Determine the current flowing through an element if the charge flow is given by

\[ q(t) = 5t^2 + 2t - 1 \ C \ . \]

**Solution**

Current is the flow of charge per unit of time. So

\[ i(t) = \frac{dq(t)}{dt} \]

\[ = 10t + 2 \ \frac{A}{s} \]

\[ \therefore 10t + 2 \ A \]
2) Electric Stove:

<table>
<thead>
<tr>
<th>Time</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 - 40 mins</td>
<td>Burner: 1.2 kW</td>
</tr>
<tr>
<td>B2 - 35 mins</td>
<td>Oven: 2.2 kW</td>
</tr>
<tr>
<td>B3 - 25 mins</td>
<td>Cost: 8 cents/kWh</td>
</tr>
<tr>
<td>B4 - 45 mins</td>
<td></td>
</tr>
<tr>
<td>Oven - 30 mins</td>
<td></td>
</tr>
</tbody>
</table>

The product of power rating & time (in hours) determines the number of kWh used. So the total energy used is

\[ U = 1.2 \text{ kW} \times \left( \frac{40 + 35 + 25 + 30}{60} \right) \text{ hours} \]

\[ + 2.2 \text{ kW} \times \frac{30}{60} \text{ hours} = 4 \text{ kWh} \]

The cost is 8 cents/kWh, so

\[ \text{Cost} = 8 \text{ cents/kWh} \times 4 \text{ kWh} = 32 \text{ cents} \]

3) Find I & power absorbed by each element.

![Electrical Circuit Diagram]

① By KCL, \[ 0 = 6A - 2A - I \Rightarrow I = 4A \]

② The power absorbed by each element is \( P = VI \), so

- \( P_{6V} = (6\text{V})(6\text{A}) = 36 \text{ W} \)
- \( P_{2A} = (6\text{V})(2\text{A}) = 12 \text{ W} \)
- \( P_{4H} = (3\text{V})(4\text{A}) = 12 \text{ W} \)
- \( P_{3V} = (3\text{V})(4\text{A}) = 12 \text{ W} \)
4) Find $V_0$ and the power absorbed by each element.

![Circuit Diagram]

1. To find $V_0$, use KVL with the loop containing 28V & $V_0$. So using the convention $+$ is negative.

$$0 = 28V - 12V - V_0 \Rightarrow V_0 = 16V$$

2. The power absorbed in each element is:
   - **Source 28V**: $P = (28V)(6A) = 168 \text{ W}$
   - **Load 12V**: $P = (12V)(6A) = 72 \text{ W}$
   - **Load $V_0$**: $P = (16V)(3A) = 48 \text{ W}$
   - **Load 20V 2A**: $P = (20V)(2A) = 40 \text{ W}$
   - **Load 20V 1A**: $P = (20V)(1A) = 20 \text{ W}$
   - **Source 2$V_0$ V**: $P = (2V_0)(3A) = 4(16V)(3A) = 12 \text{ W}$