What is the efficiency of a heat engine that does 500 J of work and exhausts 800 J of heat to the cold reservoir?

Given:

Work done by heat engine: $W = 500$ J

Heat exhausted to the cold reservoir: $Q_C = 800$ J

To determine: the efficiency of the engine: e

Use formula:

$$e = W / Q_H \text{ ----------(1)}$$

Here Q_H is the heat transferred from the hot reservoir to the engine.

But $W = Q_H - Q_C$ ----------(2)

Rearranging (2) and substituting for W and Q_C :

$$Q_H = 500 + 800 = 1300 \text{ J}$$

Substituting for W and Q_H in (1):

$e = 500 / 1300 = 0.38 = 38\ \%$