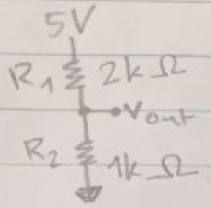
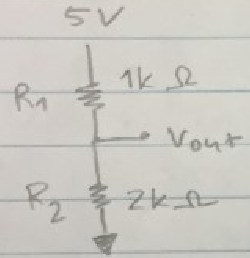
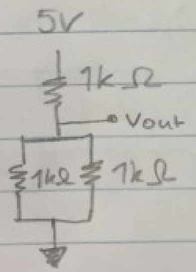
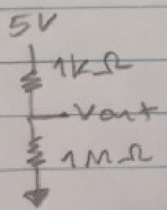
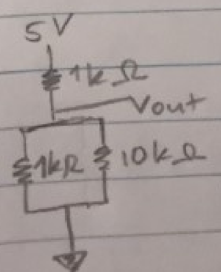
(1) my expected Vin is not equal to my actual Vin

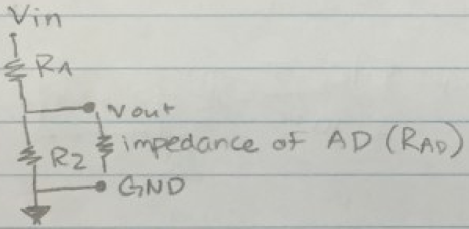
(2) the analog discovery is essentially a large parallel resistance

Circuit	expected V_{out}	measured V_{out}
	$R_{series} = \Sigma R = 2k + 1k = 3k\,\Omega$ $V = IR$ $V_{in} = IR_{total}$ $I = \frac{V_{in}}{R_{total}}$ $V_{out} = IR_2$ $I = \frac{V_{out}}{R_2}$ $V_{out} = \frac{R_2 V_{in}}{R_{total}} = \frac{10^3 \cdot 5}{3 \cdot 10^3} = \frac{5}{3} = \boxed{1.67\ V}$	1.73 V
	$R_{series} = 3k\,\Omega$ $V_{out} = \frac{2 \cdot 10^3 \cdot 5}{3 \cdot 10^3} = \frac{10}{3} = \boxed{3.33\ V}$	3.44 V
	$R_{parallel} = \frac{1}{\Sigma \frac{1}{R}} = \frac{1}{\frac{1}{1k} + \frac{1}{1k}} = \frac{1k}{2} = \frac{10^3}{2} = 500\,\Omega$ $R_{total} = 1k + 500 = 1500\,\Omega$ $V_{out} = \frac{500 \cdot 5}{1500} = \frac{5}{3} = \boxed{1.67V}$	1.72 V
	$R_{total} = 10^3 + 10^6 = 1{,}001{,}000\,\Omega$ $V_{out} = \frac{10^6 \cdot 5}{(10^6 + 10^3)} = \boxed{4.995\ V}$	5.17 V
	$R_{parallel} = \frac{1}{\frac{1}{1k} + \frac{1}{10k}} = \frac{1}{\frac{10}{10k} + \frac{1}{10k}} = \frac{10k}{11} = \frac{10^4}{11} = 909.1\,\Omega$ $V_{out} = \frac{909.1 \cdot 5}{(909.1 + 10^3)} = \boxed{2.38V}$	2.47 V

Part 6

$V_{in} = 5.18V$

Circuit	measured V_{out}	① I calculated	② $\frac{V_{out}}{I}$ calc	③ R_{AD} calc
$10k\Omega$	2.57V	261 μA	$9.85 \cdot 10^3 \Omega$	$6.57 \cdot 10^5 \Omega$
$100k\Omega$	2.47V	27.1 μA	$9.11 \cdot 10^4 \Omega$	$1.02 \cdot 10^6 \Omega$
$1M\Omega$	1.74V	3.44 μA	$5.06 \cdot 10^5 \Omega$	$1.02 \cdot 10^6 \Omega$



other than the outlier on $10k\Omega$, the impedance/resistance appears to be

$$\boxed{1.02 \cdot 10^6 \Omega}$$

$$R_{parallel} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_{AD}}} = \frac{R_{AD} R_2}{R_{AD} + R_2}$$

$$V_{out} = \frac{R_{parallel} \cdot V_{in}}{R_{parallel} + R_1}$$

$V = IR$

① $$I = \frac{(V_{in} - V_{out})}{R_1}$$

② $$R_{parallel} = \frac{V_{out}}{I} = \frac{R_{AD} R_2}{R_{AD} + R_2}$$

$$(R_{AD} + R_2)\frac{V_{out}}{I} = R_{AD} R_2$$

$$R_{AD} R_2 - R_{AD}\left(\frac{V_{out}}{I}\right) = \frac{R_2 V_{out}}{I}$$

③ $$R_{AD} = \frac{R_2\left(\frac{V_{out}}{I}\right)}{\left(R_2 - \frac{V_{out}}{I}\right)}$$