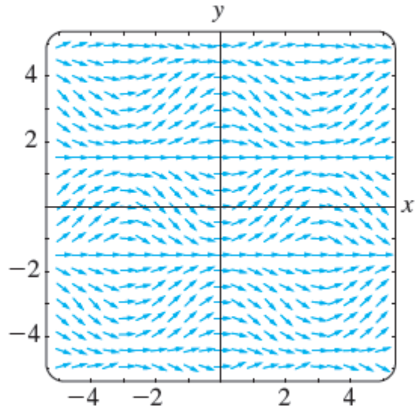
Math 2C03 2021 Assignment #2 (18382125)

Question	1	2	3	4	5	6	7	8	9	10	11	12

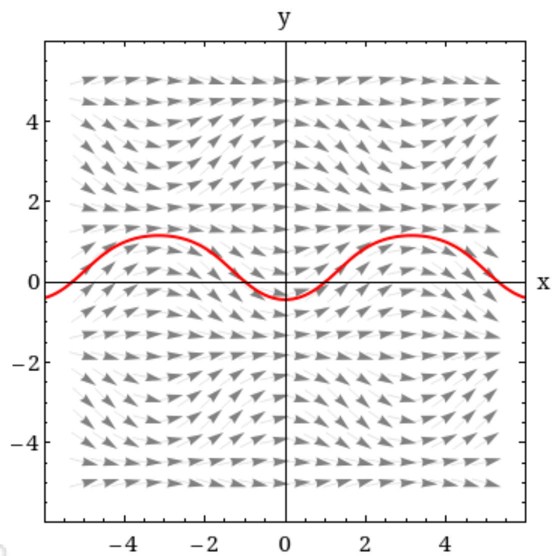
1. Question Details ZillDiffEQ9 2.1.004. [3876529]

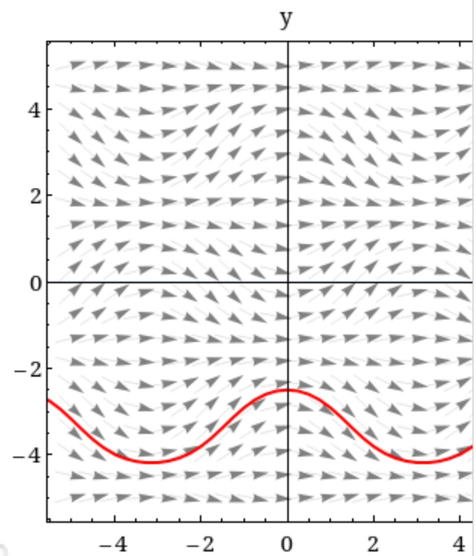
Reproduce the given computer-generated direction field. Then sketch an approximate solution curve that passes through each of the indicated points.

