2.) Find the critical points of y':

$$y' = y(y-1)(y-2) \implies y = 0, 1, 2 \text{ are critical points}$$

Fill in the sign chart to determine solution stability:

	y	$(y-1)$	$(y-2)$	result
$y = -\frac{1}{2}$	$-$	$-$	$-$	$-$
$y = \frac{1}{2}$	$+$	$-$	$-$	$+$
$y = \frac{3}{2}$	$+$	$+$	$-$	$-$
$y = \frac{5}{2}$	$+$	$+$	$+$	$+$

Thus $y = 0, 2$ are unstable solutions and $y = 1$ is a stable solution.

5.) a.) For the sake of establishing a contradiction, suppose $y \neq 1$ is a critical point of y', thus $k(1-y)^2 = 0$. We can manipulate the equation as follows:

$$\begin{aligned} k(1-y)^2 = 0 &\implies (1-y)^2 = 0 \\ &\implies (1-y) = \pm 0 = 0 \\ &\implies 1 = y \end{aligned}$$

But $y \neq 1 \Rightarrow\Leftarrow$, thus for y to be a critical point of y', $y = 1$. Q.E.D.

b.) Fill in the sign chart to determine solution stability:

	$k(1-y)^2$	result
$y = \frac{1}{2}$	$+$	$+$
$y = \frac{3}{2}$	$+$	$+$

Thus $y = 1$ is a semistable solution.

c.) Solve for y:

$$\frac{dy}{dt} = k(1-y)^2 \implies dy = k(1-y)^2 dt$$

$$\implies \int dy = \int k(1-y)^2 \; dt \implies y = k\left[\int 1 - 2y + y^2 \; dt\right]$$

$$\implies y = k\left[t - 2yt + y^2 t\right]$$

Substituting $y(0) = y_0$:

6.) Find the critical points of y':

$$y' = y^2(y^2 - 1) \implies y = -1, 0, 1 \text{ are critical points}$$

Fill in the sign chart to determine solution stability:

	y^2	(y^2-1)	result
$y = -\frac{3}{2}$	$+$	$+$	$+$
$y = -\frac{1}{2}$	$+$	$-$	$-$
$y = \frac{1}{2}$	$+$	$-$	$-$
$y = \frac{3}{2}$	$+$	$+$	$+$

Thus $y = -1$ is a stable solution, $y = 0$ is a semistable solution, and $y = 1$ is an unstable solution.

7.) Find the critical points of y':

$$y' = y(1 - y^2) \implies y = -1, 0, 1 \text{ are critical points}$$

Fill in the sign chart to determine solution stability:

	y	$(1-y^2)$	result
$y = -\frac{3}{2}$	$-$	$-$	$+$
$y = -\frac{1}{2}$	$-$	$+$	$-$
$y = \frac{1}{2}$	$+$	$+$	$+$
$y = \frac{3}{2}$	$+$	$-$	$-$

Thus $y = -1, 1$ are stable solutions, and $y = 0$ is an unstable solution.

14.) Since $f(y) = \dfrac{dy}{dt}$, $f'(y) = \dfrac{d^2y}{dt^2}$, thus $f'(y)$ can be used to determine the "acceleration" of the slope. If $f'(y)$ is