

Exponents. Form A

1. if $3^x = 3^5$, then $x =$

(A) 3

(B) 2

(C) 4

(D) 5

(E) 6

$(\text{Base})^{\text{exponent}} = (\text{Base})^{\text{exponent}}$
 if the bases are equal, the exponents are equal

so $\boxed{x=5}$

2. if $5^{x+1} = 25$, then $x =$

(A) -1

(B) 1

(C) 4

(D) -5

(E) 6

Rewrite 25 as 5^2

$$5^{x+1} = 5^2$$

$$x+1=2 \Rightarrow \boxed{x=1}$$

3. if $2^x - 16 = 0$, then $x =$

(A) 1

(B) 2

(C) 4

(D) 5

(E) 6

$$16 = 2 \cdot 2 \cdot 2 \cdot 2 = 2^4$$

$$2^x = 16$$

$$2^x = 2^4$$

$$\boxed{x=4}$$

4. if $8^x = 16$, then $x =$

(A) $\frac{3}{4}$

$$8 = 2 \cdot 2 \cdot 2 = 2^3$$

$$(2^3)^x = 2^4$$

$$(a^m)^n = a^{mn}$$

$$2^{3x} = 2^4$$

$$3x = 4$$

$$\boxed{x = \frac{4}{3}}$$

(B) $\frac{1}{4}$

(C) $\frac{4}{3}$

(D) $\frac{16}{8}$

(E) $\frac{1}{2}$

5. if $3^x = \frac{1}{3}$, then $x =$

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

(A) -3

(B) 2

(C) 4

(D) 5

(E) -1

$$3^x = 3^{-1}$$

$$x = -1$$

6. if $7^x = 1$, then $x =$

$$1 = 7^0$$

$$a^0 = 1$$

(A) 7

(B) 2

(C) 4

(D) 0

(E) 6

$$7^x = 7^0$$

$$x = 0$$

7. if $2^x = \frac{1}{32}$, then $x =$

$$32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5$$

$$\frac{1}{32} = \frac{1}{2^5} = 2^{-5}$$

(A) -1

(B) 2

(C) 4

(D) -5

$$2^x = \frac{1}{32}$$

$$2^x = 2^{-5}$$

$$x = -5$$

(E) 6

8. What is $5^x + 5^x + 5^x + 5^x + 5^x = 55^x$
 $= 5^{x+1}$

$$a^m \cdot a^n = a^{m+n}$$

$$5^1 \cdot 5^x = 5^{1+x}$$

(A) 5^{x+1}

(B) 5^{5x}

(C) 25^x

(D) 5^{25x}

(E) 5^{5x+1}

9. if $3^2 9^2 = 3^x$, what is x ?

$$9^2 = (3^2)^2 = 3^4$$

(A) 2

(B) 3

(C) 4

(D) 5

(E) 6

$$3^2 9^2 = 3^x$$

$$3^2 \cdot 3^4 = 3^x$$

$$3^6 = 3^x \quad \text{so} \quad x = 6$$

10. if $4^{2n+3} = 8^{n+5}$, then $n =$

(A) 6

(B) 7

(C) 8

(D) 9

(E) 10

$$4^{2n+3} = 8^{n+5}$$

$$(2^2)^{2n+3} = (2^3)^{n+5}$$

$$2^{2(2n+3)} = 2^{3(n+5)}$$

$$2 = 2$$

make the bases equal

$$4n+6 = 3n+15 \Rightarrow 4n-3n = 15-6$$

$$\boxed{n=9}$$

11. Reduce $\frac{x^3 y^{-2} z^4}{x^2 y^{-3} z^7}$ to its simplest form

(A) $\frac{xy}{z^3}$

Simplest form: ① Every variable appears only once
 ② Exponents are +

$$\frac{x^{3-2} y^{-2+3} z^{4-7}}{z^{7-4}} = \frac{xy}{z^3}$$

(B) $\frac{x^3}{y^5 z^{11}}$

(C) $\frac{x^6 y^{-2}}{yz^3}$

(D) $\frac{x^3}{y^5 z^{11}}$

(E) $\frac{x^5 z^4}{z^7}$

12. $(4x^3)(3xy^2)(2xy^2)$ is equivalent to:

(A) $9x^3 y^4$

(B) $9x^5 y^4$

(C) $24x^3 y^4$

(D) $24x^5 y^4$

(E) $24x^5 y^6$

$$\left. \begin{array}{l} 4 \cdot 3 \cdot 2 = 24 \\ x^3 \cdot x \cdot x = x^5 \\ y^2 \cdot y^2 = y^4 \end{array} \right\} \Rightarrow 24x^5 y^4$$

13. For nonzero real numbers a, b, and c, the expression

$\frac{a^5 b^3 c^4}{5a^2 b^7 c}$ is equivalent to:

(A) $\frac{a^3 c^3}{5b^4}$

(B) $\frac{a^3 c^4}{5b^4}$

(C) $\frac{a^3 b c^4}{5ab^4 c}$

(D) $\frac{a^3 c^4}{b^4}$

(E) $5abc$

$$\frac{a^{5-2} c^{4-1}}{5 b^{7-3}} = \frac{a^3 c^3}{5 b^4}$$

14. Which of the following is equivalent to $(3x^4)^3$?

(A) $3x^7$

$$\begin{aligned} (3x^4)^3 &= 3^3 x^{4 \cdot 3} \\ &= 3^3 x^{12} \\ &= 27x^{12} \end{aligned}$$

$$(a^m)^n = a^{mn}$$



(B) $3x^{12}$

(C) $9x^7$

(D) $27x^7$

(E) $27x^{12}$

15. If x, y, z are positive integers such that $x^z = a$ and $y^z = b$, then $ab = ?$

$$ab = x^z y^z = (xy)^z$$

(A) xy^z

(B) xy^{2z}

(C) $(xy)^z$

(D) $(xy)^{2z}$

(E) $(xy)^{z+1}$

16. $4n^7 \cdot 3n^5$ is equivalent to:

(A) $7n^2$

(B) $7n^{12}$

(C) $7n^{35}$

(D) $12n^{12}$

(E) $12n^{35}$

$$4 \cdot 3 = 12$$

$$n^7 \cdot n^5 = n^{12}$$

$$a^m \cdot a^n = a^{m+n}$$

17. if $49^a = 7$, and $2^{a+b} = 8$, then $b = ?$

(A) $\frac{1}{2}$

(B) $\frac{3}{2}$

(C) $\frac{5}{2}$

(D) 3

$$49^a = 7$$

$$(7^2)^a = 7$$

$$7^{2a} = 7^1$$

$$2a = 1$$

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

$$2^{a+b} = 8$$

$$2^{a+b} = 2^3$$

$$a+b = 3$$

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

$$\frac{1}{2} + b = 3$$

$$b = 3 - \frac{1}{2} = \frac{6}{2} - \frac{1}{2} = \frac{5}{2}$$

(E) $\frac{7}{2}$

18. if $2^{2x}4^{4y} = 8^{8z}$, which of the following equations must be true?

(A) $xy = z$

(B) $x + y = z$

(C) $2x + 4y = 8$

(D) $x + 4y = 12z$

(E) $2x + y = z$

$$\begin{aligned} 2^{2x} 4^{4y} &= 8^{8z} \\ 2^{2x} (2^2)^{4y} &= (2^3)^{8z} \quad \text{make the base 2} \\ 2^{2x} 2^{8y} &= 2^{24z} \\ 2^{2x+8y} &= 2^{24z} \\ 2x+8y &= 24z \quad \div 2 \\ x+4y &= 12z \end{aligned}$$

19. if $8^x = 16$, then $3x + 1 =$

(A) $\frac{3}{4}$

(B) 5

(C) 4

(D) 32

(E) $\frac{1}{2}$

$$\begin{aligned} 8^x &= 16 \\ (2^3)^x &= 2^4 \end{aligned}$$

$$2^{3x} = 2^4$$

$$3x = 4$$

$$x = \frac{4}{3}$$

$$\begin{aligned} 3x+1 &= 3\left(\frac{4}{3}\right)+1 \\ &= 4+1=5 \end{aligned}$$

20. if $3^{x+2} = \frac{1}{27}$, then $x =$

(A) -1

(B) 5

(C) 3

(D) -5

(E) 6

$$\begin{aligned} 3^{x+2} &= \frac{1}{27} \\ 3^{x+2} &= \frac{1}{3^3} = 3^{-3} \end{aligned}$$

$$x+2 = -3$$

$$x = -5$$

21. If $\log_2(8) = x$, then $x = ?$

$$\log_a y = x \iff a^x = y$$

base

(A) 8

(B) 2

(C) 0

(D) 4

(E) 3

$$\log_2(8) = x \iff 2^x = 8$$

$$\downarrow$$

$$2^x = 2^3$$

$$\boxed{x=3}$$

22. If $\log_4(x) = -3$, then $x = ?$

(A) $\frac{1}{12}$ (B) $\frac{1}{4}$ (C) $\frac{3}{4}$ (D) $\frac{-1}{64}$ (E) $\frac{1}{64}$

$$\log_4 x = -3 \iff 4^{-3} = x$$

$$\downarrow$$

$$\frac{1}{4^3} = x$$

$$\boxed{\frac{1}{64} = x}$$

23. What is the value of the positive real number x such that

$$\log_x\left(\frac{1}{25}\right) = -2, \text{ then } x = ?$$

(A) 5

(B) 50

(C) $\frac{1}{50}$ (D) $\frac{-1}{5}$ (E) $\frac{1}{5}$

$$\log_x\left(\frac{1}{25}\right) = -2$$

$$x^{-2} = \frac{1}{25} = \frac{1}{5^2} = 5^{-2}$$

$$\text{so } x^{-2} = 5^{-2} \Rightarrow \boxed{x=5}$$

24. If $\log_2\left(\frac{1}{8}\right) = x$, then $x = ?$

(A) -8

$$2^x = \frac{1}{8} = \frac{1}{2^3} = 2^{-3}$$

$$\text{so } 2^x = 2^{-3} \Rightarrow \boxed{x=-3}$$

(B) 2

(C) -3

(D) 4

(E) -2

Answers

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|-------|-------|-------|
| 1. D | 11. A | 21. E |
| 2. B | 12. D | 22. E |
| 3. C | 13. A | 23. A |
| 4. C | 14. E | 24. C |
| 5. E | 15. C | |
| 6. D | 16. D | |
| 7. D | 17. C | |
| 8. A | 18. D | |
| 9. E | 19. B | |
| 10. D | 20. D | |