$$\begin{aligned} & \text{ADVANCE}(p, v, m, dt) \colon \mathbb{R}^2_{5,3}, \mathbb{R}^2_{5,3}, \mathbb{R}^1_{5}, \mathbb{R} \to \mathbb{R}^3 \\ & accs_{i,j} \mid 0 \leq i \leq 4 \land 0 \leq j \leq 4 = \begin{cases} \frac{(p_j - p_i) \cdot m_j}{\rho(p_i, p_j)^3} & j < i \\ 0 & otherwise \end{cases} \\ & accs_{i,j} \mid j > i = -accs_{j,i} \\ & a_{i,j} = \sum_k accs_{i,k,j} \\ & v = v + a \cdot dt \\ & p = p + v \cdot dt \\ & \mathbf{return} \ (p, v) \end{aligned}$$

$$\begin{split} & \text{ENERGY}(p,v,m) \colon \mathbb{R}^2_{5,3}, \mathbb{R}^2_{5,3}, \mathbb{R}^1_5 \to \mathbb{R} \\ & e \in \mathbb{R} \\ & e = \sum_{i=0}^4 \frac{m_i \cdot \sum_j v_j^2}{2} \\ & e = e - \sum_{i=0,j=0}^{i < 5,j < 5} \begin{cases} \frac{m_i \cdot m_j}{\rho(p_i - p_j)} & i < j \\ 0 & \text{otherwise} \end{cases} \\ & \mathbf{return} \ (e) \end{split}$$

$$\begin{aligned} \text{OFFSET_MOMENTUM}(v,m) \colon \mathbb{R}^2_{5,3}, \mathbb{R}^1_5 &\to \mathbb{R}^2_{5,3} \\ v_{0,j} \mid 0 \leq j \leq 2 &= \frac{-\sum_i v_{i,j} \cdot m_i}{4 \cdot \pi^2} \\ \textbf{return} \ (v) \end{aligned}$$

```
MAIN(): \rightarrow \mathbb{Z}
p \in \mathbb{R}^2_{5,3}, v \in \mathbb{R}^2_{5,3}, m \in \mathbb{R}^2_5
                                                                                                                                            0
                    1.28943695621391310e + 01 \\ -1.51111514016986312e + 01 \\ -2.23307578892655734e - 01
                      1.53796971148509165e + 01 -2.59193146099879641e + 01 1.79258772950371181e - 01
                                                                               0
                                                                                                                                                                  0
                                                                                                                                                                                                                                                        0
                                           v = 365.24 \cdot
                                           8.34336671824457987e + 00 4.12479856412430479e + 00 -4.03523417114321381e -
                                           1.28943695621391310e + 01 \\ -1.51111514016986312e + 01 \\ -2.23307578892655734e \\ -2.2330757889265574e \\ -2.2330757889265574e \\ -2.2330757889265574e \\ -2.2330757889265574e \\ -2.2330757889265574e \\ -2.2330757889265574e \\ -2.233075788926574e \\ -2.233075788926574e \\ -2.233075788926574e \\ -2.233075788926574e \\ -2.233075788926574e \\ -2.233075788926574e \\ -2.2330757889266666 \\ -2.2330757886666 \\ -2.23307866666 \\ -2.23307866666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.2330786666 \\ -2.233078666 \\ -2.233078666 \\ -2.233078666 \\ -2.233078666 \\ -2.233078666 \\ -2.233078666 \\ -2.233078666 \\ -2.23307866 \\ -2.23307866 \\ -2.23307866 \\ -2.23307866 \\ -2.23307866 \\ -2.23307866 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.2330786 \\ -2.233078 \\ -2.2330786 \\ -2.233078 \\ -2.233078 \\ -2.233078 
                                            9.5479384224326609e - 04
                                              2.8588598066613812e - 04\\
                                             4.3662440433515629e - 05
                                               5.1513890046611451e - 05
v = \text{OFFSET\_MOMENTUM}(v, m)
print (ENERGY(p, v, m))
p^{[0]}, v^{[0]} = p, v
p^{[i]}, v^{[i]} = \text{ADVANCE}(p^{[i-1]}, v^{[i-1]}, m, 0.01)
p, v = filter(p^{[i]}, v^{[i]} | i = n)
print (ENERGY(p, v, m))
```

return (0)