

TEACHER'S GUIDE

MATH AND SCIENCE



By Tracy Edmunds, M.A. Ed.
Reading With Pictures

Classroom Activity and Discussion Guide



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BASICS OF MINECRAFT FOR TEACHERS

Minecraft is an open-ended, “sandbox” video game in which players can use the basic unit of “blocks” to build pretty much anything. Players interact with the environment around them, including plants, animals, and different types of earth materials (e.g., cobblestone, emerald, lava, water). They can pick up objects and “mine” or break blocks to access resources. They can combine items to “craft” food, tools, clothing, weapons, etc. Crafting uses a grid system. The world of Minecraft has many biomes, such as deserts, forests, tundra, and swamps.

MATH

The *Diary of an 8-Bit Warrior* world of Minecraftia holds unlimited opportunities for students to practice and apply math skills. From multiplication and division with crafting to perimeter, area, and volume with building, students can create their own math challenges and invite other students to solve them. The following math challenge pages will help students practice and apply math skills and see some possibilities. Most of the challenges require math reasoning and critical thinking. These challenges can be tackled by a single student, but they are also rich opportunities for collaboration between pairs or groups of students. Each page ends with an invitation for students to pose their own math challenges

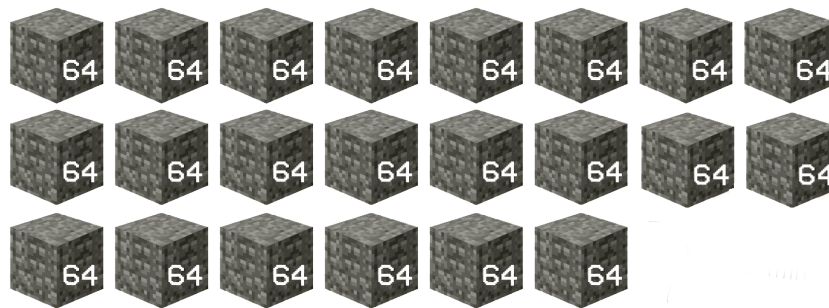


- **Cobblestone Crafting Math**, page 4: addition, subtraction, multiplication, problem-solving, reasoning
- **Zombie Math**, page 8: percentages, multiplication, division, problem-solving, reasoning
- **Walls and Fences Math**, page 10: area, volume, perimeter, problem-solving, reasoning
- **Felhound Math**: page 12: multiplication, percentages, time, problem-solving, reasoning
- **Emerald Shopping**, page 14: multiplication, division, percentages, problem-solving, reasoning.



Cobblestone Crafting Math

In their first mining class, Runt and Stump mined 22 cobblestone stacks, with each stack holding 64 cobblestones. Runt and Stump also have 6 dozen sticks.



1. How many cobblestones do Runt and Stump have?

Equation: _____ Answer _____

2. Do they have enough to get the “Chestful of Cobblestone” achievement (1,728 cobblestones)?

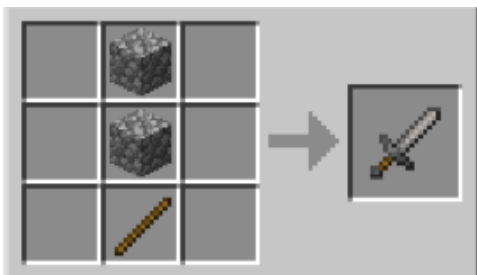
Answer: _____

3. If not, how many more would they need?

Equation: _____ Answer _____

4. Using the recipes on page 6, craft as many items as possible using Runt and Stump’s cobblestones (quantity from question #1) and sticks (5 dozen = 60). Fill in a crafting grid on page 7 for each type of item you want to craft. Below it, write how many of that item you are crafting and how many cobblestones and sticks you used. Your goal is to use as many of Runt and Stump’s cobblestones as possible without using more than they have.

