Answers

Get Ready, pages 116–117

1. a) 25 cm^2 **b)** 81 m^2

2. a) 8 mm **b)** 6 cm

3. 22 m

4. a) 120 cm^3 **b)** 18 cm^3

Math Link

1. circle, cube, rectangular prism, square, cylinder

2. To find the area of the square, multiply the length by the width; $A = s^2$.

3. Area: πr^2; Circumference: $C = \pi d$, $C = 2\pi r$

4. Answers may vary. Example: **a)** *SA* of rectangular prism = area of top and bottom + area of 2 ends + area of 2 sides; *SA* of cylinder = $2\pi r + 2\pi rh$; *SA* of cube = $6s^2$

b) *V* of rectangular prism = *lwh*; *V* of cylinder = $\pi r^2 h$; *V* of cube = s^3

5. Answers will vary. Example: I would use a rectangular prism and a cylinder because they are similar sizes and would balance each other.

3.1 Warm Up, page 119

1. a) 8 **b)** 25 **c)** 1 **d)** 27

2. a) +9 **b)** –16 **c)** +64 **d)** –49 **e)** –27 **f)** +16

3. a) 25 m^2 **b)** 144 cm^2

4. a) 64 m^3 **b)** 8 cm^3

3.1 Using Exponents to Describe Numbers, pages 120–127

Working Example 1: Show You Know

a) 4^3; 64 **b)** 10^4; 10 000

Working Example 2: Show You Know

Power	Repeated Multiplication	Evaluate
a) 6^2	*6 × 6*	*36*
b) 3^4	*3 × 3 × 3 × 3*	*81*
c) 5^3	*5 × 5 × 5*	*125*

Working Example 3: Show You Know

a) Answers will vary. Example: In $(-5)^2$, the negative sign is included in the repeated multiplication. In -5^2, the negative sign is not included.

b) Answers will vary. Example: They are both to the power 2.

c) i) 9 **ii)** –243 **iii)** –9 **iv)** –243

Communicate the Ideas

1. Answers will vary. Example: **a)** A power is a shorter form. **b)** 2^3 is shorter than 2 × 2 × 2.

2. a) YES **b)** $(-2)^4 = 16$; $(-2)^3 = -8$

Practise

3. a) 7^2 **b)** 10^6

4. a) Base: 1; Exponent: 4 **b)** Base: 13; Exponent: 1

5. a) 243 **b)** 1

6.

Repeated Multiplication	Exponential Form	Value
a) 6 × 6 × 6	6^3	*216*
b) 3 × 3 × 3 × 3	*3^4*	*81*
c) *7 × 7*	*7^2*	49
d) 11 × 11	11^2	*121*
e) *2 × 2 × 2*	*2^3*	8

7. a) 81 **b)** –125 **c)** −1 **d)** 27

8. NO; $(-2)^4 = 16$; $-2^4 = -16$

Apply

9. Repeated multiplication: 3 × 3 × 3
Exponential: 3^3

10. a)

End of Month	Body Length	Power
June	1 × 2 = 2	2^1
July	2 × 2 = *4*	2^2
August	4 × 2 = *8*	2^3
September	8 × 2 = *16*	2^4
October	*16 × 2 = 32*	*2^5*
November	*32 × 2 = 64*	*2^6*
December	*64 × 2 = 128*	*2^7*
January	*128 × 2 = 256*	*2^8*
February	*256 × 2 = 512*	*2^9*
March	*512 × 2 = 1024*	*2^{10}*

b) 32 cm; 2^5 **c)** 6

11. 1^{13}, 2^5, 7^2, 4^3, 3^4

Math Link

a) $SA = 6 \times s \times s$; $V = \pi \times r \times r \times h$

b) cube; volume; cylinder

c) Answers will vary. Example: cube; $V = s^3$; $V = s \times s \times s$; circle; $A = \pi r^2$; $A = \pi \times r \times r$

3.2 Warm Up, page 128

1. a) 6^4 **b)** 3^7 **c)** $(-4)^5$ **d)** $(-9)^2$

2. a) 81 **b)** –8 **c)** –1 **d)** –4 **e)** –16 **f)** (–25)

3.