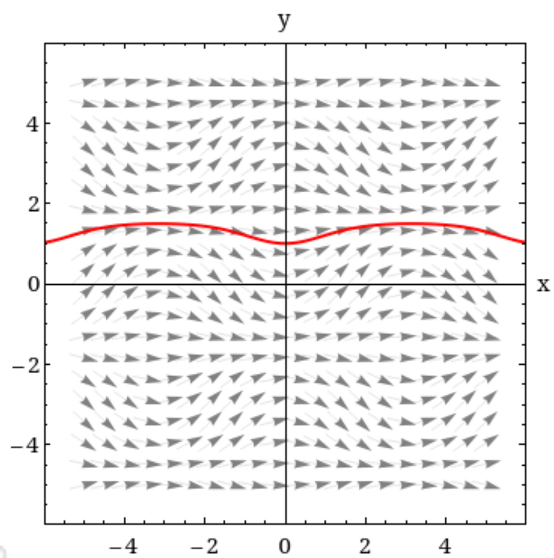
$$\frac{dy}{dx} = (\sin(x))\cos(y)$$

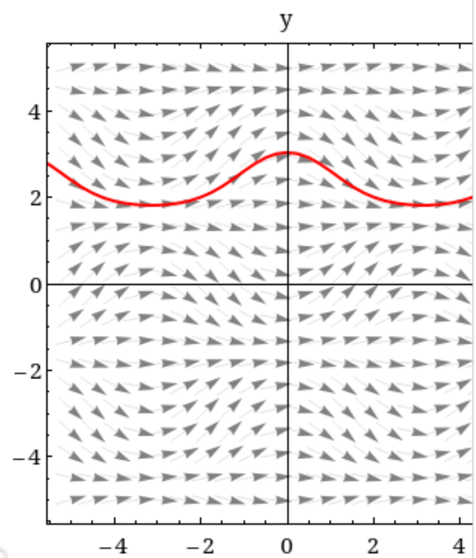


(a) $y(0) = 1$

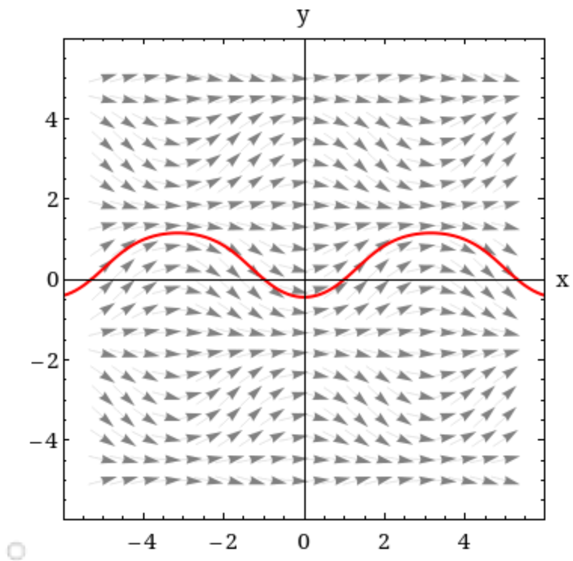


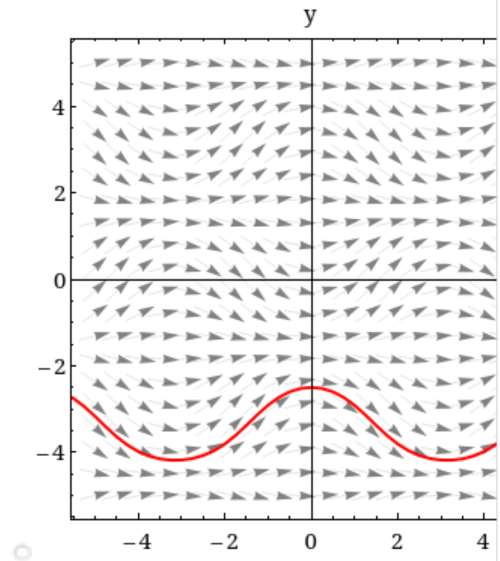


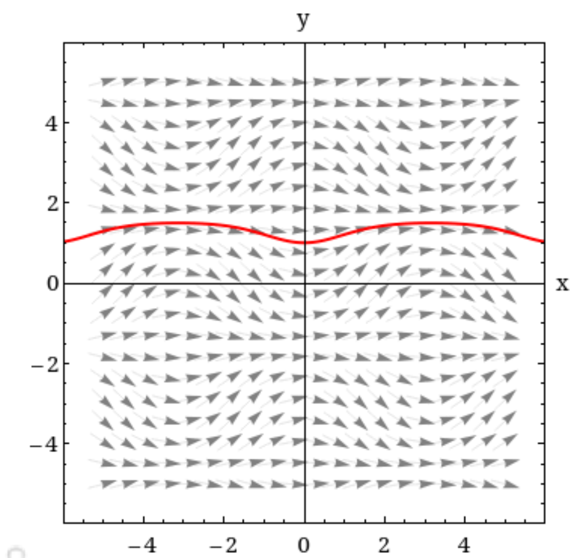


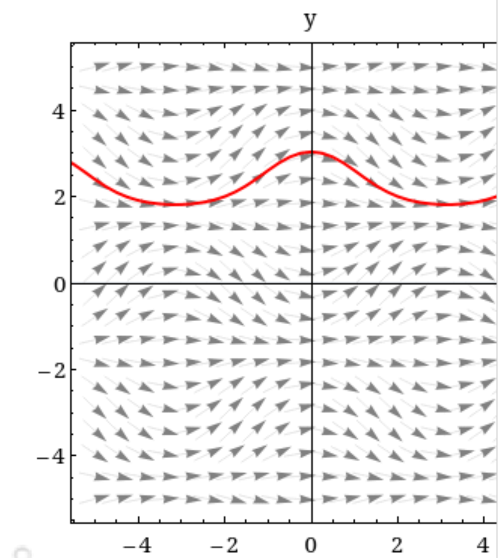


(b) $y(1) = 0$

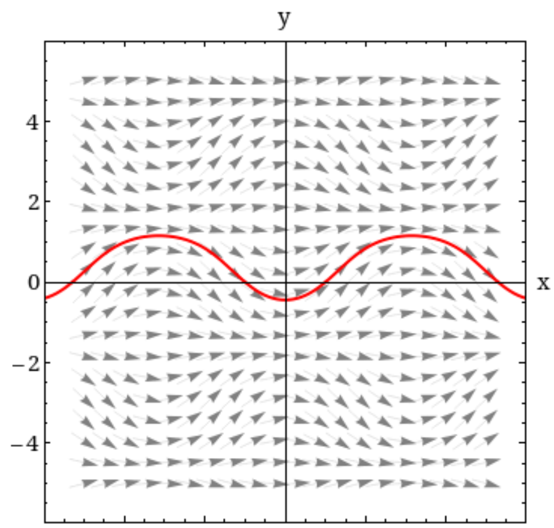








(c) $y(2) = 2$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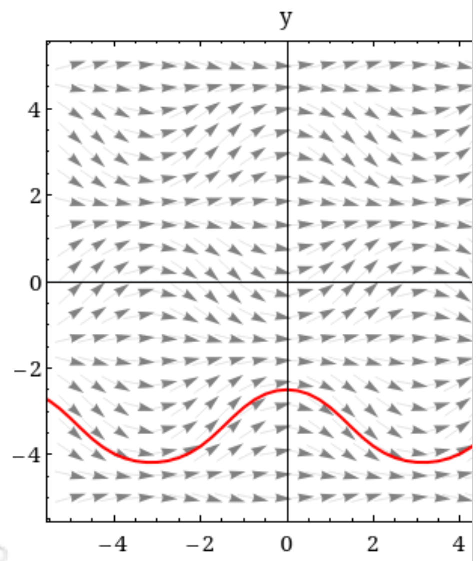
−2
−4
x
−4 −2 0 2 4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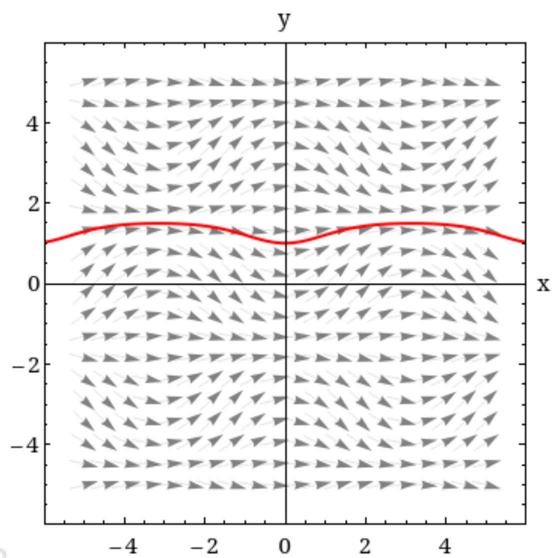
−4 −2 0 2 4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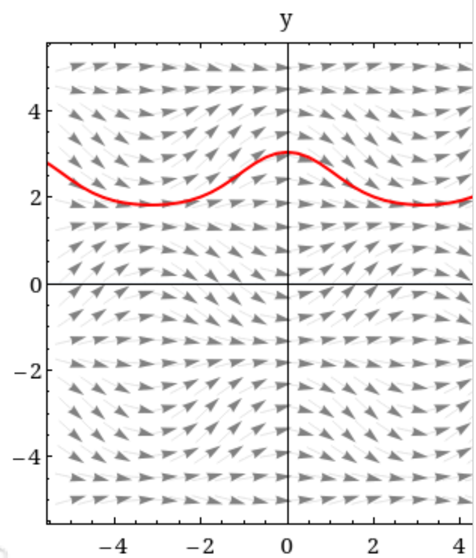
y
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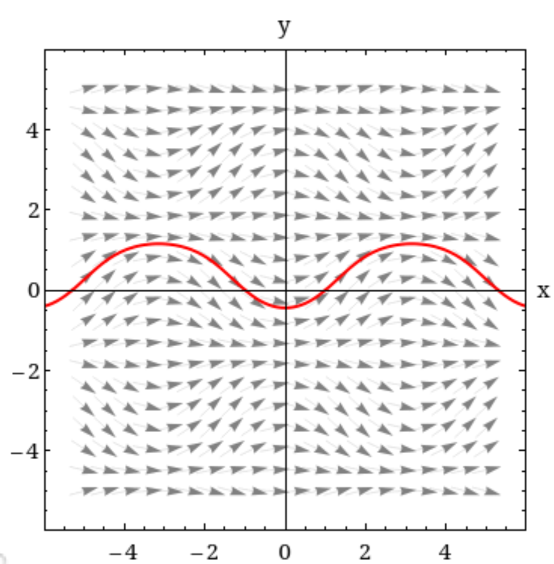
−4
−4 −2 0 2 4