Example: Stone Sword



How many crafted? 10

Cobblestones used: $10 \times 2 = 20$

Sticks used: $1 \times 10 = 10$



5. How many cobblestones did you use altogether? _____ How many sticks? _____

6. How many cobblestones do you have left over?

Equation: _____ Answer: _____

7. If you use all of your sticks to craft stone swords, how many stone swords can you craft?

Equation: _____ Answer: _____

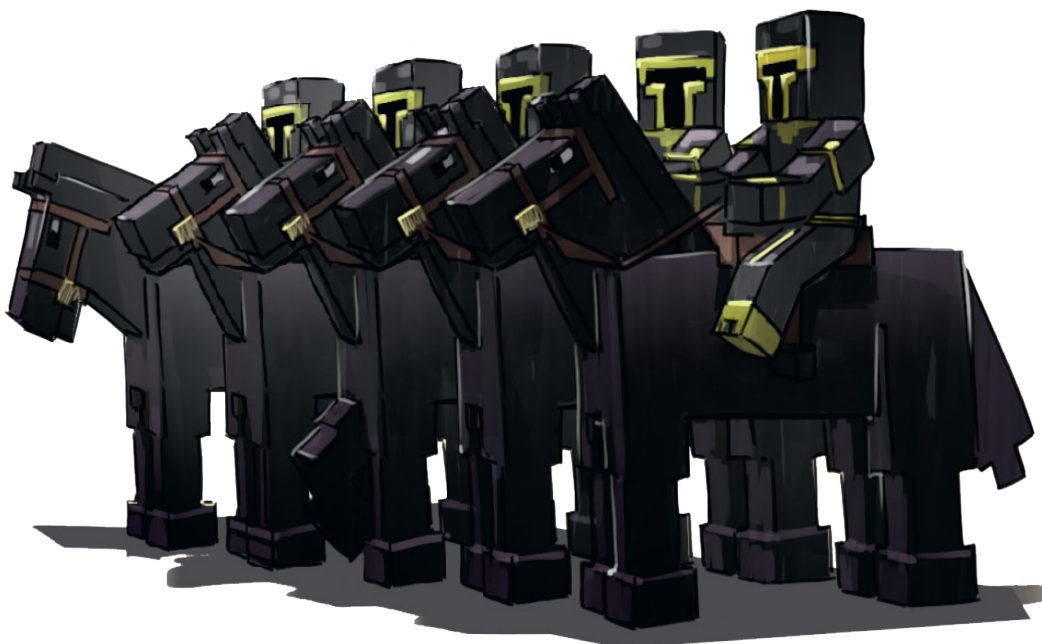
How many cobblestones did you use?

Equation: _____ Answer: _____

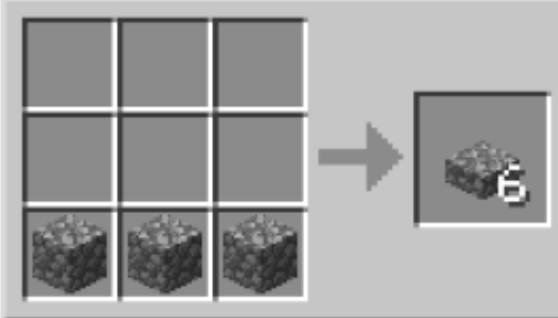
What one item can you craft to use up every one of your leftover cobblestones?

How many of that item would you end up with?

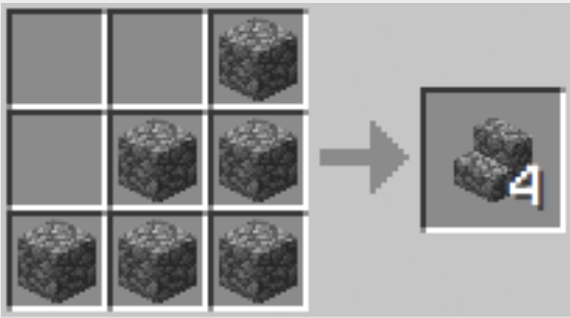
8. Write your own math challenges involving crafting and challenge others to solve them. Be sure to write equations to solve your problems, and the answers as well, but keep them a secret until they have met your challenges!



