

A2.A.27: Exponential Equations 4: Solve exponential equations with and without common bases

- 1 The value of x in the equation $4^{2x+5} = 8^{3x}$ is
 - 1) 1
 - 2) 2
 - 3) 5
 - 4) -10
- 2 Which value of k satisfies the equation $8^{3k+4} = 4^{2k-1}$?
 - 1) -1
 - 2) $-\frac{9}{4}$
 - 3) -2
 - 4) $-\frac{14}{5}$
- 3 Solve algebraically for x : $8^{2x} = 4^6$
- 4 Solve algebraically for x : $16^{2x+3} = 64^{x+2}$
- 5 Solve for x : $4^{2x+1} = 8^{2x}$
- 6 Solve for x : $16^{x+4} = 32^{2x-10}$
- 7 Solve for x : $4^x = 8^{x-1}$
- 8 If $8^{x+1} = 4^{2x}$, what is the value of x ?
- 9 Solve for x : $32^x = 4^{(2x+1)}$
- 10 Solve for x : $4^{3x+1} = 8^{4x}$
- 11 What is the value of x in the equation $9^{3x+1} = 27^{x+2}$?
 - 1) 1
 - 2) $\frac{1}{3}$
 - 3) $\frac{1}{2}$
 - 4) $\frac{4}{3}$
- 12 Solve algebraically for x : $27^{2x+1} = 9^{4x}$
- 13 Solve algebraically for x : $27^x = 9^{x+2}$
- 14 Solve for x : $9^x = 27$
- 15 Solve for x : $27^x = 9^{2x-1}$
- 16 Solve for x : $27^{x+2} = 9^{2x-1}$
- 17 Solve for x : $9^{2x} = 27^{x+1}$
- 18 If $9^{x+1} = 27^x$, what is the value of x ?
- 19 Solve algebraically for all values of x : $81^{x^3+2x^2} = 27^{\frac{5x}{3}}$

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Answer Section

1 ANS: 2

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

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

$$2^{4x+10} = 2^{9x}$$

$$4x + 10 = 9x$$

$$10 = 5x$$

$$2 = x$$

REF: 061105a2

2 ANS: 4

$$8^{3k+4} = 4^{2k-1}$$

$$(2^3)^{3k+4} = (2^2)^{2k-1}$$

$$2^{9k+12} = 2^{4k-2}$$

$$9k + 12 = 4k - 2$$

$$5k = -14$$

$$k = -\frac{14}{5}$$

REF: 011309a2

3 ANS:

$$8^{2x} = 4^6$$

$$\log 8^{2x} = \log 4^6$$

$$2x \cdot \log 8 = 6 \log 4$$

$$x = \frac{6 \log 4}{2 \log 8}$$

$$x = 2$$

$$8^{2x} = 4^6$$

$$(2^3)^{2x} = (2^2)^6$$

$$6x = 12$$

$$x = 2$$

Plot1 Plot2 Plot3
 $\sqrt{Y_1} = 8^{(2X)}$
 $\sqrt{Y_2} = 4^6$
 $\sqrt{Y_3} =$
 $\sqrt{Y_4} =$
 $\sqrt{Y_5} =$
 $\sqrt{Y_6} =$
 $\sqrt{Y_7} =$

X	Y1	Y2
0	1	4096
1	64	4096
2	4096	4096
3	262144	4096
4	1.68E7	4096
5	1.07E9	4096
6	6.9E10	4096

X=2

REF: 010626b

4 ANS:

$$16^{2x+3} = 64^{x+2}$$

$$(4^2)^{2x+3} = (4^3)^{x+2}$$

$$4x + 6 = 3x + 6$$

$$x = 0$$

REF: 011128a2

5 ANS:
1

REF: 088705siii

6 ANS:
11

REF: 010409siii

7 ANS:
3

REF: 069506siii

8 ANS:
3

REF: 069905siii

9 ANS:
2

REF: 089913siii

10 ANS:
 $\frac{1}{3}$

REF: 080309siii

11 ANS: 4
 $9^{3x+1} = 27^{x+2}$.
 $(3^2)^{3x+1} = (3^3)^{x+2}$
 $3^{6x+2} = 3^{3x+6}$
 $6x+2 = 3x+6$
 $3x = 4$
 $x = \frac{4}{3}$

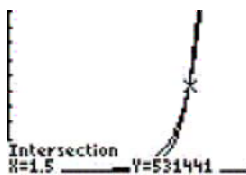
REF: 081008a2

12 ANS:

$$\begin{aligned}
 27^{2x+1} &= 9^{4x} \\
 \log 27^{2x+1} &= \log 9^{4x} \\
 (2x+1)\log 27 &= 4x \cdot \log 9 \\
 \frac{(2x+1)\log 27}{\log 9} &= 4x \\
 \frac{3}{2} \cdot \frac{3}{2}(2x+1) &= 4x \\
 2x+1 &= \frac{8x}{3} \\
 6x+3 &= 8x \\
 x &= \frac{3}{2}
 \end{aligned}$$

$$\begin{aligned}
 27^{2x+1} &= 9^{4x} \\
 (3^3)^{2x+1} &= (3^2)^{4x} \\
 3^{6x+3} &= 3^{8x} \\
 6x+3 &= 8x \\
 x &= \frac{3}{2}
 \end{aligned}$$

Plot1 Plot2 Plot3
 Y1=27^(2X+1)
 Y2=9^(4X)
 Y3=
 Y4=
 Y5=
 Y6=
 Y7=

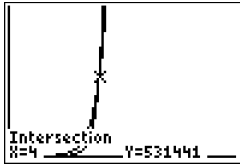


Intersection
X=1.5 Y=531441

REF: 060422b

13 ANS:

$$\begin{aligned}
 27^x &= 9^{x+2} \\
 \log 27^x &= \log 9^{x+2} \\
 x \log 27 &= (x+2) \log 9 \\
 4. \frac{x \log 27}{\log 9} &= x+2 \\
 \frac{3x}{2} &= x+2 \\
 3x &= 2x+4 \\
 x &= 4
 \end{aligned}$$

$$\begin{aligned}
 27^x &= 9^{x+2} \\
 (3^3)^x &= (3^2)^{x+2} \\
 3^{3x} &= 3^{2x+4} \\
 3x &= 2x+4 \\
 x &= 4
 \end{aligned}$$


Intersection
X=4 Y=531441

WINDOW
 Xmin=0
 Xmax=10
 Xscl=0
 Ymin=0
 Ymax=1000000
 Yscl=0
 Xres=1

REF: 080922b

14 ANS:

$$\frac{3}{2}$$

REF: 068515siii

15 ANS:

$$2$$

REF: 069012siii

16 ANS:

$$8$$

REF: 019508siii

17 ANS:
3

REF: 060005siii

18 ANS:
2

REF: 080106siii

19 ANS:

$$81^{x^3 + 2x^2} = 27^{\frac{5x}{3}}$$

$$\left(3^4\right)^{x^3 + 2x^2} = \left(3^3\right)^{\frac{5x}{3}}$$

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

$$4x^3 + 8x^2 - 5x = 0$$

$$x(4x^2 + 8x - 5) = 0$$

$$x(2x - 1)(2x + 5) = 0$$

$$x = 0, \frac{1}{2}, -\frac{5}{2}$$

REF: 061239a2