Repeated Multiplication	Exponential Form	Value
a) 5 × 5 × 5 × 5	*5^4*	625
b) (–3) × (–3) × (–3)	$(-3)^3$	*–27*
c) *5 × 5 or (–5) × (–5)*	*5^2 or $(-5)^2$*	25
d) *(–7) × (–7)*	$(-7)^2$	*49*
e) (–10) × (–10) × (–10) × (–10)	*$(-10)^4$*	*10 000*

4. $(-3)^3$, -2^4, 1^{10}, $(-4)^2$

3.2 Exponent Laws, pages 129–140

Working Example 1: Show You Know

a) $4^8 = 65\,536$ **b)** $(-5)^5 = -3125$

Working Example 2: Show You Know

a) $2^2 = 4$ **b)** $(-3)^3 = -27$

Working Example 3: Show You Know

a) $3^6 = 729$ **b)** $5^2 \times 4^2 = 400$ **c)** $\frac{2^5}{5^5} = \frac{32}{3125}$

Working Example 4: Show You Know

a) 1 **b)** –1 **c)** –1 **d)** 1

Communicate the Ideas

1. Answers will vary. Example: You can simplify this power by multiplying the 2 exponents.

2. Answers will vary. Example: The exponent applies to both numbers in the brackets.

3. NO; the negative is not in brackets with the 6 so it is not raised to the zero power.

Practise

4. a) $4^5 = 1024$ **b)** $5^4 = 625$ **c)** $8^3 = 512$ **d)** $(-3)^4 = 81$ **e)** $(-2)^7 = -128$

5. a) $4^3 \times 4^2 = 4^5$ **b)** $2^5 \times 2^2 = 2^7$

6. a) $5^2 = 25$ **b)** $(-4)^2 = 16$ **c)** $7^3 = 343$

7. a) $6^4 \div 6^3 = 6^1$ **b)** $5^7 \div 5^1 = 5^6$

8. a) $3^6 = 729$ **b)** $5^4 = 625$ **c)** -4^4 or $(-4)^4 = -256$

9. a) $5^2 \times (-4)^2 = 400$ **b)** $3^2 \times 4^2 = 144$ **c)** $2^4 \times (-1)^4 = 16$

10. $\frac{5^3}{6^3} = \frac{125}{216}$

Apply

11. a) 7^{5-3} **b)** Jenny should have added the exponents instead of multiplying.

12. 3^{11}

3.3 Warm Up, page 141

1.

Power	Repeated Multiplication	Value
a) 3^3	$3 \times 3 \times 3$	*27*
b) $(-10)^5$	*$(-10) \times (-10) \times (-10) \times (-10) \times (-10)$*	*−100 000*
c) -4^2	*$-(4 \times 4)$*	*−16*
d) $-(-9^2)$	*$-[(-9) \times (-9)]$*	*−81*

2. a) $2^6 = 64$ **b)** $(-4)^3 = -64$ **c)** $5^0 = 1$ **d)** $(-9)^2 = 81$

3. a) 14 **b)** −35 **c)** 9 **d)** −13

3.3 Order of Operations, pages 142–148

Working Example 1: Show You Know

a) 36 **b)** −750 **c)** −49 **d)** −8

Working Example 2: Show You Know

a) 0 **b)** 389

Communicate the Ideas

1. *Step 1:* Subtract 5 − 3. *Step 2*: Apply the exponents. *Step 3:* Add.

2. a) Maria multiplied 8 × 5 before she applied the exponent.
b) $8 \times 125 = 1000$

Practise

3. a) $4(2^4) = 64$ **b)** $3(-2)^3 = -24$ **c)** $7(10)^5 = 700\,000$ **d)** $-1(9^2) = -81$

4. a) 128 **b)** 63 **c)** −250 **d)** −12

5. a) C 4 × 2 y^x 5 = 128

b) C 5 +/− × 4 y^x 3 = −320

6. a) 18 **b)** 70 **c)** 1 **d)** −71 **e)** 1 **f)** 44

Apply

7. a) $3(2)^3 = 24$; $2(3)^2 = 18$; $3(2)^3$ is larger. **b)** $(2 + 4)^2 = 36$; $2^2 + 4^2 = 20$; $(2 + 4)^2$ is larger.

8. a) Step 3 **b)** −27

9. a) $6^2 - 5^2$ **b)** The difference is 11 cm^2.

Math Link

Answers will vary. Example: **a)** height of cylinder = 2 cm; radius of cylinder = 2 cm; height of cube = 2 cm **b)** Cylinder: 50.24 cm^2; Cube: 24 cm^2 **c)** CYLINDER; The cylinder needs 26.2 cm^2 more material. **d)** $2\pi r^2 + 2\pi rh + 6s^2$ **e)** The total area of material needed to make both shapes is 74.24 cm^2.

3.4 Warm Up, page 149

1. a) 120 cm^2 **b)** 1017.36 cm^2

2. a) 384 cm^2 **b)** 1004.8 cm^2

3. a) 11.7 cm **b)** 11.2 cm

3.4 Using Exponents to Solve Problems, pages 150–157

Working Example 1: Show You Know

a) The area of the square attached to the hypotenuse is 289 cm^2. **b)** The surface area of the cube is 54 cm^2. **c)** The area of the shaded region is 18 cm^2.

Working Example 2: Show You Know

a) 150 **b)** 4050 **c)** 12 150 **d)** 50×3^n

Communicate the Ideas

1. a) $SA = 4\pi r^2$ **b)** coefficient: $4 \times \pi$ or 4×3.14; variable: r; exponent: 2

Practise

2. 216 cm^3

3. $14^2 = 196$; $6 \times 6^2 = 216$; The surface area of a cube with an edge length of 6 cm is larger.

4. a) There will be 60 bacteria after 1 h. **b)** There will be 1620 bacteria after 4 h. **c)** There will be 20×3^n bacteria after n h.

Apply

5. Sara will need 864 cm^2.

6. a) The stopping distance is 37.5 m. **b)**

C 0.75 × 50 × (1000 ÷ 1000) y^x 2 = 37.5

7. a) the number of questions
b) the number of possible answers
c) There are 1024 possible answers.

Math Link

a)

Side Length of Cube	Surface Area of 1 Cube	SurfaceArea of 5 Cubes
s = 3 cm	*54 cm^2*	*270 cm^2*
s = 4 cm	*96 cm^2*	*480 cm^2*
s = 5 cm	*150 cm^2*	*750 cm^2*

b) The surface of 5 cubes with a side length of 5 cm is 480 cm^2 greater than the surface area of 5 cubes with a side length of 3 cm.

Graphic Organizer, page 158

Answers will vary. Example:

Left side:

Repeated multiplication: $2^3 = 2 \times 2 \times 2$
Parts of a power: In 2^3, 2 is the base and 3 is the exponent.
Evaluate powers with a positive base: $2^3 = 8$
Evaluate powers with a negative base: $(-2)^3 = -8$
Product of a power: $4(2)^3 = 4 \times 8 = 32$

Order of operations:
$9 + (-2)^3 - 2(-6^2)$
$= 9 + (-8) - 2(-36)$
$= 9 + (-8) + (72)$
$= 1 + 72$
$= 73$

Expression with a power: $4^2 + (-4^2) = 16 + (-16) = 0$

Right side:

Multiplying powers with the same base: $2^3 \times 2^2 = 2^{3+2} = 2^5 = 32$
Dividing powers with the same base: $2^3 \div 2^2 = 2^{3-2} = 2^1 = 2$
A power raised to an exponent: $(2^3)^2 = 2^{3 \times 2} = 2^6 = 64$
A product raised to an exponent: $(2 \times 3)^2 = 2^2 \times 3^2 = 4 \times 9 = 36$

A quotient raised to an exponent: $\left(\frac{2}{3}\right)^2 = \frac{2^2}{3^2} = \frac{4}{9}$

An exponent to a power of 0: $2^0 = 1$
Formula to solve a problem:
Find the area of a cube with an edge length of 2 cm.
$A = 6s^2$
$A = 6(2)^2$
$A = 6(4)$
$A = 24$

Pattern to develop a formula:
Bacteria triple in number every hour. If there are 20 bacteria, how many will there be after 2 h?
20×3^2
$= 20 \times 9$
$= 180$

Chapter 3 Review, pages 159–162

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. $V = 4 \times 4 \times 4$; $V = 4^3$; 64 cm^3

