

Practice

Check

- ① Write each product as a single power.
- a) $5^5 \times 5^4$ b) $10^2 \times 10^{11}$
 c) $(-3)^3 \times (-3)^3$ d) $21^6 \times 21^4$
 e) $(-4)^1 \times (-4)^3$ f) $6^{12} \times 6^3$
 g) $2^0 \times 2^4$ h) $(-7)^3 \times (-7)^0$

②

Write each quotient as a power.

- a) $4^5 \div 4^3$ b) $8^9 \div 8^6$
 c) $15^{10} \div 15^0$ d) $(-6)^8 \div (-6)^3$
 e) $\frac{2^{12}}{2^{10}}$ f) $\frac{(-10)^{12}}{(-10)^6}$
 g) $\frac{6^5}{6^1}$ h) $\frac{(-1)^5}{(-1)^4}$

Apply

- ③ a) Evaluate.
- i) $3^4 \div 3^4$ ii) $(-4)^6 \div (-4)^6$
 iii) $\frac{5^8}{5^8}$ iv) $\frac{(-6)^3}{(-6)^3}$
- b) Use the results of part a. Explain how the exponent law for the quotient of powers can be used to verify that a power with exponent 0 is 1.

④

- a) Compare these products.
 i) $3^4 \times 3^9$ ii) $3^9 \times 3^4$
- b) Explain the results in part a.

⑤

- Express as a single power.
- a) $3^4 \times 3^9 \div 3^{11}$
 b) $(-4)^3 \div (-4)^2 \times (-4)^{10}$
 c) $6^0 \times 6^3 \div 6^2$
 d) $\frac{4^3 \times 4^5}{4^2 \times 4^6}$ e) $\frac{(-3)^4 \times (-3)^4}{(-3)^4}$

⑥

- a) Express as a single power, then evaluate.
 i) $(-6)^1 \times (-6)^7 \div (-6)^7$
 ii) $(-6)^7 \div (-6)^7 \times (-6)^1$
- b) Explain why changing the order of the terms in the expressions in part a does not affect the answer.

⑦

- Simplify, then evaluate.
- a) $10^2 \times 10^2 + 10^4$ b) $10^3 \times 10^3 - 10^3$
 c) $10^{11} - 10^3 \times 10^6$ d) $10^1 + 10^5 \times 10^2$
 e) $10^6 \div 10^2 \times 10^2$ f) $10^9 \div 10^9$
 g) $\frac{10^{12}}{10^6}$ h) $\frac{10^4 \times 10^3}{10^2}$
 i) $\frac{10^{11}}{10^4 \times 10^2}$ j) $\frac{10^5}{10^3} + 10^2$

⑧

- Evaluate.
- a) $2^3 \times 2^2 - 2^5 \times 2$
 b) $3^2 \times 3 + 2^2 \times 2^4$
 c) $4^2 - 3^0 \times 3 + 2^3$
 d) $(-3)^6 \div (-3)^5 - (-3)^5 \div (-3)^3$
 e) $(-2)^4 [(-2)^5 \div (-2)^3] + (-2)^4$
 f) $-2^4(2^6 \div 2^2) - 2^4$
 g) $(-5)^3 \div (-5)^2 \times (-5)^0 + (-5)^2 \div (-5)$

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Identify, then correct any errors in the student work below. Explain how you think the errors occurred.

a) $4^3 \times 4^4 = 4^{12}$	b) $\frac{(-7)^4}{(-7)^3} = (-7)^2$
c) $3^2 \times 2^3 = 6^5$	d) $\frac{5^8}{5^4 \times 5^2} = 1$
e) $1^2 + 1^3 \times 1^2 = 1^7$	

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Muguet uses a microscope to view bacteria. The bacteria are first magnified 10^2 times. This image is then magnified 10^1 times.

- Use powers to write an expression for the total magnification.
- How many times as large as the actual bacteria does the image appear?

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- Evaluate.
 - $5^2 + 5^3$
 - $5^2 \times 5^3$
- In part a, explain why you could use an exponent law to simplify one expression, but not the other.

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- Evaluate.
 - $4^3 - 4^2$
 - $4^3 \div 4^2$
- In part a, explain why you could use an exponent law to simplify one expression, but not the other.

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Simplify, then evaluate only the expressions with a positive value. Explain how you know the sign of each answer without evaluating.

- $(-2)^2 \times (-2)^3$
- $(-2)^0 \times (-2)^5$
- $(-2)^5 \div (-2)^3$
- $(-2)^6 \div (-2)^6$
- $\frac{(-2)^3 \times (-2)^4}{(-2)^3 \times (-2)^2}$
- $\frac{(-2)^6}{(-2)^3 \times (-2)^2}$