Ten Practice Problems

Analog Electronics, 2026-02-06. Problems 1-9 were hand-written. Here is the 10th.

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10. Discharging the Capacitor — Numerical Analysis

We want to study what happens to this capacitor over the course of 1 second by dividing up time into little chunks that are 0.1 second long. Here's the code that does it. To understand the code, I am leaving two rows of the table blank for you to do.

In[173]:=

```
qNumerical[0] = 60 × 10^-6;
c = 10 × 10^-6;
r = 47 000;
dt = 0.1;
vNumerical[i_] := qNumerical[i] / c;
iNumerical[i_] := vNumerical[i] / r;
dqNumerical[i_] := dt iNumerical[i];
qNumerical[i_] := qNumerical[i - 1] - dqNumerical[i - 1];
data[i_] := If[i ≠ 2 && i ≠ 3, {N[i * 0.1], Round[N[10^6 qNumerical[i]], 0.1],
    Round[N[vNumerical[i]], 0.01], Round[N[1000 iNumerical[i]], 0.001],
    Round[N[10^6 dqNumerical[i]], 0.1]}, {N[i * 0.1], "", "", "", ""}]
Grid[Join[{{"t", "q(t) (μC)", "V(t) (V)", "I(t) (mA)", "Δq(t) (μC)"}},
  Table[data[i], {i, 0, 10}]], Frame → All, Alignment → Center,
 ItemStyle → Directive[FontFamily → "Arial", FontSize → 12],
 Background → {None, {LightGray, Sequence @@ ConstantArray[None, 11]}},
 ItemSize → {{3, 8, 8, 8, 8}, Automatic}]
```

Out[182]=

t	$q(t)$ (μC)	$V(t)$ (V)	$I(t)$ (mA)	$\Delta q(t)$ (μC)
0.	60.	6.	0.128	12.8
0.1	47.2	4.72	0.1	10.
0.2				
0.3				
0.4	23.	2.3	0.049	4.9
0.5	18.1	1.81	0.039	3.9
0.6	14.3	1.43	0.03	3.
0.7	11.2	1.12	0.024	2.4
0.8	8.9	0.89	0.019	1.9
0.9	7.	0.7	0.015	1.5
1.	5.5	0.55	0.012	1.2