MAT 17BA Fall 2023
Solutions to homework 1

1. (10 points) At the surface of the ocean, the water pressure is the same as the air pressure above the water, 15 lb/in^2. Below the surface, the water pressure increases by 4.34 lb/in^2 for every 10 ft of descent.

(a) Express the water pressure as a function of the depth below the ocean surface.

(b) At what depth is the pressure 100 lb/in^2?

Solution: a) Let $f(x)$ be the pressure at depth x. The function $f(x)$ is linear with $f(0) = 15$ and the slope $4.34/10 = 0.434$, so

$$f(x) = 15 + 0.434x.$$

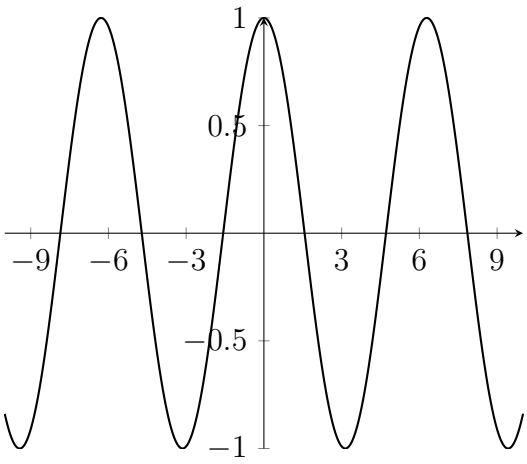
b) We need to solve the equation $15 + 0.434x = 100$:

$$0.434x = 100 - 15 = 85,\ x = \frac{85}{0.434} \approx 195.85 \text{ ft}.$$

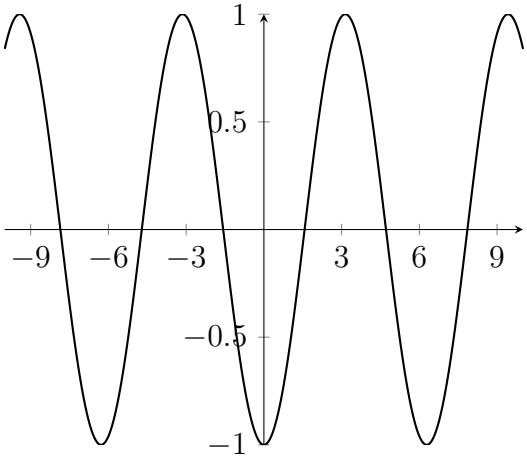
Graph the functions below by hand, not by plotting points, but by starting with the graph of one of the standard functions, and then applying the appropriate transformations. Plot the graphs of the functions at all intermediate steps.

2. (10 points) $y = \frac{1}{2}(1 - \cos x)$

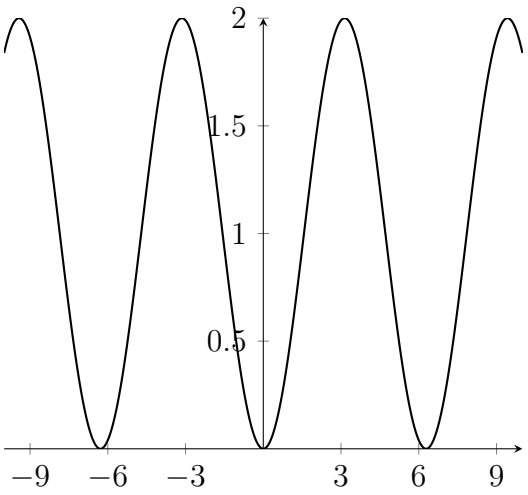
Solution: We start with the basic function $\cos x$ with the graph



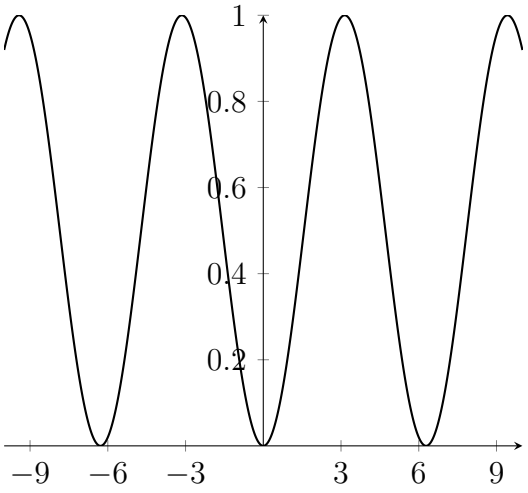
Next we reflect it in the x-axis to get the graph of $-\cos x$:



