CHAPTER EXERCISE: Answers for this chapter start on page 252.

A calculator should NOT be used on the following questions.

1

If $a^{-\frac{1}{2}} = 3$, what is the value of a?

A) -9

B) $\dfrac{1}{9}$

C) $\dfrac{1}{3}$

D) 9

2

$$\text{Let } n = 1^2 + 1^4 + 1^6 + 1^8 + \ldots + 1^{50}$$

What is the value of n?

A) 10

B) 20

C) 25

D) 30

3

If $4^{2n+3} = 8^{n+5}$, what is the value of n?

A) 6

B) 7

C) 8

D) 9

4

If $\dfrac{2^x}{2^y} = 2^3$, then x must equal

A) $y + 3$

B) $y - 3$

C) $3 - y$

D) $3y$

5

If $3^x = 10$, what is the value of 3^{x-3}?

A) $\dfrac{10}{3}$

B) $\dfrac{10}{9}$

C) $\dfrac{10}{27}$

D) $\dfrac{27}{10}$

6

If $x^2y^3 = 10$ and $x^3y^2 = 8$, what is the value of x^5y^5?

A) 18

B) 20

C) 40

D) 80

7

If a and b are positive even integers, which of the following is greatest?

A) $(-2a)^b$

B) $(-2a)^{2b}$

C) $(2a)^b$

D) $2a^{2b}$

8

Which of the following is equivalent to $x^{\frac{2a}{b}}$, for all values of x?

A) $\sqrt[b]{ax^2}$

B) $\sqrt[b]{x^{2a}}$

C) $\sqrt[b]{x^{a+2}}$

D) $\sqrt[2a]{x^b}$

9

If $x^2 = y^3$, for what value of z does $x^{3z} = y^9$?

A) -1

B) 0

C) 1

D) 2

10

If $2^{x+3} - 2^x = k(2^x)$, what is the value of k?

A) 3

B) 5

C) 7

D) 8

11

If $\sqrt{x\sqrt{x}} = x^a$, then what is the value of a?

A) $\dfrac{1}{2}$

B) $\dfrac{3}{4}$

C) 1

D) $\dfrac{4}{3}$

12

$$2\sqrt{x+2} = 3\sqrt{2}$$

If $x > 0$ in the equation above, what is the value of x?

A) 2.5

B) 3

C) 3.5

D) 4

13

If $x^{ac} \cdot x^{bc} = x^{30}$, $x > 1$, and $a + b = 5$, what is the value of c?

A) 3

B) 5

C) 6

D) 10

A calculator is allowed on the following questions.

14

If $n^3 = x$ and $n^4 = 20x$, where $n > 0$, what is the value of x?

15

If $x^8 y^7 = 333$ and $x^7 y^6 = 3$, what is the value of xy?

28

Answers to the Exercises

Chapter 1: Exponents & Radicals

EXERCISE 1:

1. 1

2. −1

3. 1

4. −1

5. 1

6. −1

7. −1

8. −27

9. −27

10. 27

11. −36

12. 64

13. −72

14. 108

15. −648

16. 1

17. $\frac{1}{6}$

18. $\frac{1}{4}$

19. 1

20. 9

21. $\frac{1}{9}$

22. 125

23. $\frac{1}{125}$

24. 49

25. $\frac{1}{49}$

26. 1,000

27. $\frac{1}{1,000}$

EXERCISE 2:

1. $6x^5$

2. $\dfrac{8}{k^2}$

3. $15x^2$

4. -21

5. $\dfrac{1}{8x^6}$

6. $-\dfrac{9b^5}{a^3}$

7. $\dfrac{n^4}{2}$

8. a^4b^6

9. $\dfrac{y^2}{x^2}$

10. x^3

11. $\dfrac{x^6}{y^3}$

12. $\dfrac{3u^2}{4}$

13. $-8u^3v^3$

14. x^5

15. $3x^8$

16. x

17. x^9

18. $\dfrac{2}{x^3}$

19. $36m^8$

20. $\dfrac{1}{a^6}$

21. b^{12}

22. $\dfrac{m^4}{n}$

23. x^2

24. $\dfrac{1}{mn^2}$

25. k

26. $\dfrac{m^6}{n^9}$

27. $x^5y^7z^9$

EXERCISE 3:

