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## Chapter 2 Review

For each type of question, the achievement level is indicated. Showing work is an important strategy in communicating your knowledge and ideas so please be thorough.

<b>Learning Goal 2.1</b>	I can identify the base and exponent of a power and understand the relationship between powers and repeated multiplication.
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**Developing**

1. Identify the base, exponent and power of each expression.

a. $3^{52}$	b. $(-7)^{23}$	c. $2^{-18}$	d. $-4^{67}$	e. $5^{25}$	f. $(-12)^0$	g. $1^{-100}$
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**Developing**

2. Write the following numbers as repeated multiplication, then evaluate. Do not leave answers as decimals, only as fractions where appropriate.

a. $3^5$	b. $7^3$	c. $2^8$
d. $4^6$	e. $5^2$	f. $12^0$
		g. $1^{10}$

**Proficient**

a. $(-3)^3$	b. $-3^3$	c. $-6^2$
d. $(-6)^2$	e. $-5^4$	f. $(-5)^4$

**Extending**

a. $(-4)^{-3}$	b. $-4^{-3}$	c. $-2^{-4}$
d. $(-2)^{-4}$	e. $-10^{-5}$	f. $(-10)^{-5}$

**Extending**

3. A text message tree is used to send messages. The person at the top texts 2 people. Each person texts 2 more people. Suppose it takes 1 minute to call someone. A message is relayed until the bottom row of the tree has 256 people. How long does it take? How do you know?

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<b>Learning Goal 2.2</b>	I can apply exponent laws to expressions.
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1. Simplify the following expressions to a single power (if possible). Show all your work.

Developing			
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a.	$5^2 \times 5^9$	b.	$7^{10} \times 7^{12}$	c.	$4^8 \times 3^9$	d.	$a^{14} \times a^{18}$
e.	$\frac{4^{14}}{4^8}$	f.	$\frac{8^8}{5^3}$	g.	$\frac{2^{23}}{2^6}$	h.	$\frac{f^{19}}{f^{13}}$
i.	$(3^6)^{10}$	j.	$(6^{14})^3$	k.	$(t^5)^{12}$	l.	$(8^9)^4$

Proficient			
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a.	$(5^6 \times 5^2)^4$	b.	$(7^0 \times 7^{15})^2$	c.	$(3^8 \times 3^9)^0$	d.	$(a^4 \times a^8)^{12}$
e.	$\frac{4^8}{4^{14}}$	f.	$\frac{8^8}{8^{17}}$	g.	$\frac{2^2}{2^{16}}$	h.	$\frac{f^{11}}{f^{24}}$
i.	$\left(\frac{3^6}{3^3}\right)^{12}$	j.	$\left(\frac{6^{14}}{6^{21}}\right)^3$	k.	$\left(\frac{t^5}{t^{11}}\right)^8$	l.	$\frac{a^4}{a^5} \times a^{-6}$
m.	$\left(\frac{x^5 \times x^8}{x^3}\right)^9$	n.	$\left(\frac{x^5}{x^3} \times x^8\right)^9$	o.	$\left(\frac{x^5}{x^3}\right)^9 \times x^8$	p.	$\frac{(x^5 \times x^8)^9}{x^3}$

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2. Simplify the following expressions. Show all your work.

## Proficient

a.	$\left(\frac{6}{12a}\right)^3$	b.	$(2b^2c^5)^3$	c.	$(4m^4n^{-3})^{-3}$	d.	$(-3a^{-4}b^{-5})^{-3}$
e.	$\frac{4q^2r^5}{12q^7r^2}$	f.	$\left(\frac{f^5}{fg^3}\right)^{-4}$	g.	$\frac{2xy^2z^3}{x^3y^2z}$	h.	$\left(\frac{14f^{11}}{7f^{24}}\right)^4$
i.	$\frac{x^9y^5}{x^6y^{-2}}$	j.	$\left(\frac{c^5d^{-3}}{c^{-2}d^3}\right)^{-4}$	k.	$\left(\frac{-r^5s^3}{2t^{-11}}\right)^8$	l.	$\left(\frac{16g^7}{8g^5h^{-4}}\right)^{15}$
m.	$\left(-\frac{x^5y^8}{6y^3}\right)^3$	n.	$\left(\frac{j^5}{k^3} \times j^8k^{-4}\right)^9$	o.	$\left(\frac{c^{-2}d}{a^{-3}b^{-4}}\right)^{-9}$	p.	$(-3p^{-4}q^3)^{-3}$

## Extending

a.	$(3p^4q^5)^{-2} \times (2p^{-3})^4$	b.	$(15r^6s^2t^{-4})^3 \times (3r^3s^{-6}t^{-8})^{-4}$
c.	$\left(\frac{-12a^7b^{-6}}{20a^{-3}c^4}\right)^{-3}$	d.	$\left(\frac{60x^9y^{-12}}{12x^{-3}y^4z^{-2}}\right)^{-2}$