(d) $y(0) = -\frac{5}{2}$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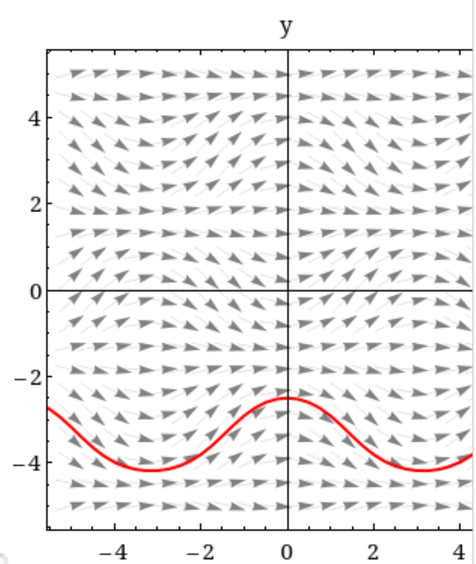
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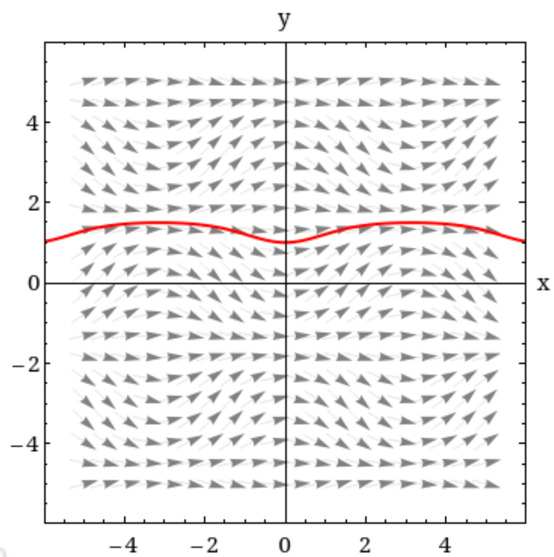

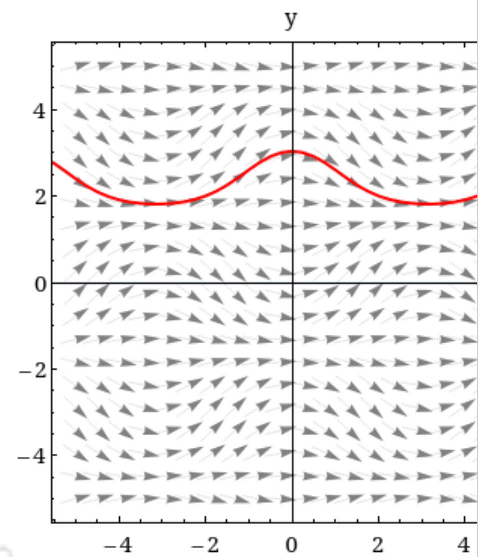

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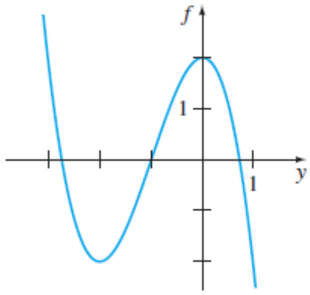
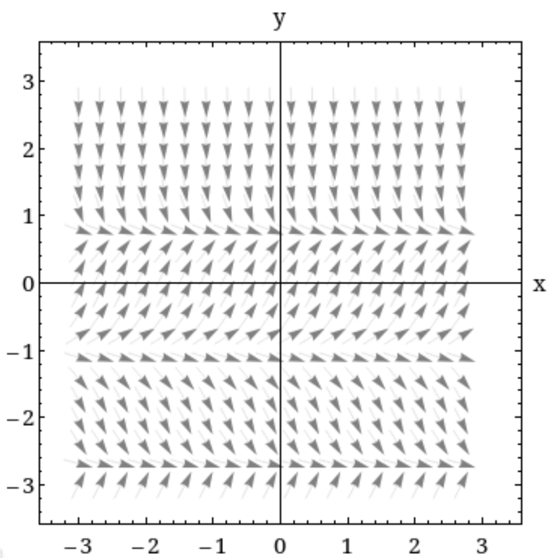
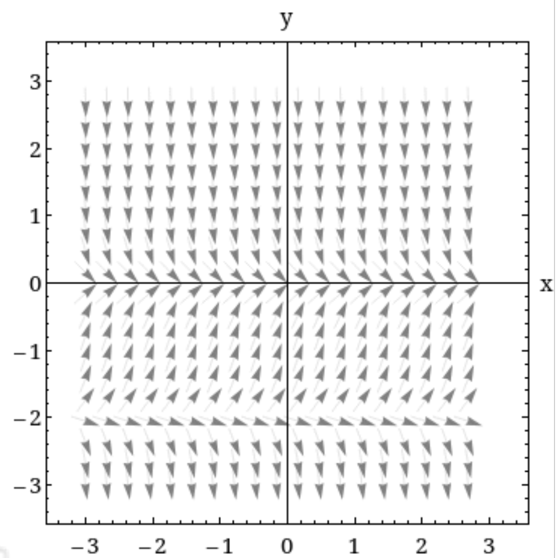
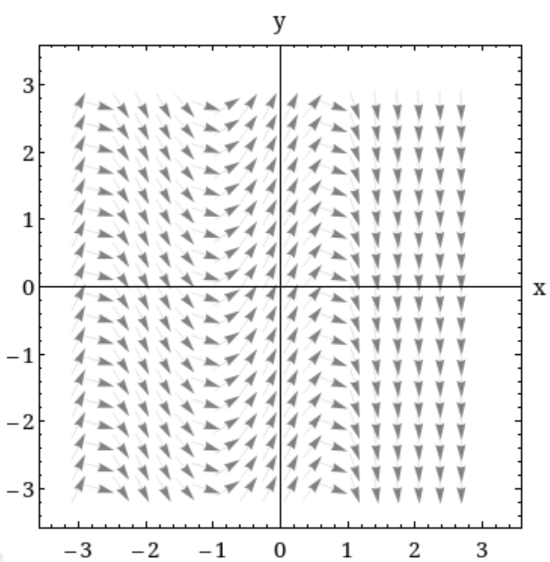
2. Question Details ZillDiffEQ9 2.1.013. [3876540]

