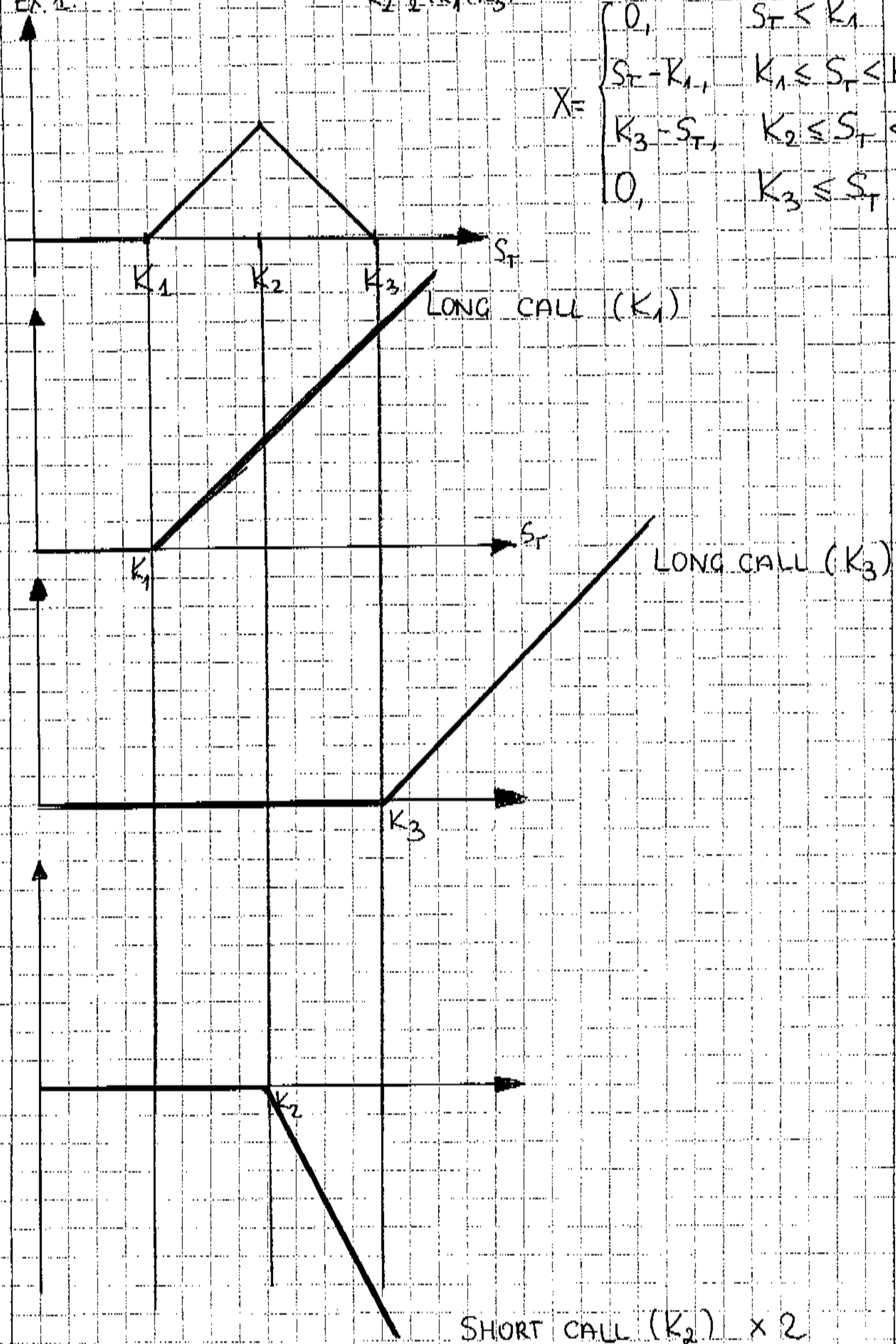
Ex. 1.

$K_2 = \frac{1}{2}(K_1 + K_3)$

$$X = \begin{cases} 0, & S_T < K_1 \\ S_T - K_1, & K_1 \leq S_T < K_2 \\ K_3 - S_T, & K_2 \leq S_T < K_3 \\ 0, & K_3 \leq S_T \end{cases}$$



THUS

$$X = \underbrace{(S_T - K_1)^+}_{\text{LONG CALL }(K_1)} + \underbrace{(S_T - K_3)^+}_{\text{LONG CALL }(K_3)} - \underbrace{2 \cdot (S_T - K_2)^+}_{\text{2× SHORT CALL }(K_2)}$$

Ex. 1.

Analitical method

$$X=(S_T-K_1)\mathbb{1}_{\{K_1\leq S_T<K_2\}}+(K_3-S_T)\mathbb{1}_{\{K_2\leq S_T<K_3\}}$$

$$=(S_T-K_1)^+-(S_T-K_1)\mathbb{1}_{\{K_2\leq S_T\}}-(S_T-K_3)\mathbb{1}_{\{K_2\leq S_T<K_3\}}$$

$$=(S_T-K_1)^+-(S_T-K_1)\mathbb{1}_{\{K_2\leq S_T\}}-(S_T-K_3)\mathbb{1}_{\{K_2\leq S_T\}}$$

$$+(S_T-K_3)\mathbb{1}_{\{K_2\leq S_T\}}-(S_T-K_3)\mathbb{1}_{\{K_2\leq S_T<K_3\}}$$

$$=(S_T-K_1)^+-(2\cdot S_T-2(K_1+K_3)\tfrac{1}{2})\mathbb{1}_{\{K_2\leq S_T\}}$$

$$+(S_T-K_3)\underbrace{\left[\mathbb{1}_{\{K_2\leq S_T\}}-\mathbb{1}_{\{K_2\leq S_T<K_3\}}\right]}_{=\mathbb{1}_{\{K_3\leq S_T\}}}$$

$$=(S_T-K_1)^+-2(S_T-K_2)^++(S_T-K_3)\mathbb{1}_{\{K_3\leq S_T\}}$$

$$=(S_T-K_1)^+-2(S_T-K_2)^++(S_T-K_3)^+$$

Summing up: the representation of the payoff consists of:

- one long call with strike K_1
- one long call with strike K_3
- two short call with strike $K_2=\frac{1}{2}(K_1+K_3)$