## Extending

3. The tallest tree in the world, Hyperion in California, is about $10^2$ m tall. The highest mountain, Mount Everest, is about $10^4$ m high. About how many times as high as the tree is the mountain?			
4. Scientists grow bacteria. This table shows how the number of bacteria doubles every hour. How many bacteria are there at noon? At 3:00 PM? If the pattern continues, how many bacteria would you expect by midnight?	Time	Elapsed Time After Noon (h)	Number of Bacteria
	noon	0	$1000 \times 2^0$
	1:00 P.M.	1	$1000 \times 2^1$
	2:00 P.M.	2	$1000 \times 2^2$
	3:00 P.M.	3	$1000 \times 2^3$

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<b>Learning Goal 2.3</b>	I can evaluate an expression using order of operations with powers and applying exponent laws.
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1. The following equations are true. Show each step, using order of operations how the answer is achieved.

Developing			
a.	$4^3 - 2^3 = 56$	b.	$(4 - 2)^3 = 8$
c.	$(6^2 \times 7) \div 2^1 = 126$	d.	$48 \div 3 \times 2^2 = 64$
e.	$5 \times (2^3 - 2^4) = -40$	f.	$5 \times 2^3 - 2^4 = 24$
Proficient			
g.	$4^3 \div (8 \times (6^1 - 2^3)) = -4$	h.	$(4^3 \div 8) \times (6^1 - 2^3) = -16$
i.	$(2 \times 3) + 3^2 - 5 \times 3 = 0$	j.	$\frac{5^3 \times (2^3 - 4^2)}{5^2} = -40$
k.	$(10 - 7)^4 + 2 \times 3^2 = 99$	l.	$\frac{2^3(3^2 - 5)}{4^2} = 2$
Extending			
m.	$(10 - 2^3)^5 + 4 \times (5 - 24) + (21 - 5^2)^2 = -28$	n.	$\left( \left( \frac{3^3}{3^4} \right)^{-1} + \left( \frac{5 \times 9^1}{3^2} \right) \right) \times 2^{-2} = 2$
o.	$\left( \frac{5}{10} \right)^{-3} - 2 \times 5^2 \times 10^{-1} = 3$	p.	$6^2 \div (9 + (-2)^3) - 2(8 - (-2)^2)^3 = -92$

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<b>Learning Goal 2.4</b>	I can convert number between standard form and scientific notation.
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1. Write each number in scientific notation.

Developing			
a. 0.000 054 mg	b. 0.006 4 s	c. 0.000 32 mm	d. 0.012 345 mg
e. 0.000 000 000 1 mL	f. 0.987 mg	g. 1 500 g	h. 123 456 km
i. 120 km	j. 975.05 km	k. 900 hours	l. 6.7 m
Proficient			
m. 1 one thousandth of a second	n. 12 million km	o. 17 hundredths of a mm	p. 7.9 mL
q. 3.7 million kg	r. 187 thousand years	s. 8.2 g	t. 15 hundred L
Extending			
u. $0.00035 \times 10^{-4}$ mL	v. $23 \times 10^{-8}$ mm	w. $8 \times 10^{-17}$ mg	x. $0.00678 \times 10^{-6}$ s
y. $5 \times 10^{16}$ L	z. $123\,456 \times 10^{27}$ kg	aa. $38 \times 10^2$ m	bb. $495.8 \times 10^6$ km

2. Write each number in standard notation. Make note of which questions are written in scientific notation.

Developing			
a. $1.5 \times 10^{-2}$ s	b. $7.75 \times 10^{-1}$ mg	c. $1.71 \times 10^{-8}$ mm	d. $9.24 \times 10^{-4}$ mL
e. $4.65 \times 10^{-3}$ g	f. $3.14 \times 10^{-5}$ mm	g. $2.5 \times 10^1$ kg	h. $3.14 \times 10^5$ km
i. $5.4 \times 10^6$ kg	j. $2.71 \times 10^3$ hours	k. $7.5 \times 10^6$ L	l. $5.234 \times 10^2$ kg
Proficient			
m. $4.32 \times 10^0$ s	n. $9.75 \times 10^0$ m	o. $4.63 \times 10^0$ g	p. $3.14 \times 10^0$ L

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### Chapter 2 Review

#### Extending

q. $495.3 \times 10^{-2} \text{ s}$	r. $0.0934 \times 10^{-3} \text{ mg}$	s. $0.0067 \times 10^{-5} \text{ mL}$	t. $0.54 \times 10^{-7} \text{ mm}$
u. $31415 \times 10^5 \text{ kg}$	v. $0.00035 \times 10^8 \text{ L}$	w. $234 \times 10^3 \text{ hours}$	x. $75 \times 10^4 \text{ km}$