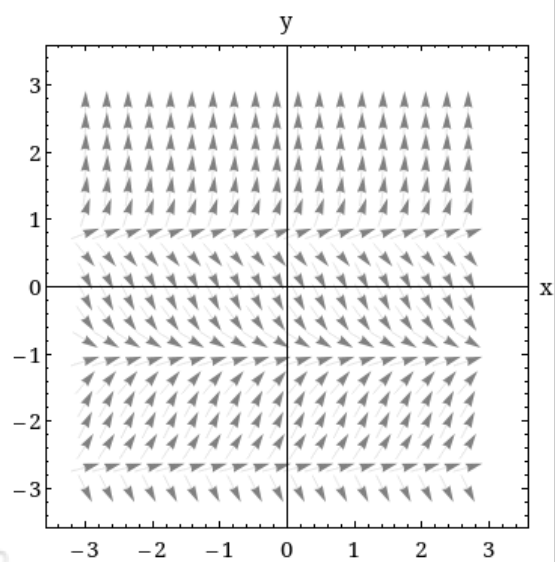
The given figure represents the graph of $f(y)$. Sketch a direction field over an appropriate grid for $dy/dx = f(y)$.











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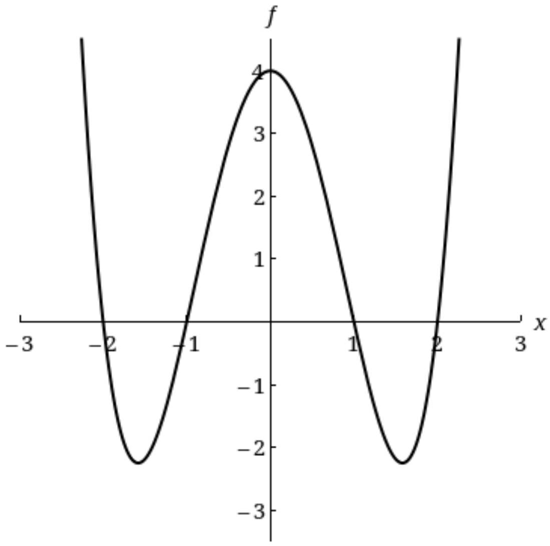
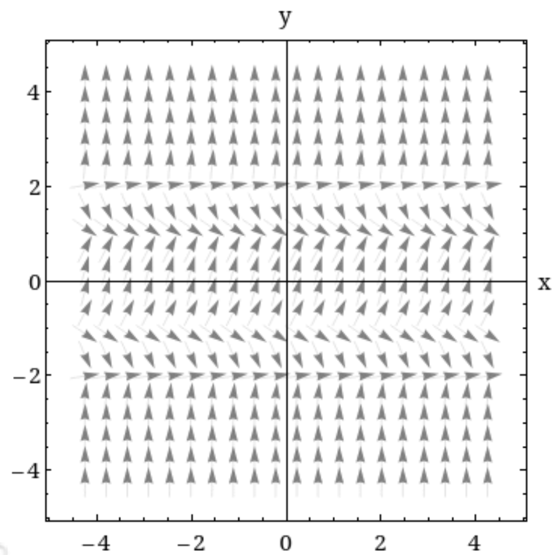
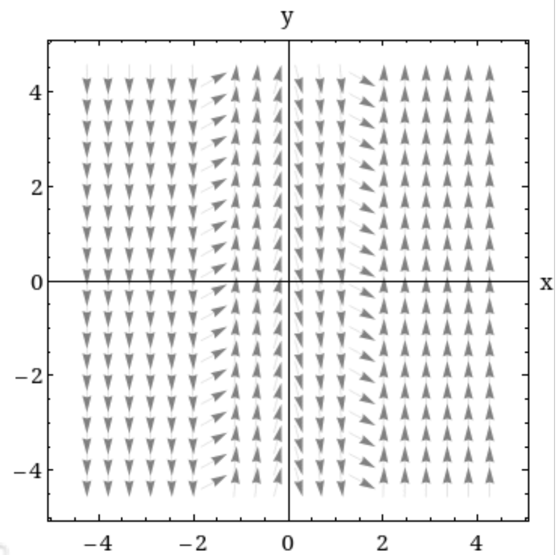
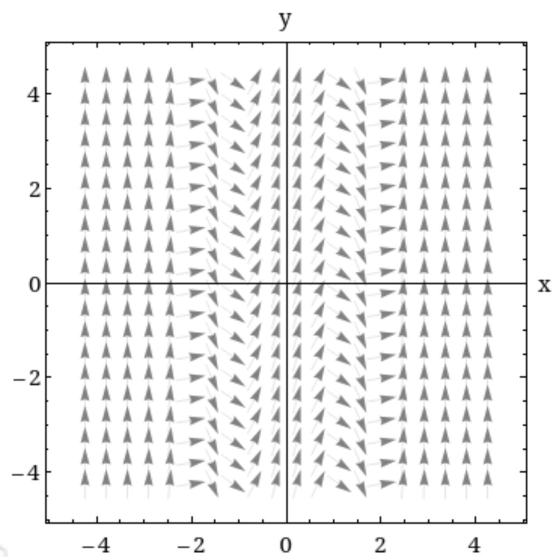
3. Question Details ZillDiffEQ9 2.1.014. [3876564] -

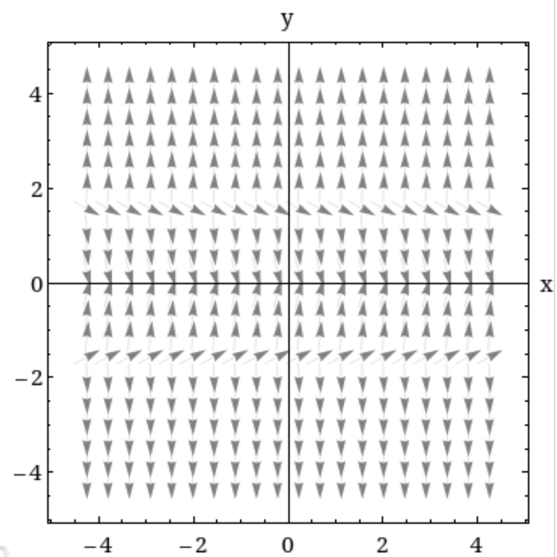
The given figure represents the graph of $f(x)$. Sketch a direction field over an appropriate grid for $dy/dx = f(x)$.











