

SOLUTIONS

$$1. 27^{5x-6} = 9^{7x+3}$$

$$3^3(5x-6) = 3^2(7x+3)$$

$$15x-18 = 14x+6$$

$$x = 18+6$$

$$x = 24$$

$$2. 81^{\frac{x}{4}} = \frac{1}{27}$$

$$3^4\left(\frac{x}{4}\right) = 3^{-3}$$

$$x = -3$$

$$3. (9^{3x})^3 = 243$$

$$9^{9x} = 3^5$$

$$3^{2(9x)} = 3^5$$

$$18x = 5$$

$$x = \frac{5}{18}$$

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

$$\ln 2 + x \ln 5 = (2x-3) \ln 3$$

$$0.693 + 1.609x = (2x-3) 1.099$$

$$0.693 + 1.609x = 2.198x - 3.297$$

~~$$3.807x = 3.990$$~~

$$0.589x = 3.990$$

$$x = \frac{3.990}{0.589}$$

$$x = 6.774$$

$$5. \frac{3^x + 3^{-x}}{3^x - 3^{-x}} = 4$$

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

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

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

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

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

$$3(3^x) = 5$$

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

$$2x \ln 3 = \ln \frac{5}{3}$$

$$x = \frac{\ln \frac{5}{3}}{2 \ln 3}$$

$$x = 0.232$$

$$6. (e^x - e^{-x})(e^x + e^{-x}) = 4$$

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

$$e^{2x} - \frac{1}{e^{2x}} = 4$$

$$\frac{e^{4x} - 1}{e^{2x}} = 4$$

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

$$e^{4x} - 4e^{2x} - 1 = 0$$

$$\text{let } y = e^{2x}$$

$$y^2 - 4y - 1 = 0$$

$$y = \frac{4 \pm \sqrt{16+4}}{2}$$

$$y = e^{2x} = \frac{4 + 4.72}{2}$$

$$e^{2x} = 4.236$$

$$2x = \ln 4.236$$

$$x = \frac{\ln 4.236}{2}$$

$$x = 0.722$$

$$y = e^{2x} = \frac{4 - 4.72}{2}$$

$$e^{2x} = -0.236$$

$$2x = \ln -0.236 \text{ - Undefined}$$

$$7. \log 6 + x \log 4 = \log 4 + \log 32 + 4^x$$

$$\log 6(4^x) = \log 4(32 + 4^x)$$

$$6(4^x) = 128 + 4(4^x)$$

$$2(4^x) = 128$$

$$4^x = \frac{128}{2}$$

$$4^x = 64$$

$$4^x = 4^3$$

$$x = 3$$

$$8. \log_3 x + \log_3 (x+2) = 1$$

$$\log_3 (x)(x+2) = 1$$

$$x^2 + 2x = 3$$

$$x^2 + 2x - 3 = 0$$

$$(x+3)(x-1) = 0$$

$$x = -3$$

$$x = 1$$

$$a) \ln A = a, \ln B = b, \ln C = c$$

$$\ln \left[\frac{A^3}{B^4 \sqrt{C}} \right]$$

$$= 3 \ln A - 4 \ln B - \frac{1}{2} \ln C$$

$$= 3(a) - 4(b) - \frac{1}{2}c$$

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

$$10 \log a = \frac{\ln a}{\ln 10}$$

$$\ln a = \ln 10 \log a$$

$$\ln a = 2.303 \log a$$