# Accelerated 7 • Unit 7 • Assessment Guide

*Exponents and Scientific Notation*

*For the Parent or Teacher — What to look for*

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*Unit 7 builds fluency with exponent properties — multiplying, dividing, powers of powers — and extends to zero and negative exponents. Scientific notation gives students a powerful tool for very large or very small numbers. Watch for STRUCTURE understanding (why the rules work), not just rote application.*

### Problem 1 — Basic exponent rules

- (a) 2^8. (b) 5^8. (c) 7^4. (d) 2^4 * 3^4 (or 1296 if computed).
- Diagnostic: do they MIX UP the rules? Common error: 2^5 * 2^3 = 2^15 (multiplied exponents instead of added).
- Strong: writes the rule (add exponents when multiplying same base, etc.).

### Problem 2 — Why 3^5 * 3^2 = 3^7

- 3^5 = 3*3*3*3*3. 3^2 = 3*3. Multiplying: (3*3*3*3*3)*(3*3) = 3*3*3*3*3*3*3 = 3^7.
- This counts 5 + 2 = 7 threes. THE conceptual basis for the product rule.
- Strong: writes this out as a chain of 3s; weak: just repeats the rule.

### Problem 3 — Zero and negative exponents

- (a) 5^0 = 1, 17^0 = 1.
- (b) 2^(-3) = 1/8 = 0.125. 10^(-2) = 1/100 = 0.01.
- (c) (1/3)^(-2) = 9 (reciprocal squared).
- Critical errors to watch: 5^0 = 5 or 5^0 = 0; 2^(-3) = -8 (treating exponent as multiplication).

### Problem 4 — Diego's error (2^(-3))

- Diego thought the negative sign distributed to the result (negation). But negative exponent means RECIPROCAL: 2^(-3) = 1/2^3 = 1/8.
- Strong response shows the PATTERN: 2^3=8, 2^2=4, 2^1=2, 2^0=1, 2^(-1)=1/2, 2^(-2)=1/4 -> each step divides by 2. So 2^(-3) = 1/8.

### Problem 5 — To scientific notation

- (a) 4.3 * 10^6. (b) 6.7 * 10^(-4). (c) 5.972 * 10^24.
- Format must be coefficient between 1 and 10 (1 ≤ |a| < 10). Watch for 43 * 10^5 or 0.43 * 10^7 — both wrong forms.

### Problem 6 — Scientific to standard

- (a) 320,000. (b) 0.000705.
- Counting decimal places carefully; common to be off by one (especially for negative exponents).

### Problem 7 — Computation in scientific notation

- (a) 6 * 10^10.
- (b) 2 * 10^6.
- (c) 2 * 10^5 + 0.3 * 10^5 = 2.3 * 10^5.
- (d) 5 * 10^4.

- Diagnostic on (c): adding requires SAME power of 10. Many students try to just add the coefficients and exponents separately — wrong.

## Problem 8 — Sunlight travel time

- t = (1.5 * 10^8) / (3 * 10^5) = 0.5 * 10^3 = 500 seconds = 8.33 minutes ≈ 8 min 20 s.
- Strong: writes in scientific notation throughout and converts to minutes at the end.
- Weak: computes 150,000,000 / 300,000 by hand — misses the point of the unit.

## Problem 9 — Comparisons

- (a) 2^10 = 1024 > 10^2 = 100. Strong: notes 2^10 ≈ 10^3.
- (b) 3.5 * 10^(-7) > 9.2 * 10^(-8) — because 10^(-7) is bigger than 10^(-8). (Common confusion: thinking 9.2 > 3.5 means the second is bigger.)
- (c) (2^5)^3 = 2^15 = 32768. 2^5 * 2^3 = 2^8 = 256. So (2^5)^3 is much bigger.
- Diagnostic on (b): does the student look at the EXPONENT first, then the coefficient?

## Problem 10 — Why 5^0 = 1

- Pattern: 5^3 = 125, 5^2 = 25, 5^1 = 5, 5^0 = ? Each step divides by 5. So 5^0 = 5/5 = 1.
- OR: 5^n / 5^n = 1, but also = 5^(n-n) = 5^0. So 5^0 = 1.
- Strong responses give one of these justifications. Weak: just states the rule.

## Problem 11 — Bacteria doubling

- (a) After 20 min: 2. After 1 hr (60 min = 3 doublings): 2^3 = 8. After 4 hrs (12 doublings): 2^12 = 4096 ≈ 4.1 * 10^3.
- (b) N(t) = 2^(3t) where t is hours. (Three doublings per hour.)
- (c) After 24 hours: 2^72 ≈ 4.7 * 10^21. That's MUCH MORE than 3 * 10^13 — by 8 orders of magnitude.
- Exponential growth dramatically outpaces large numbers. A key Algebra 1 readiness insight.

## Problem 12 — Mai's claim

- Verify a=2, m=3, n=-5: 2^3 * 2^(-5) = 8 * (1/32) = 1/4 = 2^(-2). And m+n = 3+(-5) = -2. So 2^(-2) = 1/4.
- Verify a=4, m=-2, n=-3: 4^(-2) * 4^(-3) = (1/16)(1/64) = 1/1024 = 4^(-5). m+n = -5.
- Mai is right. The exponent rules extend smoothly to negative exponents — a powerful structural insight.

*— end —*