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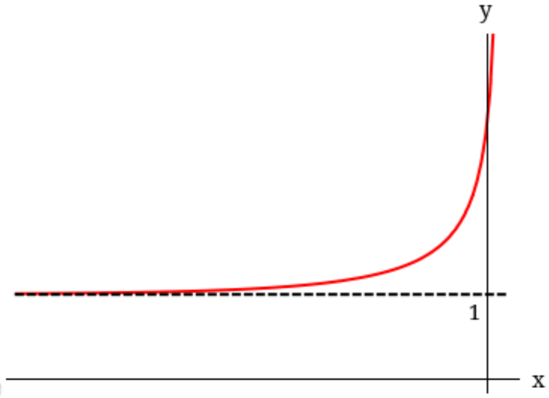
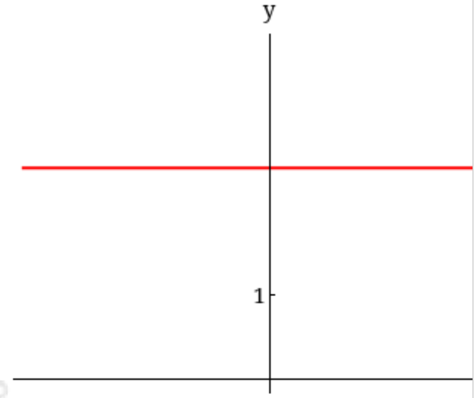
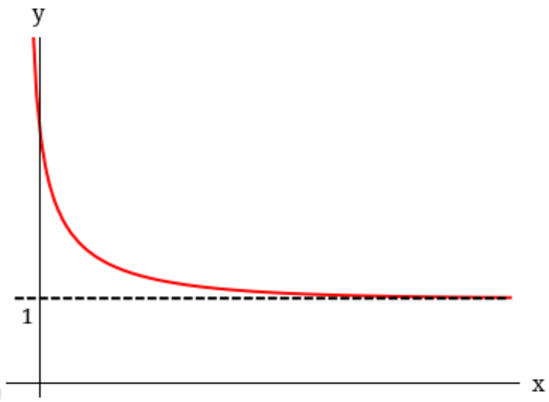
4. Question Details ZillDiffEQ9 2.1.019. [3748710] -

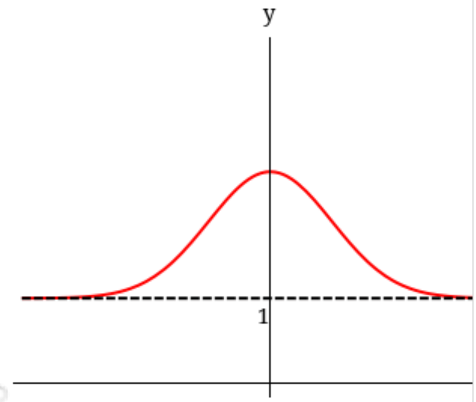
Consider the autonomous first-order differential equation $dy/dx = y - y^3$ and the initial condition $y(0) = y_0$. Sketch the graph of a typical solution $y(x)$ when y_0 has the given values.

