

Students are expected to complete homework assignments on their own before referring to the following pages. The answers and hints are designed to check work and clarify problems. The original intent of the layout was for display in class after assignments had been completed. Students should use the following information as help to understand the exercises and master the concepts.

# Calculus C

## Chapter 9

Even Answers & Hints  
for Homework

## 9.2 Even Answers

(2) (b) Equilibrium Solutions:  $y = n\pi$  ( $n$  is an integer)

(2)-(14) See direction fields

(22)  $y' = 1 - xy$ ,  $y(0) = 0$ ,  $h = 0.2$ . Estimate  $y(1)$ .

$n$	$x_n$	$y_n$	$y_0 = 0$
0	0	0	$y_1 = y_0 + h(1 - x_0 y_0) = 0 + 0.2(1 - 0 \cdot 0) = 0.2$
1	0.2	0.2	$y_2 = y_1 + h(1 - x_1 y_1) = 0.2 + 0.2(1 - (0.3)(0.2)) = 0.392$
2	0.4	0.392	$y_3 = y_2 + h(1 - x_2 y_2) =$
3	0.6	0.56064	etc.
4	0.8	0.6933632	
5	1.0	0.782425088	$\Rightarrow y(1) \approx \underline{\underline{0.7824}}$

(24) (a)  $y' = x - xy$ ,  $y(1) = 0$ ,  $h = 0.2$ , Estimate  $y(1.4)$

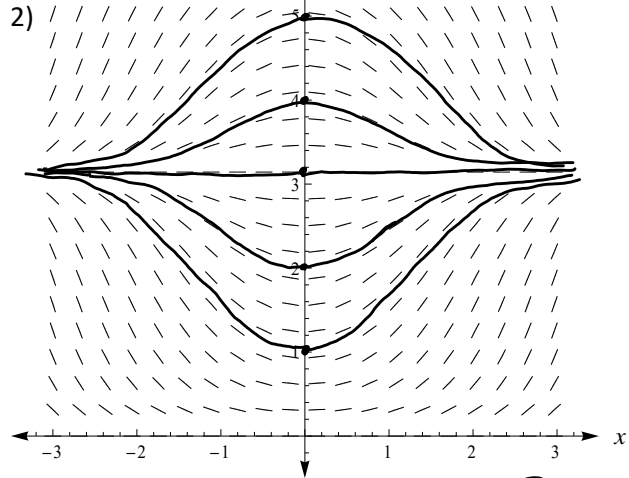
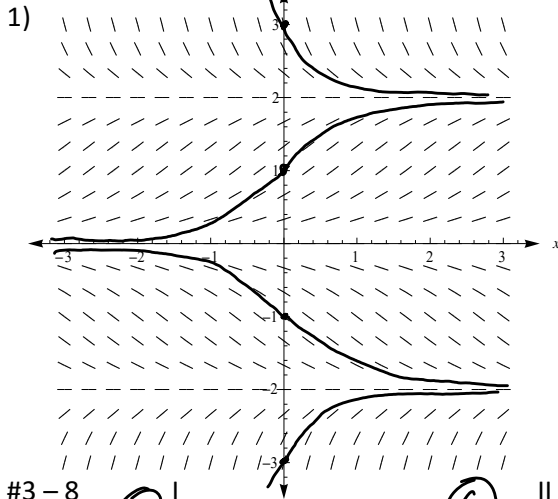
$n$	$x_n$	$y_n$	$y_0 = 0$
0	1	0	$y_1 = y_0 + h(x_0 - x_0 y_0) = 0 + 0.2(1 - (1)(0)) = 0.2$
1	1.2	0.2	$y_2 = y_1 + h(x_1 - x_1 y_1) = 0.2 + 0.2(1.2 - (1.2)(0.2)) = 0.392$
2	1.4	0.392	$y(1.4) \approx \underline{\underline{0.392}}$

(b) Same, but  $h = 0.1$

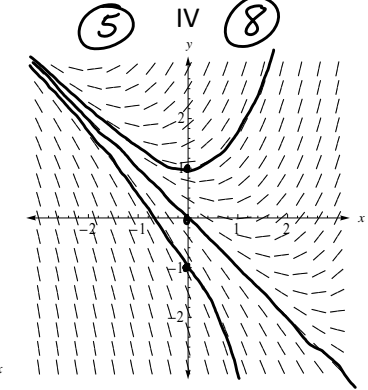
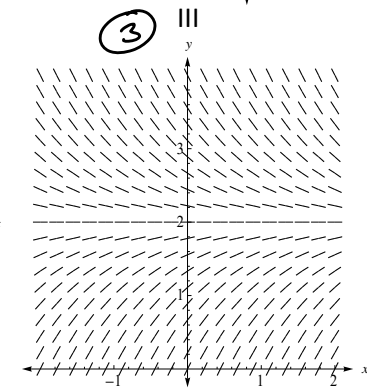
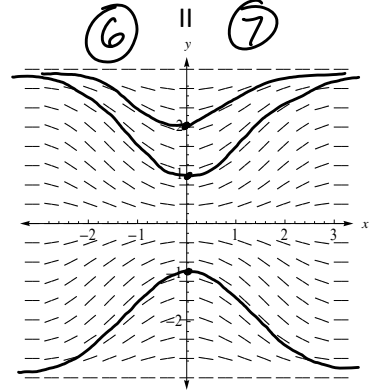
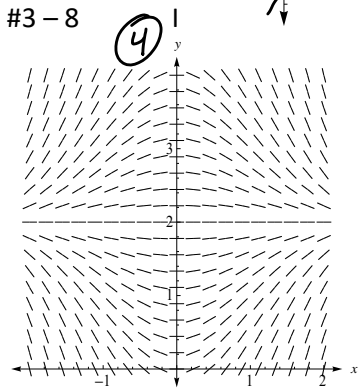
w/  $h = 0.1$   $y(1.4) \approx 0.3867544$

