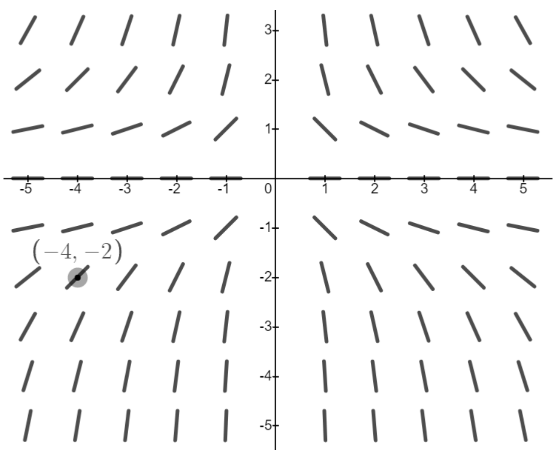
Note: Videos from March 25th – April 3rd cover the entire Unit 7. These are selected highlights.

**Example 1:** The rate of change of the height of a tree, $h$, in meters, with respect to the age of the tree, $t$, in years, is inversely proportional to the product of the time and the cube root of the height. Write this situation as a differential equation.

**Example 2:** For what value of $k$, if any, will $y = e^{2x} + ke^{-5x}$ be the solution to the differential equation $4y - y'' = 30e^{-5x}$ ?

**Example 3:** Consider the differential equation $\frac{dy}{dx} = -\frac{y^2}{x}$ $, x \neq 0$.
Let $y = f(x)$ be the particular solution to the differential equation with the initial condition $f(-4) = -2$.




(a) Sketch the solution curve to through the point $(-4, -2)$.

(b) Write the equation of the tangent line to the solution curve at the point $(-4, -2)$.

(c) Use the equation of the tangent line to approximate $f(-4.1)$.

(d) Find the particular solution $y = f(x)$ to the given differential equation with initial condition $f(-4) = -2$.

**Example 4:** Given that $\frac{dG}{d\theta} = \frac{\theta \sin(\theta^2)}{G}$ and that $G\left(\sqrt{\frac{\pi}{3}}\right) = -2$, determine $G\left(\sqrt{\frac{\pi}{2}}\right)$.

**Example 5:** The point $(1, 2)$ is on the graph of the solution curve to the differential equation $\frac{dy}{dx} = (x+2)(3-y)$. Find the $y$-coordinate such that the point $(2, y)$ is also on the graph of the solution curve.

**Example 6:** In a certain locale, there are $2345$ confirmed cases of a virus. The number of confirmed cases at time $t$, in days, is given by $N(t)$. The rate at which the number of confirmed cases is changing can be modeled by the differential equation $\frac{dN}{dt} = 0.336N$. Determine an equation for $N(t)$.