(a) $y_0 > 1$

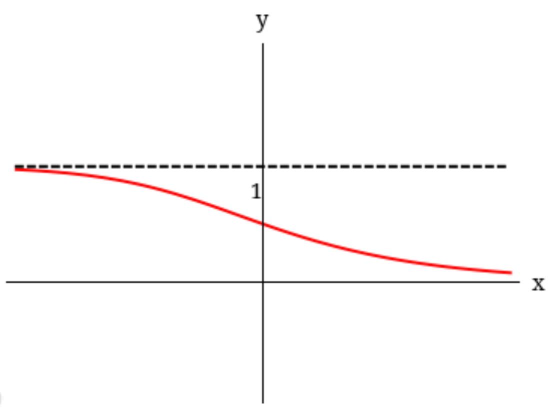


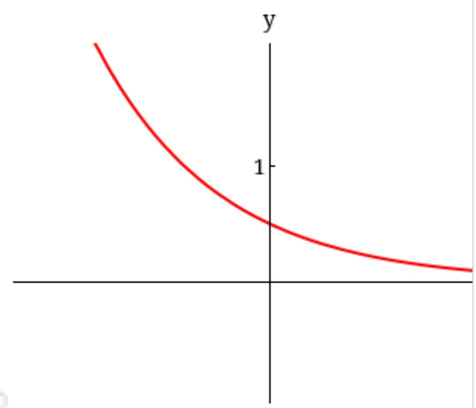


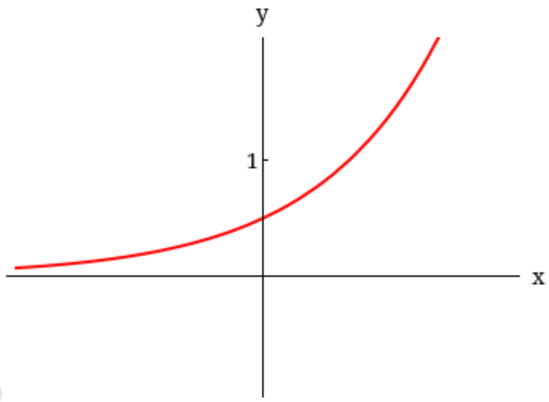


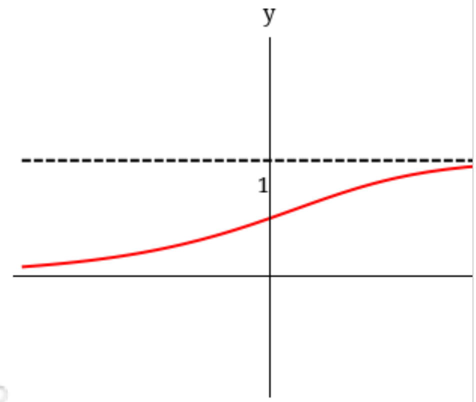


(b) $0 < y_0 < 1$

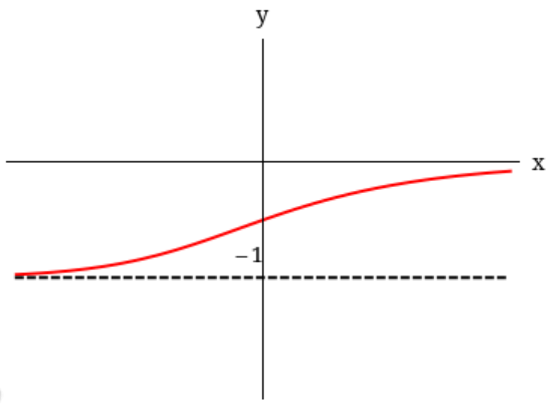


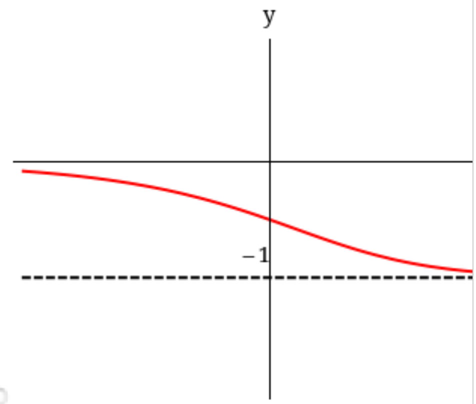


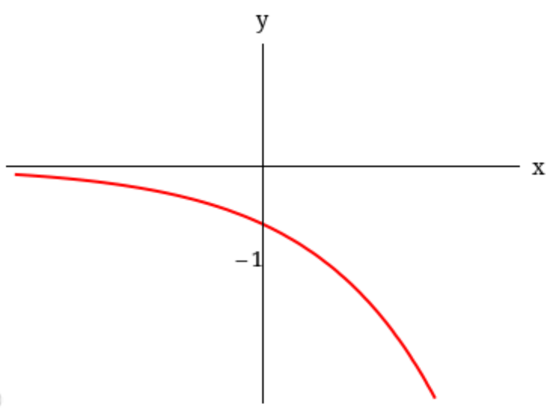


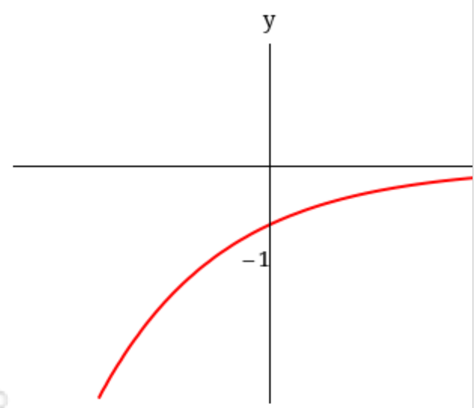


(c) $-1 < y_0 < 0$

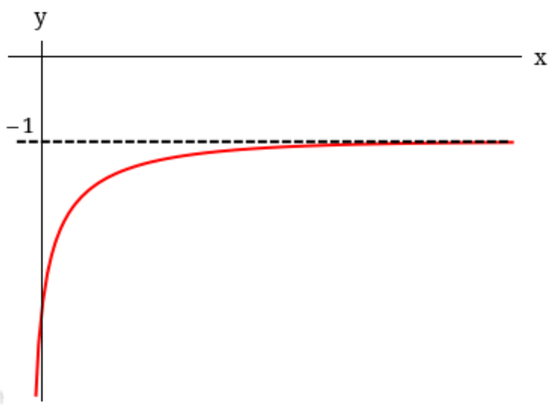


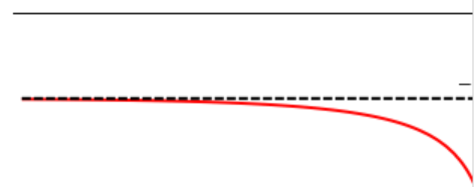


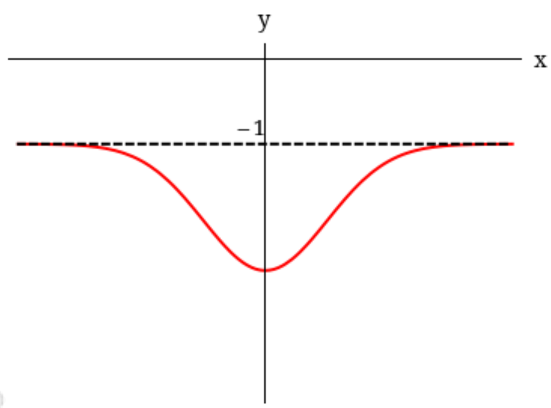


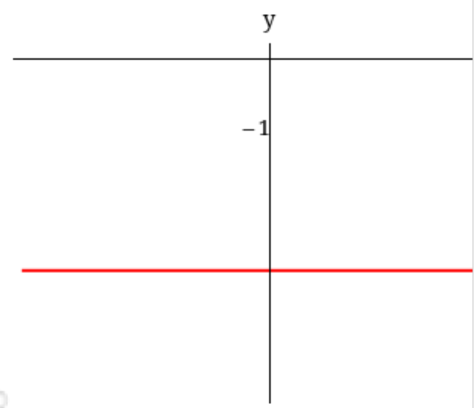


(d) $y_0 < -1$









Need Help? Read It

5. Question Details ZillDiffEQ9 2.1.027. [4805224]

Consider the following autonomous first-order differential equation.

$$\frac{dy}{dx} = y\ln(y + 2)$$

Find the critical points and phase portrait of the given differential equation.

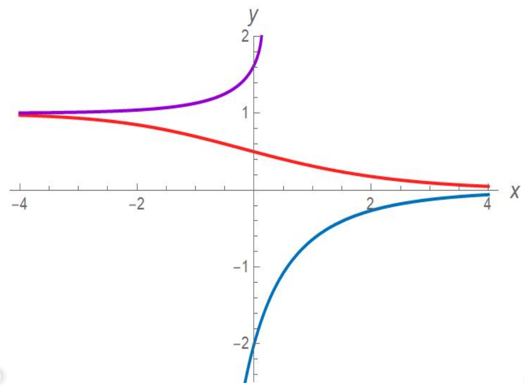
Classify each critical point as asymptotically stable, unstable, or semi-stable. (List the critical points according to their stability. Enter your answers as a comma-separated list. If there are no critical points in a certain category, enter NONE.)