1. $2\sqrt{3}$

2. $4\sqrt{6}$

3. $3\sqrt{5}$

4. $3\sqrt{2}$

5. $6\sqrt{3}$

6. $15\sqrt{3}$

7. $4\sqrt{2}$

8. $10\sqrt{2}$

9. $2\sqrt{2}$

10. $8\sqrt{2}$

11. $x = 50$

12. $x = 5$

13. $x = 2$

14. $x = 8$

15. $x = 21$

16. $x = \dfrac{1}{2}$

17. $x = 6$

18. $x = 6$

CHAPTER EXERCISE:

1. $\boxed{B}$

$$a^{-\frac{1}{2}} = 3$$

$$\frac{1}{a^{\frac{1}{2}}} = 3$$

$$1 = 3\sqrt{a}$$

$$\frac{1}{3} = \sqrt{a}$$

$$\frac{1}{9} = a$$

2. $\boxed{C}$ It's obvious that there will be a bunch of 1's, but how many? Well, how many even numbers are there between 2 and 50? If we take the list

$$2, 4, 6, \ldots, 48, 50$$

and divide each element by 2,

$$1, 2, 3, \ldots, 24, 25$$

we can clearly see that there are 25 numbers. Therefore, n is the sum of twenty-five 1's. The answer is 25.

3. $\boxed{D}$

$$2^{2(2n+3)} = 2^{3(n+5)}$$
$$2(2n + 3) = 3(n + 5)$$
$$4n + 6 = 3n + 15$$
$$n = 9$$

4. $\boxed{A}$

$$\frac{2^x}{2^y} = 2^3$$

$$2^{x-y} = 2^3$$
$$x - y = 3$$
$$x = y + 3$$

5. $\boxed{C}$

$$3^{x-3} = \frac{3^x}{3^3} = \frac{10}{3^3} = \frac{10}{27}$$

6. $\boxed{D}$ Multiply both equations together. The left hand side gives $x^5 y^5$. The right hand side gives 80.

7. $\boxed{B}$ To avoid any trickiness, it's best to plug in numbers. Let $a = 2$ and $b = 2$. Going through each choice,

A) $(-4)^2 = 16$

B) $(-4)^4 = 256$

C) $(2 \cdot 2)^2 = 16$

D) $2 \cdot 2^4 = 2 \cdot 16 = 32$

(B) is the largest.

8. $\boxed{B}$ The $2a$ means raised to the $2a$ power and the b on the bottom means the bth root.

9. $\boxed{D}$ Cube both sides of the first equation,

$$(x^2)^3 = (y^3)^3$$
$$x^6 = y^9$$

Now y^9 can be replaced by x^6,

$$x^{3z} = y^9$$
$$x^{3z} = x^6$$
$$3z = 6$$
$$z = 2$$

10. $\boxed{C}$

$$2^{x+3} - 2^x = k(2^x)$$
$$(2^x)(2^3) - 2^x = k(2^x)$$
$$2^x(2^3 - 1) = k(2^x)$$
$$2^x(7) = k(2^x)$$
$$7 = k$$

11. $\boxed{B}$

$$\sqrt{x\sqrt{x}} = \sqrt{x \cdot x^{\frac{1}{2}}} = \sqrt{x^{\frac{3}{2}}} = (x^{\frac{3}{2}})^{\frac{1}{2}} = x^{\frac{3}{4}}$$

Therefore, $a = \dfrac{3}{4}$

12. $\boxed{A}$ Squaring both sides ("unsimplifying" will get you the same result),

$$(2\sqrt{x+2})^2 = (3\sqrt{2})^2$$
$$4(x+2) = 18$$
$$4x + 8 = 18$$
$$4x = 10$$
$$x = 2.5$$

13. $\boxed{C}$

$$x^{ac} \cdot x^{bc} = x^{30}$$
$$x^{ac+bc} = x^{30}$$
$$ac + bc = 30$$
$$(a+b)c = 30$$
$$5c = 30$$
$$c = 6$$

14. $\boxed{8,000}$ Multiply the first equation by n to get

$$n^4 = nx$$

Substitute this into the left side of the second equation,

$$nx = 20x$$
$$n = 20$$

Using the first equation,
$x = n^3 = (20)^3 = 8,000$

15. $\boxed{111}$
$$x^7 y^6 = 3$$

Multiply both sides by xy,

$$x^8 y^7 = 3xy$$

We do this to make the following substitution,

$$3xy = 333$$
$$xy = 111$$