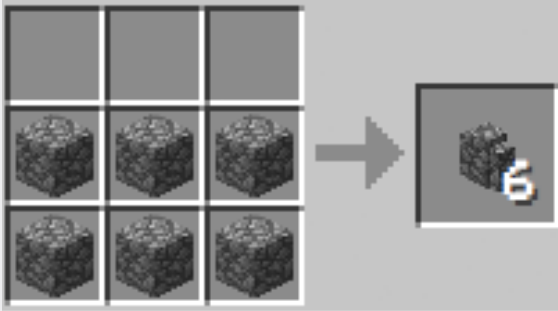
Recipes



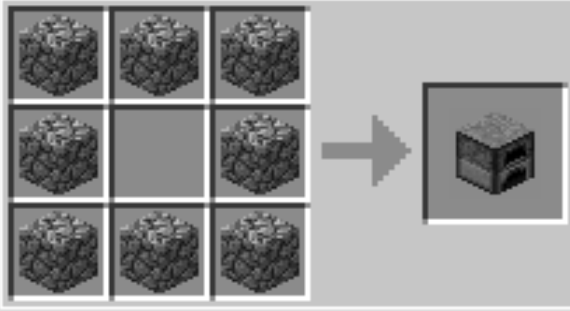
3 cobblestones = 6 cobblestone slabs



6 cobblestones = 4 cobblestone stairs



6 cobblestones = 6 cobblestone walls



8 cobblestones = 1 furnace



2 cobblestones, 1 stick = 1 stone sword



3 cobblestones = 6 cobblestone slabs

Zombie Math

“ . . . a zombie can ‘call’ another zombie, spawning a new zombie nearby. . . . The new zombie that the first zombie calls can call its own zombies. A single zombie can quickly become a small army of zombies. The zombies will multiply, one zombie after another zombie, as each new zombie calls more zombies. At first, it will only be one zombie, but it will quickly become a zombie party . . . ”

(Diary of an 8-Bit Warrior, p. 204)

1. Let's say a zombie can call 4 more zombies every 3 minutes. Complete the table below to answer the following questions.

Time	Starting # of zombies	4 new zombies from each starting zombie	= new # of zombies
3 minutes	2	2×4	8
6 minutes	8	8×4	32
9 minutes	32	32×4	
12 minutes		_____ $\times 4$	
15 minutes		_____ $\times 4$	

2. If you start with 2 zombies, how long will it be until you are facing 128 zombies?
3. How many zombies will you be facing in 15 minutes?
4. Baby zombies make up 5% of zombie spawns. How many baby zombies could be expected in the 15-minute zombie horde? *Hint: Turn the percent into a decimal by dividing by 100.*

Equation _____ Answer _____

5. A chicken jockey is a baby zombie riding a chicken. In a chicken-free environment, each spawned zombie has a 3% chance of becoming a chicken jockey. How many baby chicken jockeys can be expected in the 15-minute horde?

Equation _____ Answer _____

“A wooden sword deals two and a half hearts worth of damage with a single strike. A zombie’s life force is equal to ten hearts. That means, four swings with a wooden sword should kill a zombie, because 10 divided by 2.5 equals 4.” (Note: For now we are ignoring a zombie’s natural armor protection.)

(Diary of an 8-Bit Warrior, p. 206)

6. How many strikes with wooden swords would be needed to drop all 128 zombies from question 1?

Equation _____ Answer _____

7. A diamond sword deals 3.5 hearts worth of damage with a single strike. How many strikes with a diamond sword would take down a zombie? *Note: Round up to the nearest whole number.*

Equation _____ Answer _____

8. How many strikes with a diamond sword would be needed to drop all 128 zombies?

Equation _____ Answer _____

“But, if you use a leap attack and swing while you’re moving downward, you’ll deal more damage with a critical hit. . . .”

(Diary of an 8-Bit Warrior: Quest Mode, p. 183)

9. A critical hit deals a sword’s base damage plus 50%. How much damage does a critical hit with a wooden sword do?

Equation _____ Answer _____

10. How many critical hits with a wooden sword would Runt need to take down a zombie?

Equation _____ Answer _____

11. How many critical hits to take down the whole 128-zombie horde?

Equation _____ Answer _____

12. Write your own math problems about zombies and challenge others to solve them. Be sure to write equations to solve your problems, and the answers as well, but keep them a secret until they have met your challenges!

Walls and Fences Math

NOTE: MINECRAFT BLOCKS MEASURE 1 METER BY 1 METER BY 1 METER.

“The next hall had nothing but wooden doors. Each door led to a small room five blocks wide, five blocks deep, and three blocks high.”

(Diary of an 8-Bit Warrior: Quest Mode, p. 183)

1. What is the area of the floor of the room? *(Show your work on a separate sheet of paper.)*

Equation _____ Answer _____

2. What is the volume of the room?

Equation _____ Answer _____

3. Runt has 48 cobblestones and wants to build a wall using all of the cobblestones. Each cobblestone is the size of one block — 1 meter by 1 meter by 1 meter. What could the length and height of his wall be? List all possibilities.

4. Breeze has built a wall a single block thick. It is 25 blocks wide and the area of the wall is 125 blocks. How tall is her wall?

Equation _____ Answer _____

5. If Pebble has 62 fence blocks, what is the largest rectangular area he can fence in?

Equation _____ Answer _____

6. What would the length and width of the fence be?

Equation _____ Answer _____

7. What would the perimeter of the enclosed area be?

Equation _____ Answer _____

8. What if Pebble fenced the largest possible area by building three sides of a fence against a wall?
How many blocks long would each of the three fence sides be?

