

Chapter 3 Review

Key Words

For #1 to #5, use the clues to unscramble the letters.

1. T F N F E E I C C O I

a number that multiplies a power

2. N N T O E I P A X L E M O R F

the form for writing a number so that it is made up of a base and an exponent (two words)

3. E A S B

the number in a power that is multiplied repeatedly

4. W R O E P

an expression made up of a base and an exponent

5. T O X E N P N E

the number in a power that indicates how many times to repeatedly multiply the base by itself

3.1 Using Exponents to Describe Numbers, pages 92–98

6. Write each expression as a power.

a) $2 \times 2 \times 2$

b) $(-3) \times (-3) \times (-3) \times (-3)$

7. Write each power in repeated multiplication form.

a) 4^6

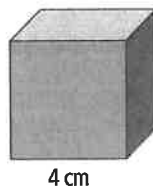
b) 6^4

c) $(-5)^7$

d) -5^7

8. The area of a square on grid paper is 5^2 . Evaluate the area. Draw the square and label its area and side length.

9. A cube has an edge length of 4 cm. Express its volume in repeated multiplication form and in exponential form. Then, evaluate.



10. Arrange the following numbers in ascending order:

4^3 7^2 -3^4 9 2^5

3.2 Exponent Laws, pages 99–107

11. Rewrite each power in the following products in repeated multiplication form.

a) $3^2 \times 5^4$

b) $(-3)^3 \times 2^6$

12. Write each expression in parentheses as a power. Then, write the entire expression as a single power.

a) $(2 \times 2 \times 2) \times (2 \times 2)$

b) $\frac{(4 \times 4)(4 \times 4 \times 4 \times 4)}{(4 \times 4 \times 4)}$

13. Write each expression in repeated multiplication form, and then as a single power.

a) $(-5)^2 \times (-5)^5$

b) $(3^2)^4$

14. Write each expression as the multiplication of two powers.

- a) $(6 \times 4)^3$
b) $[(7 \times (-2))]^5$

15. Write each expression as the division of two powers.

- a) $\left(\frac{4}{5}\right)^2$
b) $\left(\frac{2}{7}\right)^4$

16. Evaluate.

- a) -4^2
b) $(-10)^0$
c) $3^2 \times 3^3$

3.3 Order of Operations, pages 108–113

17. Write the calculator key sequence you would use to evaluate each expression.

- a) $(-2)^2 + (-2)^3$
b) $(2^3)^2 - 4 \times 6^0$
c) $(-3)^4 - (-3)^3 + (2 \times 4)^2$

18. Evaluate.

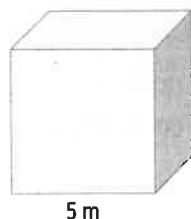
- a) $7^2 + (-2)^3 \div (-2)^2$
b) $(2 - 5)^3 + 6^2$
c) $\frac{(2)^6(2)^2 - 13 \times 2^0}{(-1 + 2^2)^5}$
d) $(-1)^{10} + (-22)^0 - \left(\frac{3}{5}\right)^2$

19. Explain the mistake in Ang's solution. Determine the correct answer.

$$\begin{aligned} & (-3)^4 + 7 \times 2^3 \\ &= 81 + 7 \times 8 \\ &= 88 \times 8 \\ &= 704 \end{aligned}$$

3.4 Using Exponents to Solve Problems, pages 114–119

20. What is the surface area of a cube with an edge length of 5 m?



21. A population of ten bacteria doubles every hour. This growth can be represented by $N = 10(2)^t$, where N is the number of bacteria, and t is the amount of time, in hours. How many bacteria will there be after each number of hours?

- a) 3
b) 6

22. A formula that approximates the distance an object falls through air in relation to time is $d = 4.9t^2$. The distance, d , is measured in metres, and the time, t , in seconds. A pebble breaks loose from a cliff. What distance would it fall in each number of seconds?

