1. Find the solution set for the equation $\frac{107}{1+\exp(x)} = 0$.

Solution: Remember that $\left[\frac{a}{b} = 0\right] = [(a = 0) \wedge (b \neq 0)]$. Using this fact, we have

$$\left[\frac{107}{1+\exp(x)} = 0\right] = \left[(107 = 0) \wedge (1 + \exp(x) \neq 0)\right]$$
$$= \varnothing$$

2. Inflation is causing the cost of chicken eggs to increase. The cost (in dollars) of a dozen chicken eggs is $C = 1.83 \times 1.052^T$, where T is the number of years after 1 January, 2022. When will chicken eggs cost \$2.00 per dozen?

Solution:

$$\left[2 = 1.83 \times 1.052^T\right] = \left[\frac{2}{1.83} = 1.052^T\right],$$
$$= \left[\ln\left(\frac{2}{1.83}\right) = T\ln(1.052)T\right],$$
$$= \left[T = \frac{\ln(\frac{2}{1.83})}{\ln(1.052)}\right],$$
$$= \left[T \approx 1.75 \text{ years}\right].$$

3. Find the inverse of the function $W(x) = 5x + 1$ and $\operatorname{dom}(W) = \mathbf{R}$.

Solution:

$$\left[y = 5x + 1, -\infty < x < \infty\right] = \left[x = \frac{y-1}{5}, -\infty < \frac{y-1}{5} < \infty\right],$$
$$= \left[x = \frac{y-1}{5}, -\infty < y < \infty\right]$$

So $W^{-1}(y) = \frac{y-1}{5}$ and $\operatorname{dom}(W^{-1}) = \mathbf{R}$.

If y is a real number, so is $\frac{y-1}{5}$. Thus the solution set of $-\infty < \frac{y-1}{5} < \infty$ is $-\infty < y < \infty$.

4. Define $Z(t) = t - 2t^2$. Find

(a) $\underset{[1,1.1]}{\text{ARC}}(Z) =$

Solution:

$$\underset{[1,1.1]}{\text{ARC}}(Z) = \frac{Z(1.1) - Z(1)}{1.1 - 1} = -3.2$$

(b) $\underset{[1,1.01]}{\text{ARC}}(Z) =$

Solution:

$$\underset{[1,1.01]}{\text{ARC}}(Z) = \frac{Z(1.01) - Z(1)}{1.01 - 1} = -3.02$$

(c) $\underset{[1,1.001]}{\text{ARC}}(Z) =$

Solution:

$$\underset{[1,1.001]}{\text{ARC}}(Z) = \frac{Z(1.001) - Z(1)}{1.001 - 1} = -3.002$$

(d) a simplified formula for $\underset{[1,b]}{\text{ARC}}(Z) =$

Solution:

We have $(-2b^2 + b + 1) \div (b - 1) = -2b - 1.$ Using this easy formula, parts 'a' through 'c' are easy.

If you need a refresher on polynomial division, see `https://www.youtube.com/watch?v=RPXMBIFG_W4`