

Solve the following equations and be sure to check your answer(s)

1. $2\log(x+2) = 1 + \log(x^2 - 4)$ 4, 11
2, 22

$$\log(x+2)^2 - \log(x^2 - 4) = 1$$

$$\log \frac{x^2 + 4x + 4}{x^2 - 4} = 1 \quad (9x^2 - 4x - 44 = 0)$$

$$\frac{x^2 + 4x + 4}{x^2 - 4} = 10 \quad (9x - 22)$$

$$x^2 + 4x + 4 = 10x^2 - 40 \quad (1: x + 2)$$

$$x = -2$$

$x = \frac{22}{9}$

2. $1 + \log(x^2 - 9) = 2\log(x - 3) - \log(x^2 - 9)$

$$1 = \log \frac{(x-3)^2}{(x-3)(x+3)} \quad x \neq 3$$

Be careful if you cancel!

$$10 = \frac{x-3}{x+3}$$

$$10x + 30 = x - 3$$

$$9x = -33$$

$$x = \frac{-33}{9} = \cancel{\frac{11}{3}} \quad x \neq 3$$

\emptyset

3. $2^{x+4} = 3^{2x-3}$

$$\log_2 3^{2x-3} = x+4$$

$$(2x-3) \log_2 3 = x+4$$

$$2x \log_2 3 - 3 \log_2 3 = x+4$$

$$2x \log_2 3 - x = 3 \log_2 3 + 4$$

$$x(2 \log_2 3 - 1) = 3 \log_2 3 + 4$$

$x = 4.035$

4. $\log(\sqrt[4]{10-5x})^3 = 3$

$$\log(10-5x)^{3/4} = 3$$

$$\frac{3}{4} \log(10-5x) = \cancel{3} \cdot \frac{4}{3}$$

$$\log(10-5x) = 4$$

$$10-5x = 10^4$$

$$10-5x = 10000$$

$x = -1998$

5. $\ln(9x^2 - 1) = 0$

$$e^0 = 9x^2 - 1$$

$$1 = 9x^2 - 1$$

$$2 = 9x^2$$

$$\frac{2}{9} = x^2$$

$x = \pm \frac{\sqrt{2}}{3}$

6. $\log_2(y^{-3}) = 12$

$$(y^{-3})^{-1/3} = (2^{12})^{-1/3}$$

$$y = 2^{-4}$$

$y = \frac{1}{16}$

$$7. \log(3x^2 + 4) - \log(2x - 2) = \log x + \log 4$$

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

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

$$x = 2$$

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

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

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

$$(5x + 2)(x - 2)$$

$$8. \log_5(y^2 + 5y + 6) = \log_5(y + 3) + \log_5 4$$

$$\log_5(y^2 + 5y + 6) = \log_5(y + 3) + \log_5 4$$

$$y^2 + 5y + 6 = 4y + 12$$

$$y^2 + y - 6 = 0$$

$$(y + 3)(y - 2) = 0$$

$$y = -3 \quad y = 2$$

$$9. 9^{2-x^2} = \frac{1}{3}$$

$$9^? = \frac{1}{3}$$

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

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

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

$$\sqrt{x^2} = \sqrt{\frac{5}{2}}$$

$$x = \pm \frac{\sqrt{10}}{2}$$

$$10. \frac{2^{x-1}}{2^{3-4x}} = 16$$

$$2^{(x-1) - (3-4x)} = 16$$

$$2^{5x-4} = 2^4$$

$$5x - 4 = 4$$

$$5x = 8$$

$$x = \frac{8}{5}$$

$$11. e^{1+6x} = 8$$

$$\ln 8 = 1 + 6x$$

$$\frac{\ln(8) - 1}{6} = x$$

$$x \approx 0.180$$

$$12. (\log^3 x)^2 = (\sqrt{\log x})^2$$

$$\log x^{1/3} = \log x$$

$$\left(\frac{1}{3} \log x\right)^2 = \log x$$

$$\frac{1}{9} (\log x)^2 - \log x = 0$$

$$\log x \left(\frac{1}{9} \log x - 1\right) = 0$$

$$\log x = 0 \quad \frac{1}{9} \log x = 1$$

$$10^0 = x \quad \log x = 9$$

$$x = 1$$

$$10^9 = x$$