TEACHER'S GUIDE
MATH AND SCIENCE

DIARY OF AN 8-BIT WARRIOR
FROM SE...
The continuing adventures of Runt, the villager turned warrior

DIARY OF AN 8-BIT WARRIOR
QUEST MODE...

DIARY OF AN 8-BIT WARRIOR
CRAFTING ALLIANCES

DIARY OF AN 8-BIT WARRIOR
FORGING DESTINY

DIARY OF AN 8-BIT VILLAGER... WARRIOR
Runt, the villager who wants to be a warrior (like Steve)
CUBE KID
ILLUSTRATED BY SABOTEN
AN UNOFFICIAL MINECRAFT ADVENTURE

DIARY OF AN 8-BIT WARRIOR
...F THE DIAMOND
Runt's training is coming to an end!
CUBE KID
ILLUSTRATED BY SABOTEN
AN UNOFFICIAL MINECRAFT ADVENTURE

Classroom Activity and Discussion Guide
The activities in this guide align with Next Generation English Language Arts Standards for grades 3–5.

Diary of an 8-Bit Warrior
Cube Kid
AMP I Kids
Andrews McMeel Publishing

GRADE LEVEL: 3—5
CURRICULUM CONNECTIONS
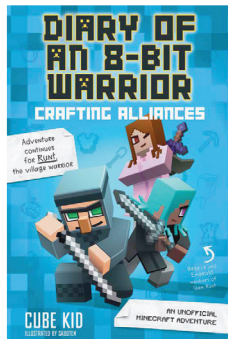Math, Science, English-Language Arts

Content Standards
Language Arts
Common Core State Standards: www.corestandards.org
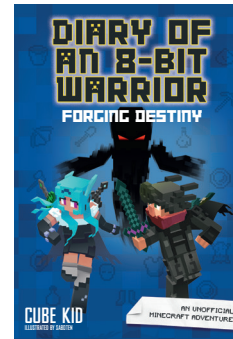
978-1-4494-8005-9   978-1-4494-8008-0   978-1-4494-8228-2   978-1-4494-8009-7   978-1-4494-9252-6   978-1-4494-9445-2

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

SECTIONS TO FOLLOW

- **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.
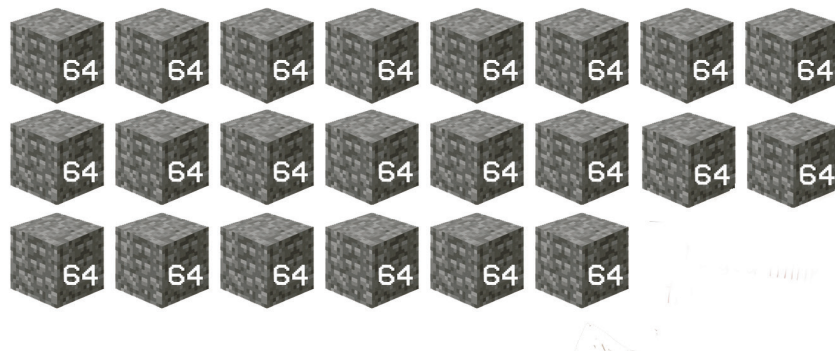
1. How many cobblestones do Runt and Stump have?

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.
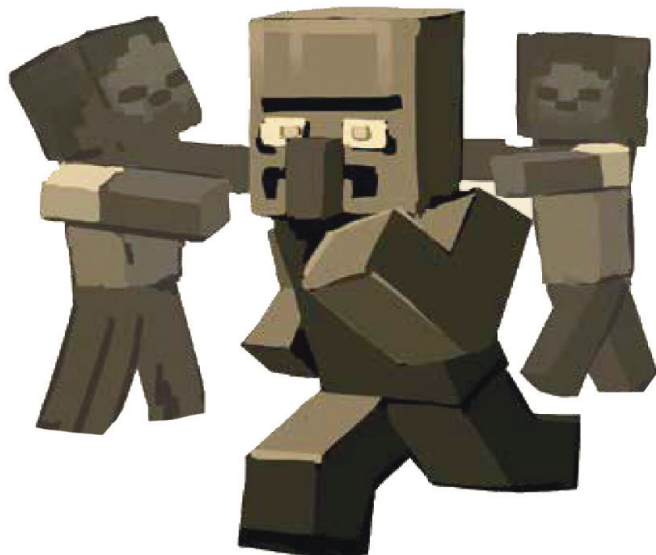
Example: Stone Sword
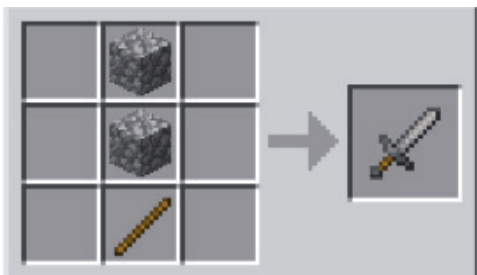
How many crafted? 10

Cobblestones used: 10 x 2 = 20

Sticks used: 1 x 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!

_____

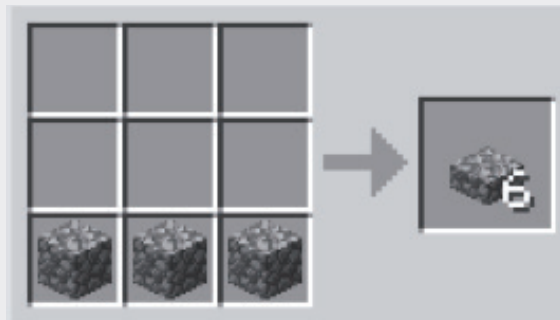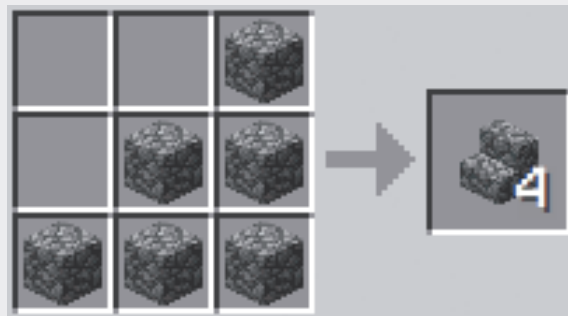_____
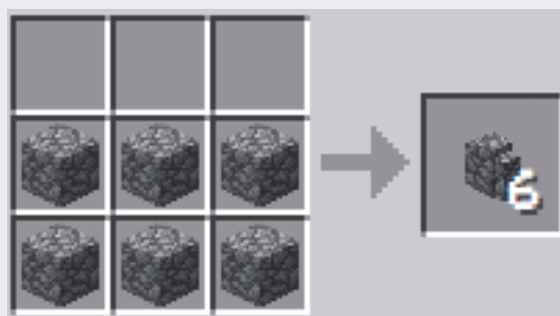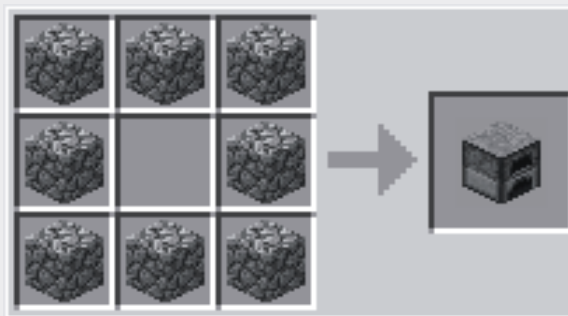
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Recipes

3 cobblestones = 6 cobblestone slabs

6 cobblestones = 4 cobblestone stairs

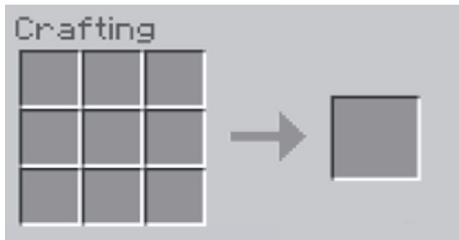6 cobblestones = 6 cobblestone walls

8 cobblestones = 1 furnace

2 cobblestones, 1 stick = 1 stone sword
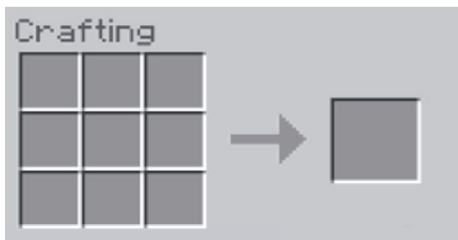
3 cobblestones = 6 cobblestone slabs

