

Part I: Multiple Choice. Multiple Choice. Choose the correct answer.

1. Solve for x : $3^{x+3} = 3^{4x-10}$

(A) $-\frac{7}{3}$

(B) $-\frac{7}{5}$

(C) $\frac{13}{5}$

(D) $\frac{13}{3}$

$$x+3 = 4x-10$$

$$3+10 = 4x-x$$

$$13 = 3x$$

$$x = 13/3$$

2. Solve for x : $2^{3x+5} = 16$

(A) $-\frac{1}{3}$

(B) 1

(C) 3

(D) $\frac{13}{3}$

$$2^{3x+5} = 2^4$$

$$3x+5 = 4$$

$$3x = 4-5$$

$$3x = -1$$

$$\rightarrow x = -1/3$$

3. Solve: $4^{x+1} = \frac{1}{16}$

(A) -3

(B) -2

(C) 1

(D) 2

$$4^{x+1} = 16^{-1}$$

$$4^{x+1} = 4^{2(-1)}$$

$$4^{x+1} = 4^{-2}$$

$$\rightarrow x+1 = -2$$

$$x = -2-1$$

$$x = -3$$

4. Solve: $8^x = 32$.

(A) $\frac{3}{5}$

(B) $\frac{5}{3}$

(C) 4

(D) 24

$$2^{3(x)} = 2^5$$

$$2^{3x} = 2^5$$

$$3x = 5$$

$$x = \frac{5}{3}$$

5. Solve: $9^{3x-1} = 81^{-x+1}$

(A) $\frac{3}{10}$

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

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

(D) $\frac{3}{5}$

$$9^{3x-1} = 9^{2(-x+1)}$$

$$9^{3x-1} = 9^{-2x+2}$$

$$= 9$$

$$3x-1 = -2x+2$$

$$3x+2x = 2+1$$

$$5x = 3$$

$$x = \frac{3}{5}$$

6. Solve: $2^x = \sqrt{32}$.

- (A) $\frac{1}{5}$ $2^x = 32^{\frac{1}{2}}$
 (B) $\frac{2}{5}$ $2^x = 2^{\frac{5}{2} \cdot (\frac{1}{5})}$ $x = \frac{5}{2}$
 (C) $\frac{5}{2}$ $2^x = 2^{\frac{5}{2}}$
 (D) 5

7. Solve: $3^{3-3x} = (\frac{1}{9})^{2-x}$.

- (A) $\frac{1}{2}$ $3^{3-3x} = 9^{-1(2-x)}$
 (B) $\frac{1}{5}$ $3^{3-3x} = 3^{2(-2+x)}$
 (C) $\frac{5}{7}$ $3^{3-3x} = 3^{-4+2x}$
 (D) $\frac{7}{5}$ $3^{3-3x} = 3^{-4+2x}$
- $3-3x = -4+2x$
 $3+4 = 2x+3x$
 $7 = 5x$
 $x = \frac{7}{5}$

8. Solve: $4^{3x+1} = \sqrt{2}$.

- (A) $-\frac{1}{12}$ $2^{2(3x+1)} = 2^{\frac{1}{2}}$
 (B) $-\frac{1}{4}$ $2^{6x+2} = 2^{\frac{1}{2}}$
 (C) $\frac{1}{6}$ $2^{6x+2} = 2^{\frac{1}{2}}$
 (D) $\frac{5}{12}$
- $2(6x+2) = \frac{1}{2}$
 $12x+4 = 1$
 $12x = 1-4$
 $12x = -3$
 $\frac{12x}{12} = \frac{-3}{12}$

9. Solve: $5^{3x} = \frac{1}{25}$.

- (A) $-\frac{3}{2}$ $5^{3x} = 25^{-1}$
 (B) $-\frac{2}{3}$ $5^{3x} = 5^{2(-1)}$ $3x = -2$
 (C) $\frac{2}{3}$ $5^{3x} = 5^{-2}$ $x = -\frac{2}{3}$
 (D) $\frac{3}{2}$
- $x = -\frac{1}{4}$

10. Solve: $4^{3x-1} = 16^{x+2}$.

- (A) 1 $4^{3x-1} = 4^{2(x+2)}$
 (B) $\frac{3}{2}$ $4^{3x-1} = 4^{2x+4}$
 (C) $\frac{9}{2}$ $4^{3x-1} = 4^{2x+4}$
 (D) 5 $3x-1 = 2x+4$
 $3x-2x = 4+1$
 $x = 5$

11. Solve: $\sqrt[3]{7} = 49^x$.

- (A) $\frac{1}{6}$
 (B) $\frac{2}{3}$
 (C) $\frac{3}{2}$
 (D) 6

$7^{\frac{1}{3}} = 7^{2(x)}$
 $7^{\frac{1}{3}} = 7^{2x}$

$\frac{1}{3} = 2x \cdot 3$

$1 = 6x$

$x = \frac{1}{6}$

12. Solve: $\sqrt[4]{5} = 125^{x+1}$.

- (A) $-\frac{11}{12}$
 (B) $-\frac{1}{4}$
 (C) $\frac{1}{3}$
 (D) $\frac{13}{12}$

$5^{\frac{1}{4}} = 5^{3(x+1)}$
 $5^{\frac{1}{4}} = 5^{3x+3}$

$\frac{1}{4} = (3x+3) \cdot 4 \rightarrow x = -\frac{11}{12}$

$1 = 12x + 12$

$1 - 12 = 12x$

$-11 = 12x$

Part II: Constructed Response. Answer each question in the space provided. Show all workings.

