1. Problem definition

$V_{inMin} := 0.2\ V$ $V_{inMax} := 0.5\ V$

$V_{outMin} := 1.5\ V$ $V_{outMax} := 4.5\ V$

2. Choose Rf >> R1 || R2, so Rf needs to be large

$R_f := 100\ k\Omega$ $R_2 := 100\ \Omega$

3. Choose a reference voltage that is available for your circuit.

$V_{ref} := 5\ V$

4. Calculate Rg based on Rf and signal gain

$$G_{signal} := \frac{V_{outMax} - V_{outMin}}{V_{inMax} - V_{inMin}} = 10$$

$$G_{signal} = \frac{R_f}{R_g} + 1$$

$$R_g := \frac{R_f}{G_{signal} - 1} = 11.111\ k\Omega$$

5. Calculate the output of the voltage divider based on minimum signal. If this number is negative, you need to used a different topology. Also, this number must be less than Vref from step 3.

$$V_{div} := \frac{V_{outMin} - V_{inMin} \cdot G_{signal}}{-\frac{R_f}{R_g}} = 0.056\ V$$

6. Calculate R1 and R2 to achieve the desired divider output

$$R_1 := R_2 \cdot \left(\frac{V_{ref}}{V_{div}} - 1 \right) = 8.9\ k\Omega$$