Next we shift it up by 1 to get the graph of $1 - \cos x$:

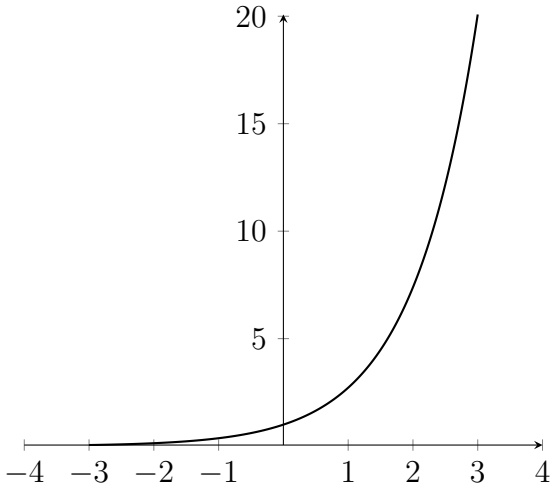


Next we scale it vertically by a factor $\frac{1}{2}$ to get the final graph of the function $\frac{1}{2}(1 - \cos x)$:

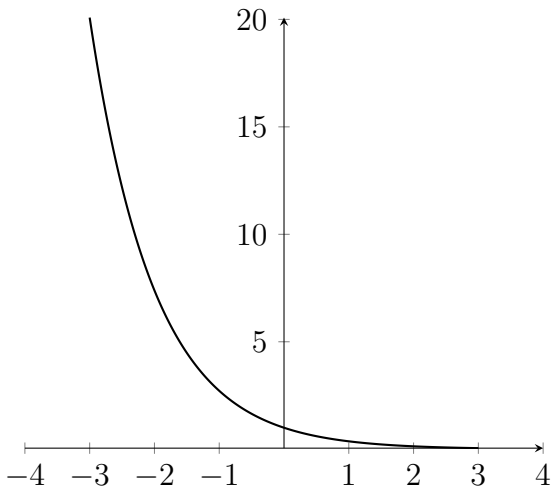


3. (10 points) $y = 1 - \frac{1}{2}e^{-x}$.

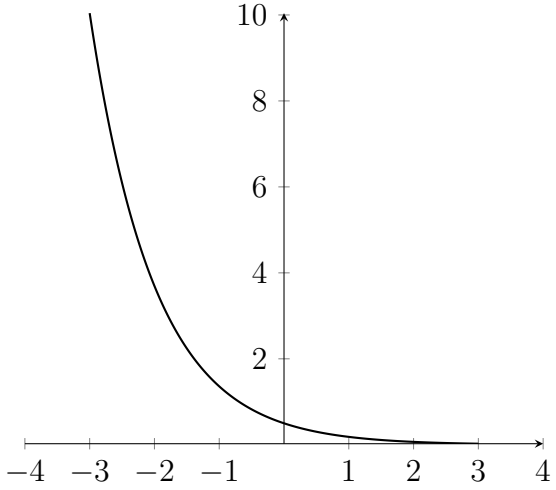
Solution: We start with the basic function e^x with the graph



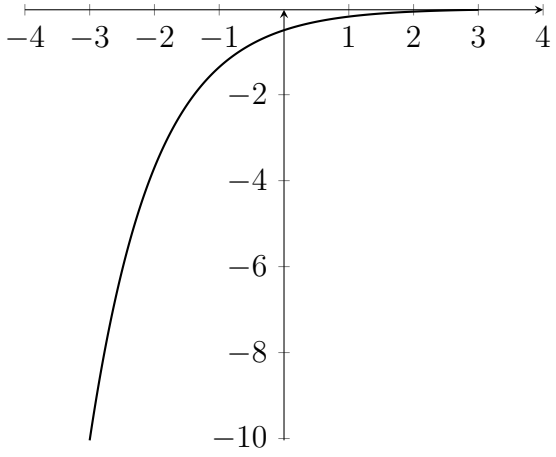
Next we reflect it in the y-axis to get the graph of e^{-x}:



Next we scale it vertically by a factor $\frac{1}{2}$ to get the graph of $\frac{1}{2}e^{-x}$:



Next we reflect it in the x-axis to get the graph of $-\frac{1}{2}e^{-x}$:



Finally, we shift it up by 1 to get the graph of $1 - \frac{1}{2}e^{-x}$: