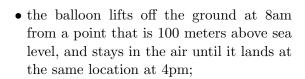
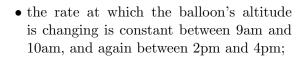
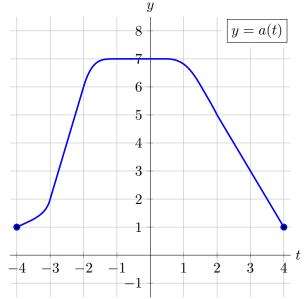
7. [5 points] Suppose a(t) is the altitude in hundreds of meters above sea level of a certain hot air balloon t hours after 12pm noon on a sunny day. Carefully draw a plausible graph of a(t) on the given axes, assuming the following are true:





- at 9:30am, the balloon is **ascending** twice as fast as it is **descending** at 3pm;
- the balloon spends at least one full hour at its maximum altitude of 700 meters.



**8.** [6 points] Let g(x) be the piecewise function defined by

$$g(x) = \begin{cases} \frac{-4(x+1)}{(x^2-1)(x+4)} & x < 0\\ e^{A(x-1)} + \frac{B(x+1)^2(x-2)}{2(x-3)(x-2)^2} & x \ge 0 \end{cases}$$

where A and B are nonzero constants.

a. [3 points] List the x-coordinates of all vertical asymptotes of q(x).

**b.** [3 points] Find values of the constants A and B such that g(x) is continuous at x = 0 and g(x) has a **horizontal asymptote** at y = -3.

Solution: We can get the horizontal asymptote at y=-3 if  $A\leq 0$  and then

$$\lim_{x \to \infty} g(x) = \lim_{x \to \infty} \frac{Bx^3}{2x^3} = B/2 = -3,$$

So B = -6. To make q continuous at 0, we set up the equation

$$\frac{-4(0+1)}{(0^2-1)(0+4)} = e^{A(0-1)} + \frac{-6(0+1)^2(0-2)}{2(0-3)(0-2)^2}, \quad \text{or} \quad 1 = e^{-A} - \frac{1}{2}.$$

Now solving for A by taking logarithms, we get

$$A = \ln(2/3).$$

**Answer:**  $A = \frac{\ln(2/3)}{\ln(2/3)}$  and  $B = \frac{-6}{\ln(2/3)}$