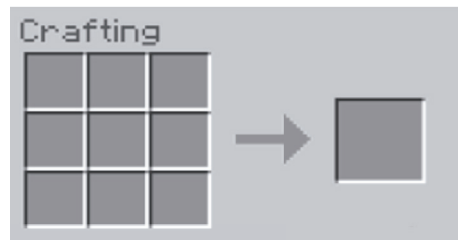Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____
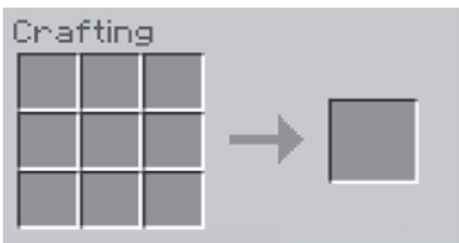
Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____
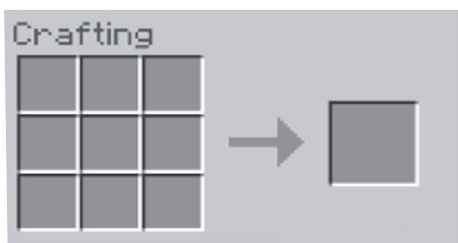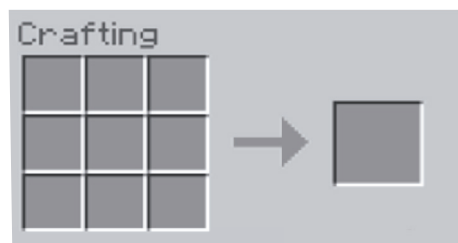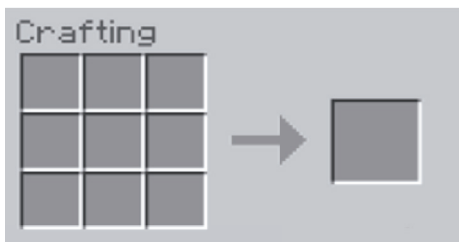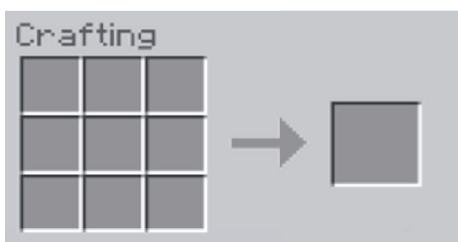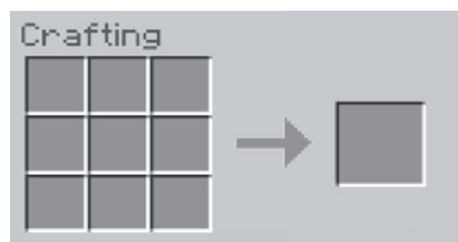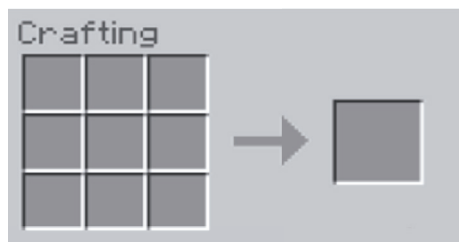
Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

Crafting

How many crafted? _____

Cobblestones used: _____

Sticks used: _____

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 x 4	8
6 minutes	8	8 x 4	32
9 minutes	32	32 x 4	
12 minutes		____ x 4	
15 minutes		____ x 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 _____

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 _____

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!

_____

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Felhound Math MINECRAFTIA PROBLEMS

FELHOUND

0:29   25:36   25:36

"... 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!

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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!

_____

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_____

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.

_____

_____

_____

_____

Cobblestone Crafting Math

1. 22 x 64 = 1,408 cobblestones

2. No

3. 1,728 – 1,408 = 320, They would need 320 more cobblestones

4. How many crafted? 10
   Cobblestones used: 10 x 2 = 20
   Sticks used: 1 x 10 = 10

5. Answers will vary but should add up to no more than 1408 cobblestones and 60 sticks.

6. 1,408 – number of cobblestones used = Answer
   1,408 – number of sticks used = Answer

7. 1 stick per sword, so 1 x 60 = 60
   2 cobblestones per sword x 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 x 4	8
6 minutes	8	8 x 4	32
9 minutes	32	32 x 4	128
12 minutes	128	128 x 4	512
15 minutes	512	512 x 4	2,048

2. 9 minutes

3. 2,048

4. 2,048 x 0.05 = 102.4, so 102 baby zombies could be expected

5. 102 x 0.003 = 3.06, so 3 baby chicken jockeys can be expected

6. 128 zombies x 4 strikes each = 512 strikes

7. 10 divided by 3.5 = 2.86, so you'd need 3 strikes to remove all 10 hearts

8. 128 x 3 = 384 strikes

9. 50% of 2.5 is 1.25; 2.5 + 1.25 = 3.75 damage for a critical hit

10. 10 [zombie life] divided by 3.75 = 2.7 [rounded], so Runt would need 3 critical hits to take down a zombie.

