Modelling Exponential Functions

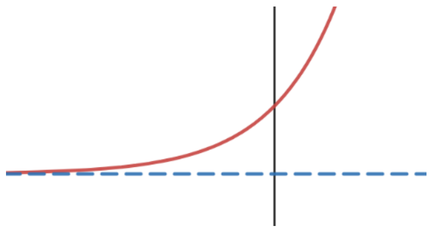
KNOW	DO	UNDERSTAND
The basic shape an exponential model will follow.	Can solve problems involving exponential functions	*Function Characteristics*: Can build a model for an exponential function. Understands the significance of the asymptote to the model and the behaviour around the asymptote. Can justify when an exponential function will reach the asymptote.

Vocab & Notation

- None

When we model an exponential problem there are four cases that the exponential could look like:

1

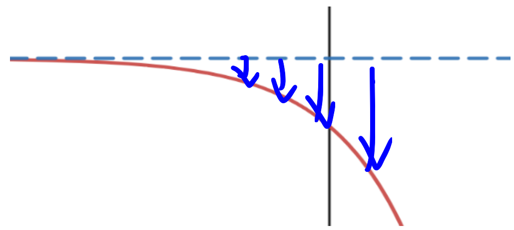


→ Population that is infected ☆ (early)

→ interest earned (compound)

→ nuclear chain reaction ☆ (beginning)

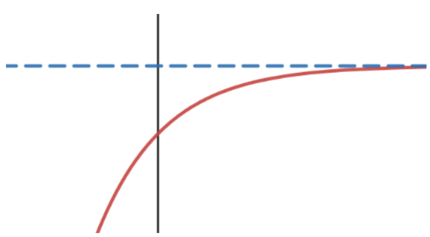
2



→ stable population starts to decline ☆ (early)

→ retirement account with reg. withdrawls

3

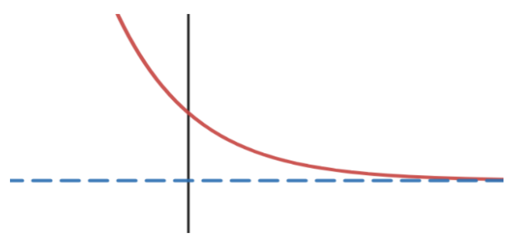


→ population that is infected (late) ☆

→ growth of collection

→ warming

4



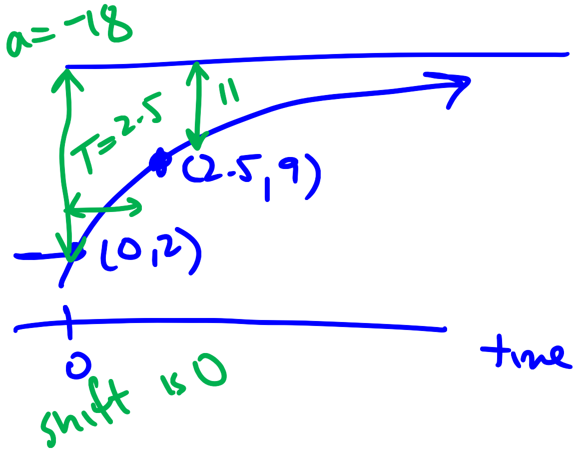
→ # of thing NOT been infected

→ cooling

→ radioactive decay

→ population declining to a stable amount (late)

Example: A glass of ice water (2°C) is left in a room that is 20°C. If it is left for 2.5 hours, at which time the temperature of the glass of water warmed to 9°C. Determine a function for the temperature of water after t hours of being left out in the room. When will the water be 15°C? When will the water be room temperature?



Room Temp = 20 = d

$e^x = \exp(x)$

$r = \frac{11}{18}$ $\quad T = 2.5$

$$T(t) = -18\left(\frac{11}{18}\right)^{\frac{t}{2.5}} + 20$$

$$= -18 \exp\left(\frac{t}{2.5}\ln\left(\frac{11}{18}\right)\right) + 20$$

$$T(t) = 15 = -18\exp\left(\frac{t}{2.5}\ln\left(\frac{11}{18}\right)\right) + 20$$

$$\ln\left(\frac{15-20}{-18}\right) \cdot \frac{2.5}{\ln\left(\frac{11}{18}\right)} = t = 6.5$$

after 6.5 hrs

$\Rightarrow$ 6 hrs + 30 min

$$19.95 = -18\exp\left(\frac{t}{2.5}\ln\left(\frac{11}{18}\right)\right) + 20$$

$$\ln\left(\frac{0.05}{18}\right) \cdot \frac{2.5}{\ln(11/18)} = 29.9 \text{ hrs}$$

$\Rightarrow$ 29 hrs + 53 min

$\sim$ 30 hrs

, $19.95 \equiv 20$

$\uparrow$ equivalent

$19 \equiv 20$

$t \sim 14$ hrs

$$T: \mathbb{Q} \to \mathbb{Q} \cap [2, 20] \qquad t \geq 0$$

Practice Problems: 7.3 page 364-365 # 8-14 8.4 page 414-415 # 11, 13, 15-17