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Computer Engineering  
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1a) Mathematical modelling is a mathematical representation of a system and simulation of a system involves solving the model and obtaining its output variable for different values of its input variable or as its input variable is changed from one value to another

b)

$$c) \frac{dT}{dt} \propto T - T_a \Rightarrow \frac{dT}{dt} = k(T - T_a)$$

$$\frac{1}{(T - T_a)} dT = k dt$$

$$\ln(T - T_a) = kt + C$$

$$T - T_a = e^{kt + C}$$

$$T - T_a = e^{kt} \cdot e^C$$

$$T - T_a = T_0 e^{kt}$$

At 0 mins,  $T = 10^\circ\text{C}$

At 5 mins,  $T = 20^\circ\text{C}$

Actual Temperature =  $25^\circ\text{C}$



$$T = T_a + T_0 e^{kt}$$

$$10 = 25 + T_0 e^{k(0)}$$

$$10 - 25 = T_0$$

$$T_0 = -15$$

$$T = 25 - 15e^{kt}$$

At 5 mins,  $T = 20^\circ\text{C}$

$$20 = 25 - 15e^{k(5)}$$

$$20 - 25 = -15e^{k5}$$

$$\frac{-5}{-15} = e^{5k}$$

$$e^{5k} = \frac{1}{3}$$

$$5k = \ln \frac{1}{3}$$

$$k = \frac{\ln \frac{1}{3}}{5}$$

$$k = -0.22$$

$$i.) T(t) = 25 - 15e^{-0.22t}$$

$$ii.) 25^\circ$$

$$v.) T(t) = 25 - 15e^{-0.22t}$$

$$T(t) = T(t) = 25 - 15e^{-0.22(0)}$$

$$T(t) = 25 - (15 \times 1)$$

$$T(t) = 25^\circ\text{C}$$