

BATTLE SHEET · CHAPTER 7

Exponents and Exponential Functions

MathBound Standard Algebra 1 · Island 7: Gearwhistle Foundry

Name _____ Class _____ Date _____

The foes of Gearwhistle Foundry are out, and each one fights with its own kind of Algebra 1 problem. **Defeat each foe by solving its problems.** Show your work in the space on each card, then circle the letter of your answer.

The foes on this sheet



Balloon Bundler

Ties balloons in bundles of bundles: the product and power properties.

Problems 1–3 · Lessons 7.1, 7.7 · Battle it online: **play.mathbound.org/alg1/?practice=r6.multiplication-properties-of-exponents**



Whale-and-Flea Wanda

A whale balloon and a flea on her hat: negative exponents and scientific notation.

Problems 4–6 · Lesson 7.2 · Battle it online: **play.mathbound.org/alg1/?practice=r6.integer-exponents-and-scientific-notation**



Sprout-Root Sid

A plant that sprouts up and roots down at once: rational exponents.

Problems 7–8 · Lesson 7.3 · Battle it online: **play.mathbound.org/alg1/?practice=r9.rational-exponents**



Beanstalk Bonnie

Climbs a beanstalk that doubles: exponential functions.

Problems 9–10 · Lessons 7.4, 7.5 · Battle it online: **play.mathbound.org/alg1/?practice=exp.functions**



Bubble Doubler

Every bubble splits in two: geometric sequences.

Problems 11–12 · Lesson 7.6 · Battle it online: **play.mathbound.org/alg1/?practice=seq.geometric**



Same-Base Sam

Stacks towers on matching bases: exponential equations with a common base.

Problems 13–14 · Lesson 7.7 · Battle it online: **play.mathbound.org/alg1/?practice=exp.equations**

> **For teachers.** 14 problems from MathBound's own question engine, on chapter 7 of MathBound Standard Algebra 1. The answer key, with worked steps, is at the end. Free to copy for your classes.
>
> Every foe here is also a battle in MathBound, the Algebra 1 adventure game: free for students, no sign-up, at **play.mathbound.org**. The link under each foe opens practice battles with it. Classes, progress by skill and assignments: **mathbound.org/teachers**.

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FOE 1 OF 6

Balloon Bundler

Ties balloons in bundles of bundles: the product and power properties. Lessons 7.1, 7.7. Battle it:
play.mathbound.org/alg1/?practice=r6.multiplication-properties-of-exponents

1 Lesson 7.1

Simplify: $7^2 \cdot 7^5$.Write the answer as a power of 7.

A. 14^7 **B.** 49^7

C. 7^7 **D.** 7^{10}

WORK

2 Lesson 7.1

What goes in the box? $(\square x^3)^2 = 4x^6$

A. 2 **B.** 3

C. 1 **D.** 4

WORK

3 Lesson 7.1

Multiply: $(\frac{3}{2}a^2b)(2ab^3)$

A. $6a^3b^4$ **B.** $3a^3b^4$ **C.** $3a^2b^3$ **D.** $-3a^3b^4$

WORK



FOE 2 OF 6

Whale-and-Flea Wanda

A whale balloon and a flea on her hat: negative exponents and scientific notation. Lesson 7.2. Battle it:
play.mathbound.org/alg1/?practice=r6.integer-exponents-and-scientific-notation

4 Lesson 7.2

Simplify: y^{-3}

A. $\frac{1}{-3y}$ **B.** $\frac{1}{y^3}$

C. $-y^3$ **D.** y^3

WORK

5 Lesson 7.2

A bacterium is about 0.00000476 meters long. Write this number in scientific notation.

A. $4.76 \cdot 10^{-5}$ **B.** $4.76 \cdot 10^{-6}$

C. $4.76 \cdot 10^{6}$ **D.** $4.76 \cdot 10^{-7}$

WORK

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FOE 2 OF 6

Whale-and-Flea Wanda (continued)

A whale balloon and a flea on her hat: negative exponents and scientific notation. Lesson 7.2. Battle it:
play.mathbound.org/alg1/?practice=r6.integer-exponents-and-scientific-notation

6 Lesson 7.2

Simplify: $(5.6 \cdot 10^{-5}) - (9 \cdot 10^{-6})$

A. $4.7 \cdot 10^{-5}$ **B.** $4.7 \cdot 10^{-6}$ **C.** $5.51 \cdot 10^{-5}$ **D.** $6.5 \cdot 10^{-5}$

WORK



FOE 3 OF 6

Sprout-Root Sid

A plant that sprouts up and roots down at once: rational exponents. Lesson 7.3. Battle it:
play.mathbound.org/alg1/?practice=r9.rational-exponents

7 Lesson 7.3

Simplify: $8^{\frac{1}{3}}$

A. 8 **B.** 3

C. 2 **D.** 512

WORK

8 Lesson 7.3

Simplify: $\dfrac{y^{\frac{2}{5}}}{y^{\frac{1}{5}}}$

A. $y^{\frac{-1}{5}}$ **B.** $y^{\frac{1}{25}}$

C. $y^{\frac{1}{5}}$ **D.** $y^{\frac{3}{5}}$

WORK

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FOE 4 OF 6

Beanstalk Bonnie

Climbs a beanstalk that doubles: exponential functions. Lessons 7.4, 7.5. Battle it: **play.mathbound.org/alg1/?practice=exp.functions**

9 Lesson 7.4

Kim says $y = 3\,(2)^x$ at $x = 2$ is $6^2 = 36$. What is the correct value?

