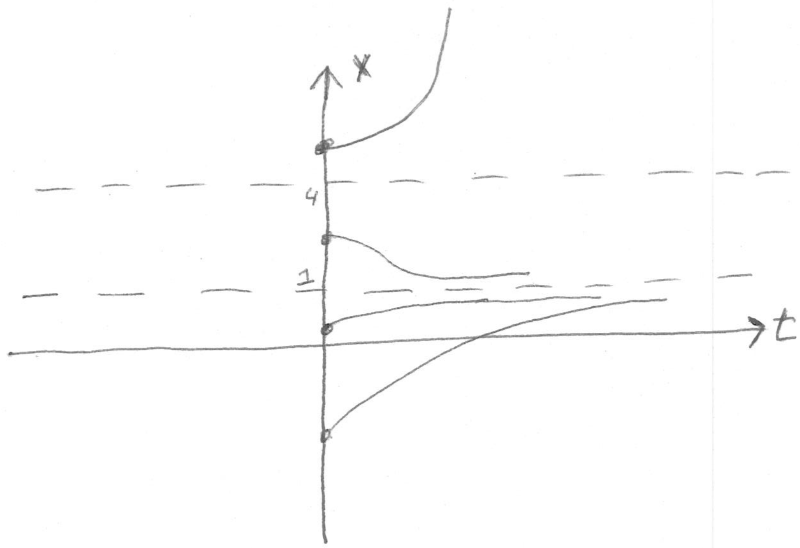
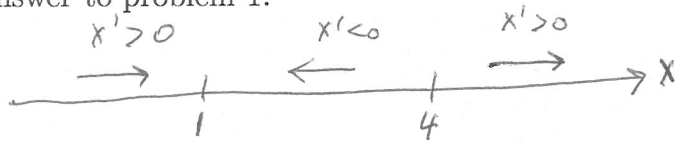
(b)



Note. Of course the phase diagram gives much of the qualitative information about our answer to problem 1.



2. **An object is moving in a straight line with position at time t given by $x(t)$ and velocity at time t given by $v(t)$. The object's motion satisfies the initial value problem**

$$\frac{dv}{dt} = -kv^{3/2}, \quad v(0) = v_0, \quad \textbf{and} \quad x(0) = x_0,$$

where k is a constant. Find $\lim_{t\to\infty} x(t)$.

We solve the DE:

$$\int v^{-3/2}dv = -kdt$$

$$-2v^{-1/2} = -kt + C$$

(At this point we learn that $-2v_0^{-1/2} = C$.)

$$\frac{-2}{-kt+C} = v^{1/2}$$

$$\frac{4}{(-kt+C)^2} = v$$

$$\frac{4}{\left(-kt - 2v_0^{-1/2}\right)^2} = v$$