

MHF 4U

SOLVING EXPONENTIAL EQUATIONS

Two methods of solving exponential equations:

- Express powers with the same base
- Express equation in logarithmic form or use logarithms

EXAMPLES

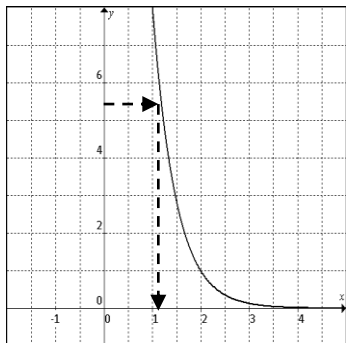
① $\left(\frac{1}{8}\right)^{x-2} = 4\sqrt{2}$

$$(2^{-3})^{x-2} = 2^2 \cdot 2^{1/2}$$

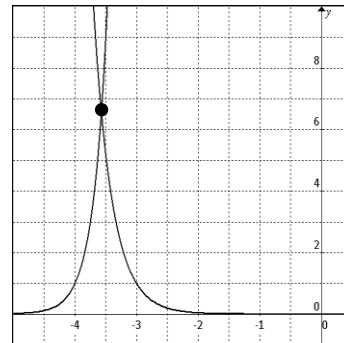
$$2^{-3x+6} = 2^{5/2}$$

$$-3x + 6 = 5/2$$

$$x = 7/6$$



② $81^{x+4} = \left(\frac{1}{27}\right)^{x+3}$



③ $6^{x-2} = 12$

OPTION 1: $\log 6^{x-2} = \log 12$

$$(x-2)\log 6 = \log 12$$

$$x\log 6 - 2\log 6 = \log 12$$

$$x\log 6 = \log 12 + 2\log 6$$

$$x = \frac{\log 12 + 2\log 6}{\log 6}$$

OPTION 2: $\log_6 12 = x - 2$

$$\frac{\log 12}{\log 6} = x - 2$$

$$x = \frac{\log 12}{\log 6} + 2$$

$$x = \frac{\log 12 + 2\log 6}{\log 6}$$



④ $4^{x-2} = 7^x$

$$\log 4^{x-2} = \log 7^x$$

$$(x-2)\log 4 = x\log 7$$

$$x\log 4 - 2\log 4 = x\log 7$$

$$x\log 4 - x\log 7 = 2\log 4$$

$$x(\log 4 - \log 7) = \log 4^2$$

$$x = \frac{\log 16}{\log 4 - \log 7} \approx -4.9545$$

⑤ $9^{2x-1} = 5^{x+4}$

Solve each equation for x . Round to 4 decimal places, if necessary.

1. $\frac{1}{16} = 2^{x+2}$

2. $0 = 216 - 6^{x-4}$

3. $8^x - 4 = 0$

4. $2(9^{x-3}) + 5 = 7$

5. $8(2^{x^2}) = 16^x$

6. $2^{x-3} = 6$

7. $10^{x+1} = 5^x$

8. $3^{x+1} + 3^x = 108$

9. $3^{x-2} + 3^{x-1} = 28$

10. $2^{x-1} + 2^{x-2} + 2^{x-3} = 448$

11. $5^x + 3(5^{x-2}) = 140$

12. $7^{x+2} + 2(7^{x-1}) = 345$

13. $2^x + 2^{x+2} = 4^x + 4^{x+2}$

14. $2^x + 2^{x+2} = 3^x + 3^{x+2}$

QUADRATIC EXPONENTIAL EQUATIONS:

15. $3^{2x} - 3^x = 702$

16. $4^x + 2^{x+1} = 80$

17. $3^{2x} - 5(3^x) + 6 = 0$

18. $5^{x+1} + 25^x = 36$

19. $9^x - 3^{x+2} = 22$

20. $16^x - 4^{x+2} + 28 = 0$

Answers: 1) -6; 2) 7; 3) 2/3; 4) 3; 5) 1, 3; 6) 5.5850; 7) -3.3219; 8) 3; 9) 3.77; 10) 9

11) 3; 12) 1; 13) -1.7655; 14) -1.7095; 15) 3; 16) 1, 0.6309; 17) 3; 18) 0.8614; 19) 2.1827; 20) 0.5, 1.9037