

We are going to look at a couple of examples that might be familiar and talk about vertical and horizontal asymptotes and their meanings. You're welcome to use Desmos to sketch the relevant graphs to check your work.

1. The temperature in Fahrenheit of a cup of hot chocolate after  $t$  minutes is given by

$$F(t) = \frac{144 + 250e^{-0.2t}}{2}.$$

- (a) Evaluate  $F(0)$  and explain its meaning, including units.

- (b) Evaluate  $F(10)$  and explain its meaning, including units.

- (c) What is  $\lim_{t \rightarrow \infty} F(t)$ ?

- (d) What is the meaning of your answer to (c) in the context of the problem?

- (e) Identify any vertical or horizontal asymptotes for  $F(t)$ .

2. The equation  $A = 1000e^{rt}$  gives the amount in a bank account earning interest rate  $r$  for  $t$  years, if the account starts at \$1,000.
- (a) If the interest rate is 6%, how much will be in the account after 8 years?
- (b) If the interest rate is 4%, how long will it take to have \$10,000?
- (c) If the interest rate is  $r$ , how long will it take to have \$10,000? The answer will depend on  $r$ .
- (d) Your answer to (c) gives a new function  $f(r)$ . We will require that  $r \geq 0$ . What is  $\lim_{r \rightarrow \infty} f(r)$ ? Why does that answer make sense in this context?
- (e) What is  $\lim_{r \rightarrow 0^+} f(r)$ ? Why does that answer make sense in this context?
- (f) Identify any vertical or horizontal asymptotes for  $f(r)$ .