$$y' = ky$$

$$\frac{dy}{dt} = ky$$

$$\int \frac{dy}{y} = \int k\,dt$$

$$\ln y = kt + c$$

$$y = e^{kt} \cdot e^{c} \qquad e^{c} = y_0$$

$$y = e^{kt} \cdot y_0$$

$$y = y_0 e^{kt}$$

(a) From the question,

$$y = 2y_0$$

ie $2y_0 = y_0 e^{kt}$

At $t = 5hr$

$$2y_0 = y_0 e^{5k}$$

$$\ln 2 = 5k$$

$$k = \frac{\ln 2}{5}$$

$$k = 0.139$$

Since $y_0 = 20$
$k = 0.139$

$$y = 20e^{0.139t} \quad --- \quad \text{Model}$$

(b) At $t = 1\frac{1}{2}$ days
$t = 36hrs$

$$y = 20e^{0.139t}$$
$$y = 20e^{(0.139 \times 36)}$$
$$y = 2937.5532$$
$$y \simeq 2937.5532$$

(c) As seen in the attached Excel document

(d) As seen in the attached Excel document

(e) From the results obtained in (d), it was concluded that an increase in time led to an exponential growth in the population of the bacteria in the growth medium