A. 36 **B.** 18

C. 12 **D.** 6

WORK

10 Lesson 7.5

The number of fish in a lake is $P = 1200(0.9)^t$, where t counts years. To the nearest hundredth of a percent, what is its monthly rate of decay?

A. decay of 71.76% a month

B. decay of 0.87% a month

C. decay of 10% a month

D. decay of 0.83% a month

WORK



FOE 5 OF 6

Bubble Doubler

Every bubble splits in two: geometric sequences. Lesson 7.6. Battle it: **play.mathbound.org/alg1/?practice=seq.geometric**

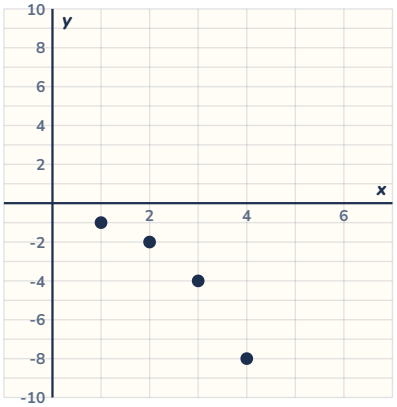
11 Lesson 7.6

The graph shows the first four terms of a geometric sequence. What is the fifth term?

A. -12 **B.** -16

C. 16 **D.** -32

WORK



12 Lesson 7.6

A geometric sequence with a positive common ratio has $a_1 = 4$ and $a_3 = 64$. Write an explicit rule for a_n.

A. $a_n = 64\,(4)^{n-1}$ **B.** $a_n = 4\,(4)^n$ **C.** $a_n = 4\,(16)^{n-1}$ **D.** $a_n = 4\,(4)^{n-1}$

WORK

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FOE 6 OF 6

Same-Base Sam

Stacks towers on matching bases: exponential equations with a common base. Lesson 7.7. Battle it:
play.mathbound.org/alg1/?practice=exp.equations

13 Lesson 7.7

The table shows $y = 3\,(2)^x$. For what value of x is $y = 384$?

x	0	1	2	3
y	3	6	12	24

A. $x = 7$ **B.** $x = 64$ **C.** $x = 192$ **D.** $x = 6$

WORK

14 Lesson 7.7

Solve: $8^x = \frac{1}{4}$

A. $x = \frac{-2}{3}$ **B.** $x = -2$ **C.** $x = \frac{-3}{2}$ **D.** $x = \frac{2}{3}$

WORK

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Answer key · Chapter 7: Exponents and Exponential Functions

Each answer is followed by its worked steps, as the game shows them after a battle.

Balloon Bundler

1. C: 7^7

1. Multiplying powers of the same base adds the exponents.
2. The base stays 7: $7^2 \cdot 7^5 = 7^7$.

2. A: 2

1. The coefficient raised to the 2 must give 4.
2. $2^2 = 4$, so the box holds 2.

3. B: $3a^3b^4$

1. Coefficients multiply; each variable's exponents add separately.
2. $\frac{3}{2} \cdot 2 = 3$; a: $2 + 1$; b: $1 + 3$.

Whale-and-Flea Wanda

4. B: $\frac{1}{y^3}$

1. A negative exponent means a reciprocal, not a negative number.
2. $y^{-3} = \frac{1}{y^3}$.

5. B: $4.76 \cdot 10^{-6}$

1. A number smaller than one has a negative power of ten.
2. The decimal point moves 6 places, so $4.76 \cdot 10^{-6}$.

6. A: $4.7 \cdot 10^{-5}$

1. To add or subtract, first rewrite one number so both have the same power of ten.
2. $9 \cdot 10^{-6} = 0.9 \cdot 10^{-5}$.
3. $5.6 - 0.9 = 4.7$, so $4.7 \cdot 10^{-5}$.

Sprout-Root Sid

7. C: 2

1. An exponent of one over 3 is the $3th$ root: $8^{\frac{1}{3}} = \sqrt[3]{8}$.
2. That is 2.

8. C: $y^{\frac{1}{5}}$

1. Dividing subtracts the exponents: $\frac{2}{5} - \frac{1}{5}$.
2. That is $\frac{1}{5}$.

Beanstalk Bonnie

9. C: 12

1. The power belongs to the base 2 only: $2^2 = 4$.
2. $3 \cdot 4 = 12$.

10. B: decay of 0.87% a month

1. A month is $\frac{1}{12}$ of a year, so the monthly factor is $(0.9)^{\frac{1}{12}} \approx 0.9913$.
2. That is decay of about 0.87% a month −− not 0.83%, since the months compound.

Bubble Doubler

11. B: -16

1. Each point is 2 times the one before.
2. $-8 \cdot 2 = -16$.

12. D: $a_n = 4\,(4)^{n-1}$

1. Two steps lead from a_1 to a_3: $r^2 = \frac{64}{4} = 16$, so $r = 4$.
2. $a_n = a_1 r^{n-1}$: $a_n = 4\,(4)^{n-1}$.

Same-Base Sam

13. A: $x = 7$

1. Keep multiplying by 2: 3, 6, 12, 24, 48, 96, 192, 384.
2. $y = 384$ when $x = 7$.

14. A: $x = \frac{-2}{3}$

1. $\frac{1}{4} = 2^{-2}$ and $8 = 2^3$.
2. $3x = -2$, so $x = \frac{-2}{3}$.

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