- a) 1
b) 2
c) 6



Chapter 3 Review, pages 120–121

1. coefficient

2. exponential form

3. base

4. power

5. exponent

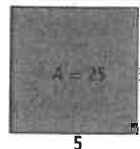
6. a) 2^3 b) $(-3)^4$

7. a) $4 \times 4 \times 4 \times 4 \times 4 \times 4$ b) $6 \times 6 \times 6 \times 6$

c) $(-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5)$

d) $-(5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5)$

8. Area = 25 square units



9. $4 \times 4 \times 4 = 4^3$
 $= 64$

$V = 64 \text{ cm}^3$

10. -3^4 , 9 , 2^5 , 7^2 , 4^3

11. a) $3 \times 3 \times 5 \times 5 \times 5 \times 5$

b) $(-3) \times (-3) \times (-3) \times 2 \times 2 \times 2 \times 2 \times 2$

12. a) $2^3 \times 2^2 = 2^5$ b) $\frac{4^2 \times 4^4}{4^3} = 4^3$

13. a) $(-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) = (-5)^7$ b) $3^2 \times 3^2 \times 3^2 \times 3^2 = 3^8$

14. a) $6^3 \times 4^3$ b) $7^5 \times (-2)^5$

15. a) $\frac{4^2}{5^2}$ b) $\frac{2^4}{7^4}$

16. a) -16 b) 1 c) 243

17. Example: a) $(-2)^2 + (-2)^3 = -4$

b) $(2^3)^2 - 4 \times 6^0 = 60$

c) $(-3)^4 - (-3)^3 + (2 \times 4)^2 = 172$

18. a) 47 b) 9 c) 1 d) $1\frac{16}{25}$

19. In step 2, the error is that Ang added $81 + 7$ when he should have multiplied 7 and 8 .

20. 150 m^2

21. a) 80 b) 640

22. a) 4.9 m b) 19.6 m c) 176.4 m

Chapter 3 Practice Test

For #1 to #6, choose the best answer.

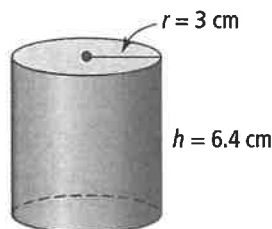
- What is the value 3 in the power 4^3 called?
A base **B** power
C exponent **D** coefficient
- What is the coefficient in the expression $-(-3)^5$?
A -3 **B** -1
C 1 **D** 3
- What expression is represented by $(3^2)^4$?
A $(3 \times 3)(3 \times 3 \times 3 \times 3)$
B $(3 \times 3 \times 3 \times 3 \times 3 \times 3)$
C $(3 \times 3)(3 \times 3)(3 \times 3)(3 \times 3)$
D $(3 \times 3 \times 3 \times 3)(3 \times 3 \times 3 \times 3)$
 $(3 \times 3 \times 3 \times 3)(3 \times 3 \times 3 \times 3)$
- What expression is equivalent to $(5 \times 4)^2$?
A 10×8 **B** 5×4^2
C $5^2 \times 4$ **D** $5^2 \times 4^2$
- What is $\frac{(-7)^3(-7)^5}{(-7)^2}$ expressed as a single power?
A $(-7)^6$ **B** $(-7)^{10}$
C $(-7)^{13}$ **D** $(-7)^{17}$
- Evaluate $(7 - 2)^3 + 48 \div (-2)^4$.
A 338 **B** 128
C 10.8125 **D** -10.8125

Complete the statements in #7 and #8.

- The expression $10^5 \times 5^5$ written with only one exponent is ■. $(10 \times 5)^5 = 50^5$
- The expression $\frac{5^6}{8^6}$ written with only one exponent is ■.

Short Answer

- Write the expression $\frac{4^4 \times 4}{4^2}$ in repeated multiplication form, and then evaluate.
- The formula for the volume of a cylinder is $V = \pi r^2 h$. Find the volume, V , of a cylinder with a radius of 3 cm and a height of 6.4 cm. Express your answer to the nearest tenth of a cubic centimetre.



- A skydiver free falls before opening the parachute. What distance would the skydiver fall during 7s of free fall? Use the formula $d = 4.9t^2$, where d is distance, in metres, and t is time, in seconds.



- Write the calculator key sequence you would use to evaluate each expression. Then, evaluate.
a) $(1 - 3)^4 \div 4$
b) $(-2)^0 + 4 \times 17^0$
c) $16 - 9(2^3) + (-4)^2$
- The prime factorization of 243 is $3 \times 3 \times 3 \times 3 \times 3$. Write 243 as the product of two powers of 3 in as many ways as possible.

14. A formula for estimating the volume of wood in a tree is $V = 0.05hc^2$. The volume, V , is measured in cubic metres. The height, h , and the trunk circumference, c , are in metres. What is the volume of wood in a tree with a trunk circumference of 2.3 m and a height of 32 m? Express your answer to the nearest tenth of a cubic metre.



Oyster River, British Columbia

Extended Response

15. Nabil made an error in simplifying the following expression.

a) Explain his mistake.

b) Determine the correct answer.

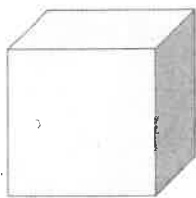
$$\begin{aligned} & (12 \div 4)^4 + (5 + 3)^2 \\ &= (3)^4 + 5^2 + 3^2 \\ &= 81 + 25 + 9 \\ &= 106 + 9 \\ &= 115 \end{aligned}$$

16. A type of bacterium triples in number every 24 h. There are currently 300 bacteria.

- Create a table to show the number of bacteria after each of the next seven days. Express each number of bacteria as the product of a coefficient and a power.
- Determine a formula that will calculate the number of bacteria, B , after d days.
- Use the formula to find the number of bacteria after 9 days.
- How many were there 24 h ago? Explain your reasoning.

Math Link: Wrap It Up!

Create a mobile that uses at least three different types of regular three-dimensional shapes such as a cube, a square-based prism, and a cylinder. You may wish to choose a different type of geometric shape to build as well.



cube



square-based prism



cylinder

- Choose whole-number dimensions between 10 cm and 20 cm for each shape.
- Use a ruler and a piece of construction paper or other heavy paper to draw a net for each shape.
- Build each shape.
- Use expressions in exponential form to label the surface area and the volume of each shape.
- Evaluate each expression. Show all of your work.
- Make your mobile. Use colour and creativity!

1. Write each product as a power.

- a) $3^5 \times 3^2$ b) $(-2)^4(-2)^3$
c) $-2^3 \times 2^5$ d) $15^3 \times 15^2$
e) $18^{18} \times 18^3$ f) $(-24)^5(-24)^{11}$

2. Write each quotient as a power.

- a) $4^5 \div 4^3$ b) $3^8 \div 3^6$
c) $7^6 \div 7^5$ d) $\frac{12^8}{12^8}$
e) $\frac{16^2}{16^2}$ f) $\frac{25^{15}}{25^{12}}$

3. a) Can you apply the laws of exponents to simplify $5^4 \times 4^5$? Explain.

b) Can you apply the laws of exponents to simplify $9^2 \div 27^2$? Explain.

4. What does each power mean? Evaluate each power.

- a) 5^3 b) 3^5 c) 5^{-3}
d) 3^{-5} e) $(-5)^3$ f) $(-3)^5$
g) $(-5)^{-3}$ h) $(-3)^{-5}$ i) 3^0

5. Which is the greater number in each pair?

- a) $8^3, 5^4$ b) $8^{-3}, 5^{-4}$
c) $6^3, 4^4$ d) $6^{-3}, 4^{-4}$
e) $9^2, 2^6$ f) $9^{-2}, 2^{-6}$

6. There is only one power of 5 between 1000 and 10 000. Which number is it?

7. Use the laws of exponents to write each expression as a product or quotient of powers.

- a) $(4 \times 5)^3$ b) $(3 \times 4)^{-2}$
c) $(12 \div 3)^5$ d) $(27 \div 9)^{-3}$
e) $(12 \times 7)^2$ f) $\left(\frac{-5}{2}\right)^4$
g) $\left(\frac{24}{28}\right)^{-5}$ h) $\left(\frac{-56}{84}\right)^3$

8. Use the laws of exponents to write each expression as a single power.

- a) $(5^2)^2$ b) $(8^3)^4$
c) $(12^5)^2$ d) $(9^3)^{-1}$
e) $[(-5)^2]^3$ f) $[(-3)^4]^{-2}$

9. Use a calculator. Evaluate each expression two different ways:

i) by doing the operations in the brackets first

ii) by using the exponent laws

Compare the results to confirm they are equal.

- a) $(3 \times 5)^4$ b) $\left(\frac{2}{5}\right)^3$ c) $(4^3)^4$
d) $(4 \times 2)^3$ e) $(56 \div 7)^2$ f) $(2^5)^5$

10. Write each expression as a power.

- a) $10^4 \times 10^9$ b) $7.3^5 \times 7.3^3$
c) $(-12)^6 \times (-12)^8$ d) $8^7 \div 8^2$
e) $9.4^{-4} \div 9.4^{-11}$ f) $(-3)^8 \div (-3)^{-5}$
g) $(3^2)^2$ h) $\frac{6.25^8}{6.25^3}$
i) $\frac{8^6 \times 8^4}{8^3}$ j) $\frac{2^5}{2^3 \times 2^8}$
k) $\frac{4^{-3} \times 4^{10}}{4^5 \times 4^{-2}}$ l) $\frac{(-7)^2 \times (-7)^9}{(-7)^3 \times (-7)^4}$

KEYS

Chapter 3 Practice Test

1. C 2. B 3. C 4. D 5. A 6. B 7. Examples: $(10 \times 5)^5$, 50^5

8. $(\frac{5}{8})^6$ 9. $\frac{4 \times 4 \times 4 \times 4 \times 4}{4 \times 4} = 64$ 10. 181.0 cm^3 11. 240.1 m

12. Calculator-sequence should show the following.

a) $(1 - 3)^4 \div 4 = 4$

b) $(-2)^0 + 4 \times 17^0 = 5$

c) $16 - 9 \times (2^3) + (-4)^2 = -40$

13. $3^0 \times 3^5$, $3^1 \times 3^4$, $3^2 \times 3^3$ 14. 8.5 m^3

15. a) Mabil should have added 5 and 3, and then applied the exponent of 2 to the sum of 8.

b) 145

16. a)

Days	Number of Bacteria as a Product	Number of Bacteria
Start	$300(3)^0$	300
1	$300(3)^1$	900
2	$300(3)^2$	2 700
3	$300(3)^3$	8 100
4	$300(3)^4$	24 300
5	$300(3)^5$	72 900
6	$300(3)^6$	218 700
7	$300(3)^7$	656 100

b) $B = 300(3)^x$

c) 5 904 900

d) 100. To find the previous number of bacteria, divide by 3:
 $300 \div 3 = 100$.

Part C

1. a) 3^7

d) 15^5

2. a) 4^2

d) 12^0

b) $(-2)^7$

e) 18^{21}

b) 3^2

e) 16^1

c) -2^8

f) $(-24)^{16}$

c) 7^1

f) 25^3

3. a) No; the bases are not the same.

b) Yes, provided you write 9 as 3^2 and 27 as 3^3 .

4. a) 125

b) 243

c) $\frac{1}{125}$

d) $\frac{1}{243}$

e) -125

f) -243

g) $-\frac{1}{125}$

h) $-\frac{1}{243}$

i) 1

5. a) 5^4

b) $\frac{1}{8^3}$

c) 4^4

d) $\frac{1}{6^3}$

e) 9^2

f) $\frac{1}{2^6}$

6. 5^5 , or 3125

7. a) $4^3 \times 5^3$

b) $\frac{1}{3^2} \times \frac{1}{4^2}$

c) $\frac{12^5}{3^5}$

d) $\frac{9^3}{27^3}$

e) $12^2 \times 7^2$

f) $\frac{(-5)^4}{2^4}$

g) $\frac{28^5}{24^5}$

h) $\frac{(-56)^3}{84^3}$

8. a) 5^4

d) $\frac{1}{9^3}$

b) 8^{12}

e) $(-5)^6$

c) 12^{10}

f) $(\frac{1}{6-3})^8$

9. a) 50 625

d) 512

b) $0.064 = \frac{8}{125}$

e) 64

c) 16 777 216

f) 33 554 432

10. a) 10^{13}

e) 9.4^7

i) 8^7

b) 7.3^8

f) $(-3)^{13}$

j) $\frac{1}{2^6}$

c) $(-12)^{14}$

g) 3^4

k) 4^4

d) 8^5

h) 6.25^5

l) $(-7)^4$