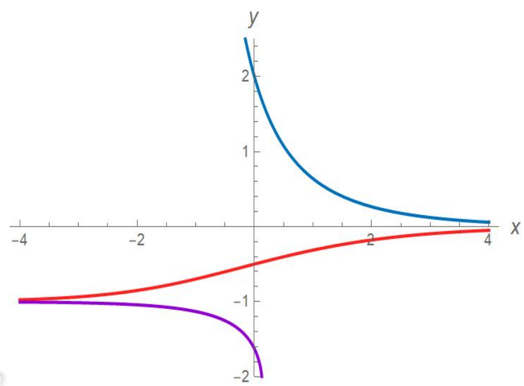
asymptotically stable

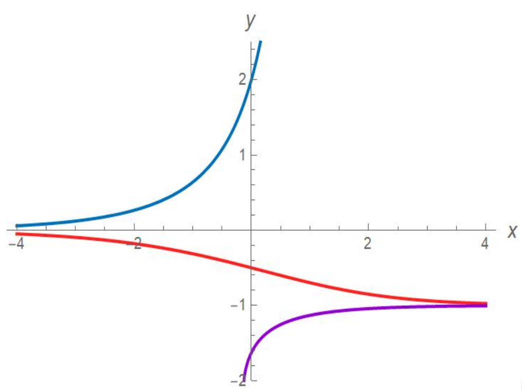
unstable

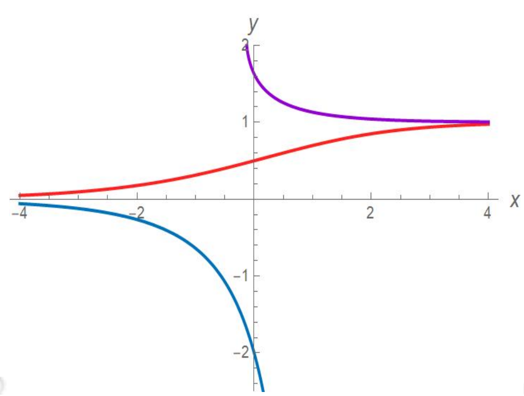
semi-stable

Sketch typical solution curves in the regions in the *xy*-plane determined by the graphs of the equilibrium solutions.





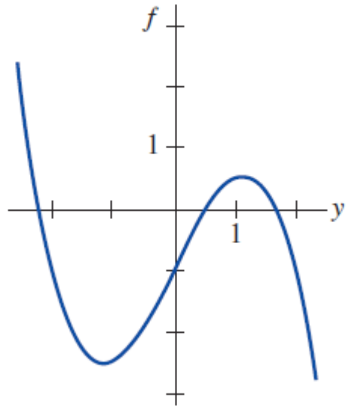


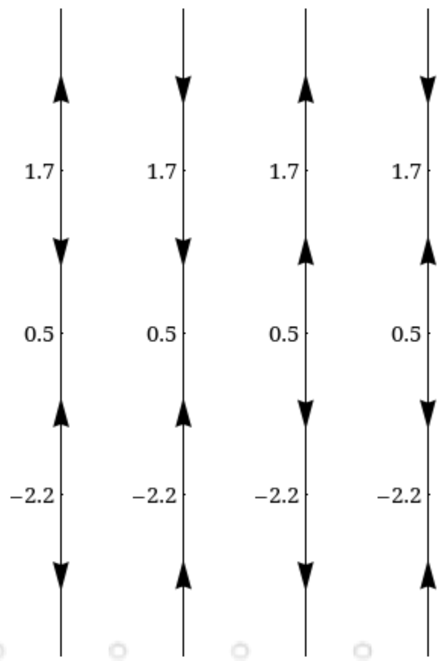


Need Help? Read It

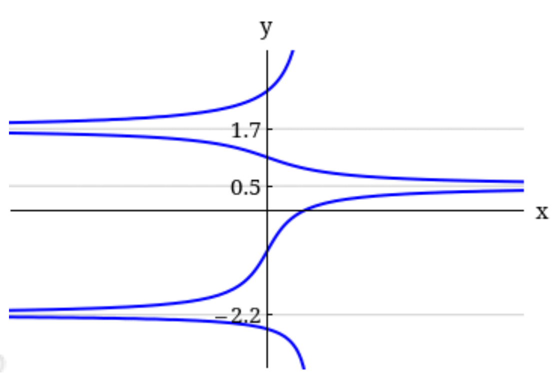
6. Question Details ZillDiffEQ9 2.1.030. [3874849] -

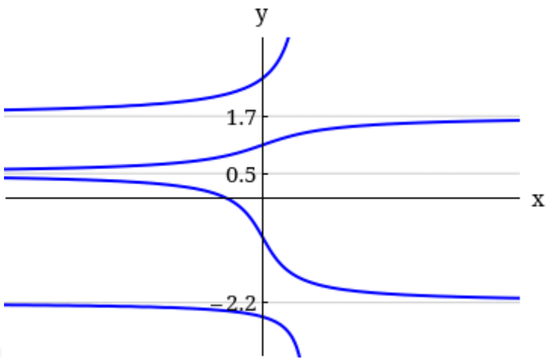
Consider the autonomous differential equation $dy/dx = f(y)$, where the graph of f is given. Use the graph to locate the critical points of each differential equation. Sketch a phase portrait of each differential equation.

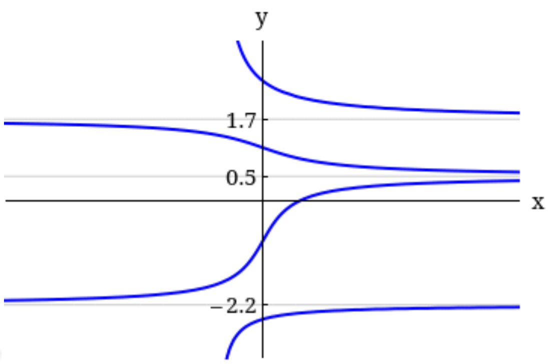


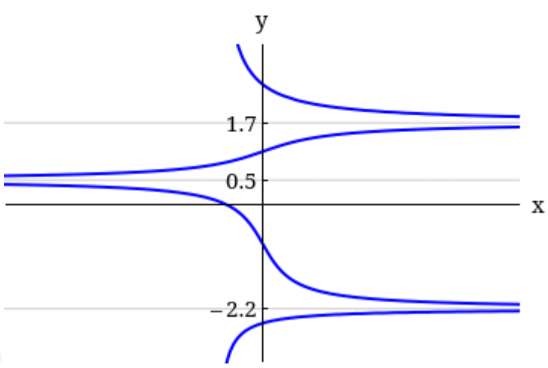


Sketch typical solution curves in the subregions in the *xy*-plane determined by the graphs of the equilibrium solutions.