11. 128 x 3 = 384 critical hits

Walls and Fences Math

1. 5 x 5 = 25 meters^2

2. 5 x 5 x 3 = 75 meters^3

3. 6 x 8, 8 x 6, 4 x 12, 12 x 4, 3 x 16, 16 x 3, 2 x 24, 24 x 26

4. 25 x 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 x 16 = 240 meters^2

6. 15 x 16 meters

7. 15 + 15 + 16 + 16 = 62 meters, or (15 x 2) + (16 x 2) = 62 meters

8. 20 + 20 + 22 = 62 meters
   20 x 22 = 440 meters^2

Felhound Math

1. 2

2. Armor bonus is 5 per power level, 5 [bonus] x 2 [power level] = 10

3. 5 − 4 = 1

4. Haste I increases attack speed by 25%, 4 x .25 = 1, 4 + 1 = 5, so its new attack speed is 5

5. 2 x .25 = .5, 2 + .5 = 2.5

Counting Slimes

6. 10 creepers x 12 slimes = 120 slimes; 120 slimes x 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 x 25 = 375 emeralds

4. 45 netherwart [15 x 3 = 45] + 240 gold nuggets [8 x 15 x 2 = 240] + 45 handfuls of gunpowder [15 x 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

GRADE 3

Mathematics

Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
[CCSS.MATH.CONTENT.3.OA.A.3]

Determine the unknown whole number in a multiplication or division equation relating three whole numbers.
[CCSS.MATH.CONTENT.3.OA.A.4]

Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations.
[CCSS.MATH.CONTENT.3.OA.C.7]

Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
[CCSS.MATH.CONTENT.3.OA.D.8]

Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
[CCSS.MATH.CONTENT.3.NBT.A.2]

Multiply one-digit whole numbers by multiples of 10 in the range 10 – 90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.
[CCSS.MATH.CONTENT.3.NBT.A.3]

Recognize area as an attribute of plane figures and understand concepts of area measurement.
[CCSS.MATH.CONTENT.3.MD.C.5]

Relate area to the operations of multiplication and addition.
[CCSS.MATH.CONTENT.3.MD.C.7]

Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.
[CCCSS.MATH.CONTENT.3.MD.D.8]

GRADE 4

Mathematics

Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
[CCSS.MATH.CONTENT.4.OA.A.2]

Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
[CCSS.MATH.CONTENT.4.OA.A.3]

Fluently add and subtract multi-digit whole numbers using the standard algorithm.
[CCSS.MATH.CONTENT.4.NBT.B.4]

Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
[CCSS.MATH.CONTENT.3.OA.D.8]

Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
[CCSS.MATH.CONTENT.4.NBT.B.5]

Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.
[CCSS.MATH.CONTENT.4.NF.C.7]

Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.
[CCSS.MATH.CONTENT.4.MD.A.3]

STANDARDS Common Core State Standards: www.corestandards.org
MATHEMATICS/SOCIAL EMOTIONAL LEARNING

GRADE 5

Mathematics

Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
[CCSS.MATH.CONTENT.5.OA.A.1]

Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.
[CCSS.MATH.CONTENT.5.OA.A.2]

Read, write, and compare decimals to thousandths.
[CCSS.MATH.CONTENT.5.NBT.A.3]

Use place value understanding to round decimals to any place.
[CCSS.MATH.CONTENT.5.NBT.A.4]

Fluently multiply multi-digit whole numbers using the standard algorithm.
[CCSS.MATH.CONTENT.5.NBT.B.5]

Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
[CCSS.MATH.CONTENT.5.NBT.B.7]

Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
[CCSS.MATH.CONTENT.5.MD.C.5]

ALL GRADES: SOCIAL AND EMOTIONAL LEARNING

CASEL Core Competencies https://casel.org/core-competencies/
Self-awareness
Self-management
Social awareness
Relationship skills
Responsible decision-making