Equation _____ Answer _____

What would the enclosed area be?

Equation _____ Answer _____

9. Write your own measurement problem using blocks. Draw a diagram if it helps solve the problem. Be sure to write the equation(s) and answer, too!



Felhound Math MINECRAFTIA PROBLEMS



“... each felhound was affected by two different buffs. The gray shield was Stoneskin, which provides an armor bonus of five per power level. The little II in the bottom right-hand corner meant its power level was two. The golden rabbits foot was Haste I, which increased movement speed and attack speed by 25%. After Breeze fired a weakness arrow at the wolf I was focusing on, a third icon appeared. A broken sword. That was the Weakness I debuff, which reduces attack damage by four.”

(Diary of an 8-Bit Warrior: Quest Mode, pp.192–193)

1. What is the felhound's current power level?

Answer _____

2. How much is its total armor bonus?

Equation _____ Answer _____

3. If the felhound's original attack damage is 5, how much is it with the Weakness I debuff?

Equation _____ Answer _____

4. If the felhound's original attack speed is 4, how much is its attack speed with Haste I?

Equation _____ Answer _____

5. What if the felhound's original attack speed is 2?

Equation _____ Answer _____

COUNTING SLIMES

“Basically, slimes piled onto a creeper. And boom! The creeper exploded. . . . Here’s the thing, though: When a slime dies, it splits into smaller slimes. The result of a creeper bomb is a rain of baby slimes . . .”

(Diary of an 8-Bit Warrior, p. 11)

6. Let’s say that when a slime dies, it splits into 5 smaller slimes. If 10 creepers exploded, each throwing 12 slimes over the wall into the village, and those slimes then split, how many smaller slimes would rain down?

Equation _____ Answer _____

DON’T FENCE ME IN

7. There is a fence in Pebble’s way. Which tool will help him break through it the fastest?

Answer _____

Tool	Breaking time in seconds
Hand	3
Wood axe	1.5
Stone axe	0.75
Iron axe	0.5
Diamond axe	0.4



8. Write your own math word problems based on the *Diary of an 8-Bit Warrior* series and challenge others to solve them. Be sure to write equations to solve your problems, and the answers as well, but keep them a secret until they have met your challenges!

Emerald Shopping

1. Runt wants to buy an aeon forge. It costs 2,500 emeralds. He makes a fake coupon for 90% off. How much would the aeon forge cost if his coupon worked?

Equation _____ Answer _____

2. The armor set Runt wants costs 8,000 emeralds. Each zombie he eliminates drops 6 emeralds. How many zombies would he have to eliminate to buy the armor? Round up to the nearest whole number.

Equation _____ Answer _____

3. Runt and Breeze need 15 healing potions. A regular healing potion works on one person and costs 25 emeralds. How much would 15 regular healing potions cost?

Equation _____ Answer _____

A splash healing potion can be used on more than one person. Here is the recipe for one splash healing potion:
1 bottle + 1 netherwart + 1 handful of gunpowder + 8 gold nuggets + 1 slice of melon

Item	Price in emeralds
Bottle	1
Netherwart	3
Handful of gunpowder	3
Gold nugget	2
Slice of melon	1



4. How much will it cost them to get all the ingredients they need to make 15 splash healing potions?

Equation _____ Answer _____

5. Which would you do, buy 15 regular healing potions or buy ingredients and craft 15 splash healing potions? Why?

6. Breeze has 262 emeralds to spend on accessories. Using the price sheet below, what would you buy? How much would you have left over?

7. Create your own math problems involving emeralds and challenge others to solve them. Be sure to work out the answers so they can check their work!

Pricing

Iron bracelet with regeneration.....	55 emeralds
Stone bracelet with 1 point of armor.....	50 emeralds
Ring with swiftness.....	150 emeralds
Wooden ring with strength.....	75 emeralds
Ring with swiftness & Strength.....	150 emeralds



SCIENCE

Both Minecraftia and the real world are comprised of many biomes. Each biome is a large area with specific plants, animals, geographic features, and weather. Examples include oceans, mountains, plains, and savanna. Have students research and compare biomes in the real world to biomes in Minecraftia. In Minecraftia, characters use a lot of resources to build and craft. Introduce students to sustainability concepts by discussing and researching renewable and nonrenewable resources in both Minecraftia and the real world.

1. Which resources in Minecraftia are renewable (players can get more) and which are nonrenewable (it is hard or impossible to get more)?

