Exercise.

Determine the best alternative between A_1, A_2 and A_3.
Three criteria to be considered in your decision making are:
C_1: to be minimised
C_2: to be minimised
C_3: to be minimised
The relative importance of criteria are: $w_1 = 0.5$, $w_2 = 0.3$, $w_3 = 0.2$
The values of criteria of the three alternatives are given in the following matrix.

	C_1	C_2	C_3
A_1	90	180	10
A_2	110	150	8
A_3	100	170	5

Select the best alternative by using the TOPSIS method.

Answer.

Step1. Calculate the elements of the normalised matrix.

$$r_{nk} = \frac{f_{nk}}{\sqrt{\sum_{n=1}^{3} f_{nk}^{2}}}, k = 1,...,3$$

	C_1	C_2	C_3
A_1	0.518	0.622	0.727
A_2	0.633	0.518	0.582
A_3	0.5575	0.587	0.364

Step 2. Construct the weighted normalised decision matrix.

	C_1	C_2	C_3
A_1	0.2590	0.1866	0.1454
A_2	0.3165	0.1554	0.1164
A_3	0.2875	0.1761	0.0728

Step 3. Determine the ideal point A^+ and nadir $A_{\#}$.

$A^+ = \{0.2590, 0.1554, 0.0728\}$
$A_{\#}. = \{0.3165, 0.1866, 0.1454\}$

Step 4. Calculate the distance between each alternative and the ideal point A^+ and nadir $A_{\#}$.

$$S_{1+} = \sqrt{(0.2590-0.2590)^2+(0.1866-0.1554)^2+(0.1454-0.0728)^2} = \sqrt{0.0062441} = 0.079$$
$$S_{2+} = \sqrt{(0.3165-0.2590)^2+(0.1554-0.1554)^2+(0.1164-0.0728)^2} = 0.072$$
$$S_{3+} = \sqrt{(0.2875-0.2590^2+(0.1761-0.1554)^2+(0.0728-0.0728)^2} = 0.037$$

$$S_{1\#} = \sqrt{(0.2590-0.3165)^2+(0.1866-0.1866)^2+(0.1454-0.1454)^2} = 0.057$$
$$S_{2\#} = \sqrt{(0.3165-0.3165)^2+(0.1554-0.1866)^2+(0.1164-0.1454)^2} = 0.0424$$
$$S_{3\#} = \sqrt{(0.2875-0.3165)^2+(0.1761-0.1866)^2+(0.0728-0.1454)^2} = 0.079$$

Step 5. Calculate the relative closeness to the ideal point $A*$.

$$P_1 = \frac{0.057}{0.079 + 0.055} 7 = 0.419$$

$$P_2 = \frac{0.0424}{0.072 + 0.0424} = 0.3706$$

$$P_3 = \frac{0.079}{0.037 + 0.079} = 0.681$$

Step 6. The best alternative is A3 (followed by A2 and then A1).