

9. [11 points] Solve the following equations algebraically. Show all your work. Your answers should be **exact**.

a. [4 points] $\log(x + 1) - \log(x) = 1$.

Solution:

$$\log(x + 1) - \log(x) = 1$$

$$\log\left(\frac{x + 1}{x}\right) = 1$$

$$\frac{x + 1}{x} = 10$$

$$x + 1 = 10x$$

$$x = \frac{1}{9}$$

b. [3 points] $e^{3\ln(q)} = 2q^3 - 5$.

Solution:

$$e^{3\ln(q)} = 2q^3 - 5$$

$$e^{\ln(q^3)} = 2q^3 - 5$$

$$q^3 = 2q^3 - 5$$

$$q^3 = 5$$

$$q = 5^{\frac{1}{3}}$$

c. [4 points] $10\log(z^2) = \log(z) + 1$.

Solution:

$$10\log(z^2) = \log(z) + 1$$

$$20\log(z) = \log(z) + 1$$

$$19\log(z) = 1$$

$$\log(z) = \frac{1}{19}$$

$$z = 10^{\frac{1}{19}}$$

or

$$\log(z^{20}) = \log(z) + 1$$

$$\log(z^{20}) - \log(z) = 1$$

$$\log(z^{19}) = 1$$

$$z^{19} = 10$$

$$z = 10^{\frac{1}{19}}.$$