13. Solve for x: $\sqrt[3]{125^x} = \frac{5}{25^x}$

$125^{x(\frac{1}{3})} = 5^1 \cdot 25^{-x}$
 $5^{3x(\frac{1}{3})} = 5^1 \cdot 5^{2(-x)}$
 $5^x = 5^1 \cdot 5^{-2x}$

$5^x = 5^{1-2x}$
 $x = 1 - 2x$
 $x + 2x = 1$
 $3x = 1$
 $x = \frac{1}{3}$

14. Solve for x: $(\sqrt[3]{25})^x = 125^{2x-1}$

$25^{\frac{1}{3}x} = 5^{3(2x-1)}$

$\frac{2x}{3} = (6x-3) \cdot 3$

$5^{2 \cdot \frac{1}{3}x} = 5^{6x-3}$

$2x = 18x - 9$

$9 = 18x - 2x$

$5^{\frac{2}{3}x} = 5^{6x-3}$

$9 = 16x$

$x = \frac{9}{16}$

15. Solve for x:

$$3^{5x-1} = \sqrt[3]{9}$$

$$\begin{aligned} 3^{5x-1} &= 9^{\frac{1}{3}} \\ 3^{5x-1} &= 3^{2 \cdot \frac{1}{3}} \\ 3^{5x-1} &= 3^{\frac{2}{3}} \end{aligned}$$

$$3 \cdot (5x-1) = \frac{2}{3} \cdot 3$$

$$15x - 3 = 2$$

$$15x = 2 + 3$$

$$15x = 5$$

$$x = \frac{5}{15}$$

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

16. Solve for x:

$$4^{2x+1} = \sqrt[5]{2}$$

$$2^{2(2x+1)}$$

$$2^{4x+2} = 2^{\frac{1}{5}}$$

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

$$5 \cdot (4x+2) = \frac{1}{5} \cdot 5$$

$$20x + 10 = 1$$

$$20x = 1 - 10$$

$$\frac{20x}{20} = \frac{-9}{20}$$

$$x = \frac{-9}{20}$$

17. Solve:

$$25^{2x+1} - 5 = 120$$

$$25^{2x+1} = 120 + 5$$

$$5^{2(2x+1)} = 125$$

$$5^{4x+2} = 5^3$$

$$4x + 2 = 3$$

$$4x = 3 - 2$$

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

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

18. Algebraically solve: $70 = 6 + 8^{3x-1}$

$$70 - 6 = 8^{3x-1}$$

$$64 = 8^{3x-1}$$

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

$$2 = 3x - 1$$

$$2 + 1 = 3x$$

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

$$x = 1$$

19. Algebraically solve: $\left(\frac{1}{4}\right)^{3-x} = 64^{x+1}$

$$4^{-1(3-x)} = 4^{3(x+1)}$$

$$4^{-3+x} = 4^{3x+3}$$

$$-3+x = 3x+3$$

$$-3-3 = 3x-x$$

$$-6 = 2x$$

$$x = -\frac{6}{2}$$

$$x = -3$$

20. Algebraically solve: $\left(\frac{1}{81}\right)^{x+3} = (27)^{1-2x}$

$$81^{-1(x+3)} = 3^{3(1-2x)}$$

$$3^{4(-x-3)} = 3^{-6x}$$

$$-4x-12 = -6x$$

$$3 = 3$$

$$-4x-12 = 3-6x$$

$$6x-4x = 3+12$$

$$\frac{2x}{2} = \frac{15}{2}$$

$$x = 15/2$$

21. Solve for x : $(\sqrt[3]{16^{2x}}) = 64^{\frac{1}{2}}$

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

$$\frac{4x}{3} = \frac{3}{2}$$

$$8x = 9$$

$$x = \frac{9}{8}$$

22. Solve for x : $4^{2x+3} = \sqrt{8}$

$$2^{2(2x+3)} = 2^3(\frac{1}{2})$$

$$2^{4x+6} = 2^{\frac{3}{2}}$$

$$2(4x+6) = \frac{3}{2}$$

$$8x+12 = 3$$

$$8x = 3-12$$

$$8x = -9$$

$$x = \frac{-9}{8}$$