Examples

Renewable: wool, trees

Nonrenewable: gravel, diamond ore

2. How do characters get more renewable resources?

Examples

Renewable: sunlight, trees

Nonrenewable: fossil fuels (oil and natural gas), metal ores (gold, copper, etc.)

3. How is getting more renewable resources different in the real world than in Minecraftia? Have students research natural resources and compare the real world to Minecraftia. For example, research how wool is obtained and used in both Minecraftia and the real world, and then compare. This can lead to a study of natural resources and the need for conservation.

ANSWER KEY

Cobblestone Crafting Math

- $22 \times 64 = 1,408$ cobblestones
- No
- $1,728 - 1,408 = 320$, They would need 320 more cobblestones
- How many crafted? 10
Cobblestones used: $10 \times 2 = 20$
Sticks used: $1 \times 10 = 10$
- Answers will vary but should add up to no more than 1408 cobblestones and 60 sticks.
- $1,408 - \text{number of cobblestones used} = \text{Answer}$
 $1,408 - \text{number of sticks used} = \text{Answer}$
- 1 stick per sword, so $1 \times 60 = 60$
2 cobblestones per sword $\times 60 = 120$ cobblestones
 $1,408$ original cobblestones $- 120$ used to make swords = $1,288$ cobblestones left
 $1,288$ divided by $8 = 161$, so crafting 161 furnaces will use up all the cobblestones

Zombie Math

1.

Time	Starting # of zombies	4 new zombies from each starting zombie	= new # of zombies
3 minutes	2	2×4	8
6 minutes	8	8×4	32
9 minutes	32	32×4	128
12 minutes	128	128×4	512
15 minutes	512	512×4	2,048

- 9 minutes
- 2,048
- $2,048 \times 0.05 = 102.4$, so 102 baby zombies could be expected
- $102 \times 0.003 = 3.06$, so 3 baby chicken jockeys can be expected
- $128 \text{ zombies} \times 4 \text{ strikes each} = 512 \text{ strikes}$
- 10 divided by $3.5 = 2.86$, so you'd need 3 strikes to remove all 10 hearts
- $128 \times 3 = 384$ strikes
- 50% of 2.5 is 1.25; $2.5 + 1.25 = 3.75$ damage for a critical hit
- 10 [zombie life] divided by $3.75 = 2.7$ [rounded], so Runt would need 3 critical hits to take down a zombie.
- $128 \times 3 = 384$ critical hits

Walls and Fences Math

1. $5 \times 5 = 25$ meters²
2. $5 \times 5 \times 3 = 75$ meters³
3. 6×8 , 8×6 , 4×12 , 12×4 , 3×16 , 16×3 , 2×24 , 24×2
4. $25 \times h = 125$, or 125 divided by 25, $h = 5$, The wall is 5 meters tall
5. The longest possible sides are 15, 15, 16, and 16. $15 \times 16 = 240$ meters²
6. 15×16 meters
7. $15 + 15 + 16 + 16 = 62$ meters, or $(15 \times 2) + (16 \times 2) = 62$ meters
8. $20 + 20 + 22 = 62$ meters
 $20 \times 22 = 440$ meters²

Felhound Math

1. 2
2. Armor bonus is 5 per power level, $5 [\text{bonus}] \times 2 [\text{power level}] = 10$
3. $5 - 4 = 1$
4. Haste I increases attack speed by 25%, $4 \times .25 = 1$, $4 + 1 = 5$, so its new attack speed is 5
5. $2 \times .25 = .5$, $2 + .5 = 2.5$

Counting Slimes

6. 10 creepers \times 12 slimes = 120 slimes; 120 slimes \times 5 smaller slimes each = 600 small slimes

DON'T FENCE ME IN

7. The diamond axe because it works the fastest: .4 seconds is less than .75 or .5 seconds

Emerald Shopping

1. 90% of 2,500 is 2,250. $2,500 - 2,250 = 250$ emeralds
2. 8,000 divided by 6 = 1,334 [rounded up] zombies
3. $15 \times 25 = 375$ emeralds
4. 45 netherwart [$15 \times 3 = 45$] + 240 gold nuggets [$8 \times 15 \times 2 = 240$] + 45 handfuls of gunpowder [$15 \times 3 = 45$]
= 360 emeralds
5. Make splash potions because making splash potions is cheaper and they work on more than one person.
6. Iron bracelet with regeneration: 55 emeralds
Stone bracelet with 1 point of armor: 50 emeralds
Ring with swiftness: 150 emeralds
Wooden ring with strength: 75 emeralds
Ring with swiftness and strength: 150 emerald