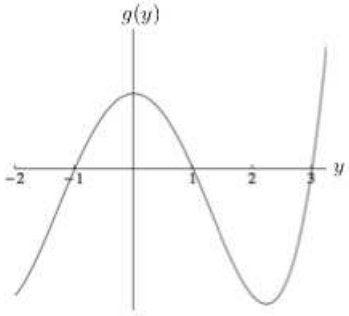
2. [12 points]

a. [10 points] Suppose the function $y(t)$ satisfies the differential equation $\dfrac{dy}{dt} = g(y)$, where the graph of $g(y)$ is shown below:



1.(4 pts) Use inequalities to describe the regions in the y-t plane where the solution curves of the differential equation are strictly increasing.

Solution: $y(t)$ is increasing on $-1 < y < 1$ and $3 < y$ since $\dfrac{dy}{dt} = g(y) > 0$ in these intervals.

2.(6 pts) Find all equilibrium solutions (if any) to the differential equation for $y(t)$. Classify each one as stable or unstable. If the equation does not have equilibrium solutions, write none.

Solution: $y = -1$ and $y = 3$ are unstable, $y = 1$ is stable.

b. [2 points] Consider the differential equation

$$\frac{dy}{dt} = (2y + 5t)t.$$

Find all equilibrium solutions (if any) to the differential equation for y. If the equation does not have equilibrium solutions, write none.

Solution: None