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

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

11. a) $[(-5) \times (-5)] \times [(-5) \times (-5) \times (-5) \times (-5) \times (-5)] = (-5)^7$
b) $(3 \times 3) \times (3 \times 3) \times (3 \times 3) \times (3 \times 3) = 3^8$

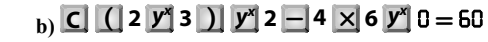
12. a) $6^3 \times 4^3$ **b)** $7^5 \times (-2)^5$

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

14. a) –16 **b)** 1 **c)** 81 **d)** 4

15. a)

b)



16. a) 51 **b)** 9

17. a) 88 × 8 **b)** 137

18. The surface area is 150 m^2.

19. a) The pebble will fall 4.9 m in 1 s. **b)** The pebble will fall 78.4 m in 4 s.

Key Word Builder, page 163

1. power **2.** base, exponent **3.** evaluate **4.** area, cube, formula
5. operations **6.** volume, cylinder **7.** laws **8.** product **9.** quotient
10. coefficient **11.** expression, negative

C	Y	L	I	N	D	E	R	R	E	E
O	P	E	R	A	T	I	O	N	S	X
E	R	V	O	L	U	M	E	P	W	P
F	O	E	C	U	B	E	R	A	A	R
F	D	T	E	M	D	E	A	M	L	E
I	U	U	L	R	W	T	R	I	P	S
C	C	Q	U	O	T	I	E	N	T	S
I	T	L	P	F	E	S	A	B	I	I
E	V	A	L	U	A	T	E	C	A	O
N	T	I	E	V	I	T	A	G	E	N
T	O	N	E	X	P	O	N	E	N	T

Repeated multiplication

Chapter 3 Practice Test, pages 164–165

1. C **2.** B **3.** C **4.** D **5.** A **6.** B

7. 3

8. 5^7

9. $\frac{4 \times 4 \times 4 \times 4 \times 4}{4 \times 4} = 64$

10. The volume of the cylinder is 180.9 cm^3.

11. a)

b)

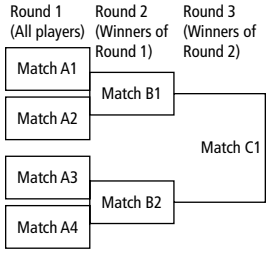
12. a) $32 \div (-8) + 8$ **b)** 12

Math Link: Wrap It Up! page 166

Answers will vary.

Challenge, pages 167–168

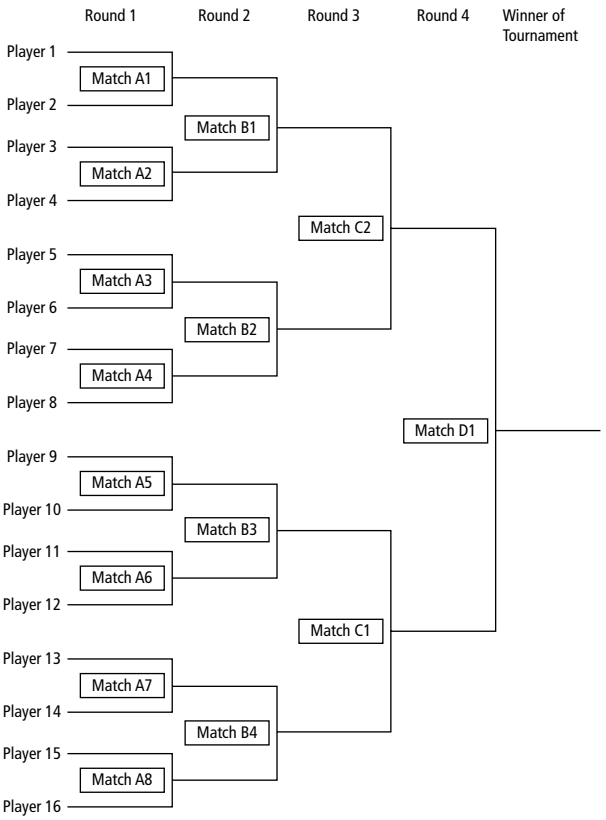
1. a)



b) NO. There are an even number of players, so there are no byes.
c) 3

2. 16, match, 4

3.



4. Answers will vary. Example: The best number of players would be a power of 2 so that no one receives a bye.

5. a) 512 **b)** 9