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7. Question Details ZillDiffEQ9 2.1.038. [3748853]

The differential equation in Example 3 of Section 2.1 is a well-known population model. Suppose the DE is changed to

$$\frac{dP}{dt} = P(aP - b),$$

where a and b are positive constants. Discuss what happens to the population P as time t increases.

If $P_0 > b/a$, then $P(t) \to$ [?] as t increases; if $0 < P_0 < b/a$, then $P(t) \to$ [?] as t increases.

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8. Question Details ZillDiffEQ9 2.2.005. [4568098]

Solve the given differential equation by separation of variables.

$$x\frac{dy}{dx} = 2y$$

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9. Question Details ZillDiffEQ9 2.2.020. [4568266]

Solve the given differential equation by separation of variables.

$$\frac{dy}{dx} = \frac{xy + 6y - x - 6}{xy - 9y + x - 9}$$

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10. Question Details ZillDiffEQ9 2.R.033. [3876596]

Solve the given initial-value problem.

$$\sin(x)\frac{dy}{dx} + (\cos(x))y = 0, \quad y\left(\frac{3\pi}{2}\right) = -2$$

$y(x) =$

Give the largest interval I on which the solution is defined. (Enter your answer using interval notation.)

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11. Question Details ZillDiffEQ9 3.2.001. [4568232]

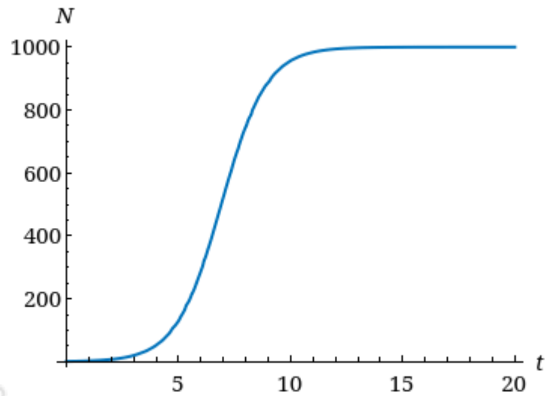
The number $N(t)$ of supermarkets throughout the country that are using a computerized checkout system is described by the initial-value problem

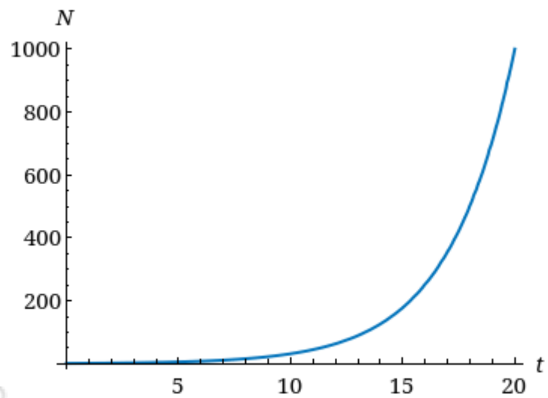
$$\frac{dN}{dt} = N(1 - 0.001N), \quad N(0) = 1.$$

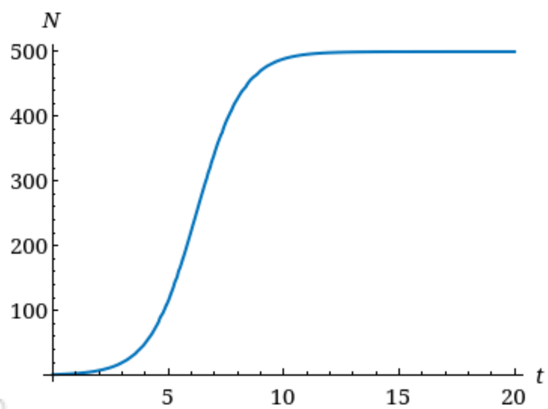
(a) Use the phase portrait concept of Section 2.1 to predict how many supermarkets are expected to adopt the new procedure over a long period of time.

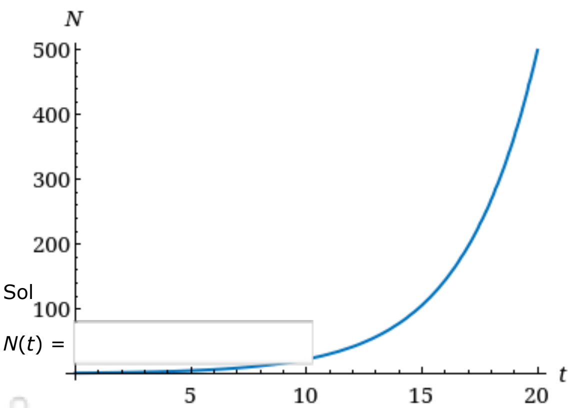
[ ] supermarkets

By hand, sketch a solution curve of the given initial-value problem.









(b) Sol tility to verify the solution curve in part (a).

$N(t) =$

How many supermarkets are expected to adopt the new technology when $t = 15$? (Round your answer to the nearest integer.)

supermarkets

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12. Question Details ZillDiffEQ9 3.2.006. [4568247] -

Investigate the following harvesting model both qualitatively and analytically.

If a constant number h of fish are harvested from a fishery per unit time, then a model for the population $P(t)$ of the fishery at time t is given by

$$\frac{dP}{dt} = P(a - bP) - h, \quad P(0) = P_0,$$

where a, b, h, and P_0 are positive constants. Suppose $a = 9$, $b = 1$, and $h = \frac{81}{4}$.

Determine whether the population becomes extinct in finite time.

- The population becomes extinct in finite time for all values of P_0.
- The population becomes extinct in finite time if $P_0 = \frac{9}{2}$.
- The population becomes extinct in finite time if $P_0 < \frac{9}{2}$.
- The population becomes extinct in finite time if $P_0 > \frac{9}{2}$.
- The population does not become extinct in finite time.

If so, find that time. (If not, enter NONE.)

$t =$

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Assignment Details

Name (AID): **Math 2C03 2021 Assignment #2 (18382125)**
Submissions Allowed: **5**
Category: **Homework**
Code: **Direction Field/separable**
Locked: **Yes**
Author: **Lia Bronsard (bronsard@mcmaster.ca)**
Last Saved: **Jan 22, 2021 06:12 PM EST**

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