the composites. Discover the primes.

Enter a chalk-drawn mine where every numbered rock holds a mathematical clue. Use proper multiples to clear composite numbers, watch the Sieve of Eratosthenes take shape, and reveal each prime as a bright gold nugget.

Ready, set, mine!

A first trip into the number field



The opening instruction appears in the miner's speech bubble

Controls

ARROWS

SPACE

ENTER

ESC



Left-click

Start a level

1. Launch PrimeMining.exe. 2. After 2.5 seconds, press any key or left-click. 3. Rock 1 is cleared automatically. 4. Find the requested proper multiples.

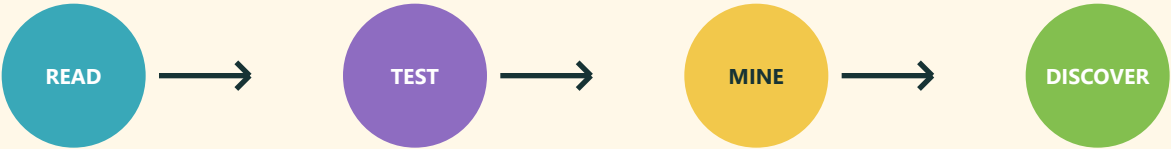
Move the yellow outline with the arrow keys and press SPACE, or simply left-click a rock. On larger fields, click the chalk arrows to reveal the rows above or below.

Mine composites. Keep primes.

One repeating decision builds the entire sieve



A five-by-five window into the 100-number field



A correct strike

A proper multiple becomes debris. Once every required rock is cleared, the active prime becomes gold.

Try another rock

An incorrect or previously mined choice brings immediate visual and audio feedback, then another chance.

Say the multiplication fact before striking: for example, 'Seven times four is twenty-eight.' Reasoning aloud makes the pattern visible and turns each choice into more than a guess.

The building blocks of whole numbers

Exactly two positive factors

A prime number is a whole number greater than 1 with exactly two positive factors: 1 and itself. Seven is prime because only 1×7 makes 7. Twelve is composite because 1×12 , 2×6 , and 3×4 all make 12.

2

3

5

7

11

13

17

19

Why primes matter

Every whole number greater than 1 can be separated into prime factors. This supports division, fractions, common factors, common multiples, ratios, algebra, and number theory.

Two is unique

Two is the only even prime. Every larger even number has 2 as a factor and is therefore composite.

Prime numbers also matter beyond elementary mathematics. Properties of very large primes are used in modern computer security and encryption.

One is neither prime nor composite

It has only one positive factor



A prime needs exactly two distinct positive factors. One has only a single positive factor - itself - so it does not meet the definition of a prime. It is not composite either.

A foundation for unique factorization

Every whole number greater than 1 has one essentially unique prime factorization. For example, $12 = 2 \times 2 \times 3$. If 1 were called prime, any number of extra factors of 1 could be inserted, weakening that useful uniqueness.

How the game shows it

At the beginning of every level, the miner automatically breaks rock 1 before normal play begins. This removes 1 from the field before prime discovery starts.

Multiply, then move beyond the number itself

Precise language for the sieve

A multiple is made by multiplying a number by a whole number. In Prime Mining, a proper multiple is made by multiplying by a whole number greater than 1. A number is not a proper multiple of itself.

3×2

6

3×3

9

3×4

12

3×5

15

Say it clearly

'Keep three, and cross out its proper multiples: six, nine, twelve, and so on. A number is not a proper multiple of itself.' This language separates the prime being tested from the composite numbers removed by the sieve.

The game uses the same wording in its speech bubble, upper-right prompt, and corrective feedback: Find every proper multiple of X.

An ancient pattern-finding tool

Remove composites and see what remains

1

Remove one

One is neither prime nor composite.

2

Keep two

Cross out every proper multiple of 2.

3

Keep three

Cross out each remaining proper multiple of 3.

4

Continue

The next untouched number is prime; remove its proper multiples.

Why call it a sieve?

Composite numbers fall away as their factors are found, leaving the prime numbers behind - much like useful material remaining after sifting.

A familiar rule across growing fields

From ten rocks to one hundred

LEVEL 1

1-10

LEVEL 2

1-25

LEVEL 3

1-50

LEVEL 4

1-100



Gold primes and debris composites at level completion

Pagination without crowding

The 50- and 100-number fields display 25 rocks at a time. Chalk arrows reveal one additional row while preserving the same readable grid size.

A visible mathematical record

At the end of each level, the game lists every discovered prime before the child continues.

Practice with purpose

Make patterns, reasoning, and feedback visible

Pattern recognition

Skip-counting patterns become connected to multiplication and divisibility.

Active decisions

Each strike asks the learner to test a relationship rather than watch a demonstration.

Immediate feedback

Animation, expression, and sound make the result clear while the reasoning is fresh.

Progressive challenge

The number field grows while the decision rule remains stable and familiar.

Fluency frees attention for the next idea.

Familiar factor relationships support fractions, ratios, algebra, and problem solving.

Make the thinking audible

Questions for families, teachers, and learning partners

Questions worth asking

- ? How do you know this is a proper multiple?
- ? What multiplication fact proves it?
- ? Was this rock cleared by an earlier prime? Why?
- ? Why do we keep the active prime?
- ? What do you predict the next gold number will be?

After the screen

Write the gold numbers. Build a composite number with equal groups. Draw factor pairs. Make a paper sieve. Find examples of even and odd numbers.

Notice strategies

A learner may skip-count, recall a multiplication fact, use repeated addition, or reason from an earlier result. Ask for an explanation and celebrate the strategy, not speed.

A wrong selection is an opportunity to name the fact, revise the idea, and try again. The game is practice - not a test of mathematical worth.

Every learner is different

Offer access, choice, and a manageable session

1

Offer another path

Use spoken choices, number cards, counters, drawings, or a shared keyboard when the game's graphics, sounds, or controls are not comfortable.

2

Keep technology bounded

One thoughtful level can be enough. Balance digital practice with conversation, movement, books, creative play, and hands-on mathematics.

3

Do not diagnose from play

Prime Mining is not a standardized or diagnostic assessment. It cannot establish mastery, identify a disability, or replace qualified educational judgment.

4

Protect curiosity

Allow wait time, welcome explanations, and stop while the experience still feels constructive and enjoyable.

A successful session does not need to be a long session.

Use the game as one part of a varied and responsive mathematics experience.

A mine built for discovery

Native Windows play with an ancient mathematical idea

Technical notes

Native 64-bit Windows application written in modern C++20. The game uses Win32, GDI+, and WinMM; renders through a fixed 1280 x 720 virtual canvas; maintains a 16:9 presentation with black letterboxing; and supports keyboard and mouse play.

Music credit

Background music: Hoe-Down, composed by Aaron Copeland, 1948, and arranged by Levi Abbott. Music and sound effects are included to establish ambience and reinforce gameplay feedback.

Family and educator reference

This manual is based on the game's current source code, packaged artwork, audio assets, and the educational copy in manual.txt. The gameplay images use the actual Prime Mining background and sprite sheets, arranged to match the live 1280 x 720 game layout.

Prime Mining version 1.0

Written and arranged by Levi Abbott

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Keep the primes. Strike the patterns.