Evolution of Supermassive Black Holes Binary

Part A. Dynamic Friction

A.1 (0.75 pt)

$k =$

A.2 (0.25 pt)

$\Delta p_x =$

A.3 (0.4 pt)

$F_{DF} =$

A.4 (0.2 pt)

$\log \Lambda =$

Part B. Gravitational sligshot

B.1 (0.25 pt)

$v_{bin} =$

$E =$

B.2 (0.5 pt)

$b =$

B.3 (1.0 pt)

$\Delta t =$

B.4 (0.25 pt)

$\frac{dE}{dt} =$

$\left(\frac{da}{dt}\right)_{SS} =$

B.5 (1.0 pt)

(formula)

$T_{SS} =$

(value)

$T_{SS} =$

Part C. Emission of gravitational waves

C.1 (0.2 pt)

$\left(\frac{da}{dt}\right)_{GW} =$

C.2 (0.7 pt)

$T_{GW} =$

C.3 (0.1 pt)

$a_H =$

Part D. Full evolution.

D.1 (0.25 pt)

$v =$

D.2 (0.75 pt)

$\left(\frac{da}{dt}\right)_{DF} =$

D.3 (0.3 pt)
(formula)
$a_1 =$

(value)
$a_1 =$

D.4 (0.75 pt)

$T_1 =$

D.5 (0.3 pt)
(formula)
$a_2 =$

(value)
$a_2 =$

D.6 (1.75 pt)

$T_2 =$

$T_3 =$

D.7 (0.3 pt)

$T_{ev} =$