# 9.2 Direction Fields for Homework

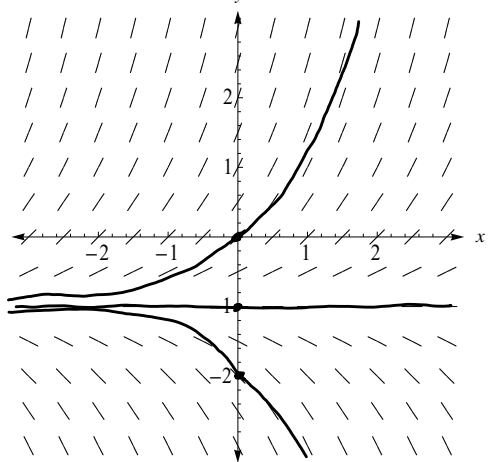
Name: Answers



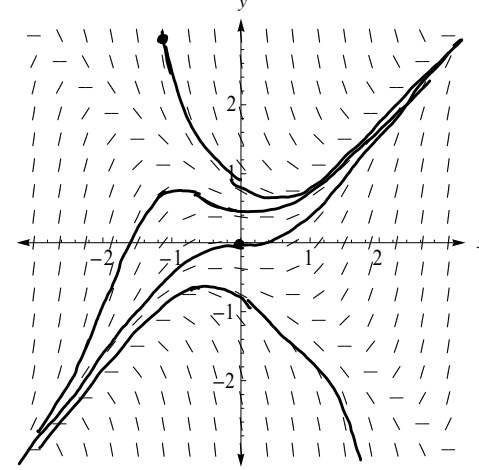
#3-8



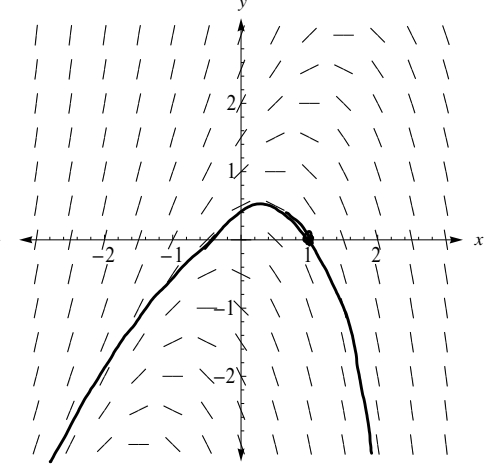
9) example of 3 curves



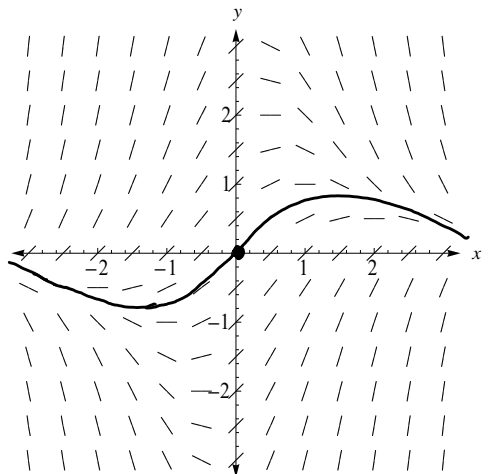
10) example of 4 curves



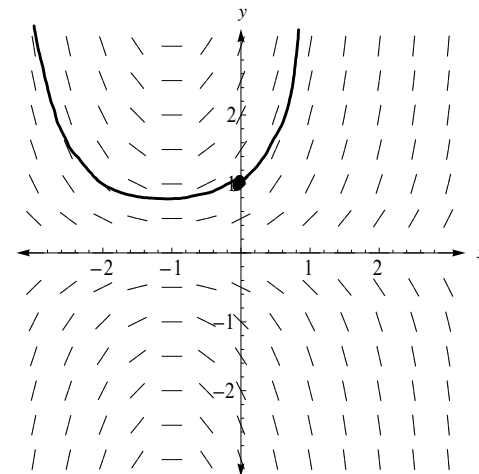
11)



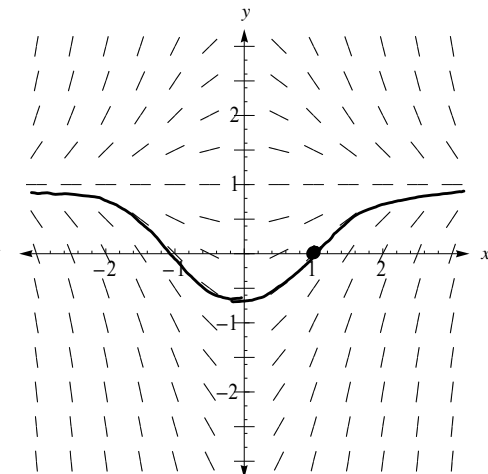
12)



13)



14)



# 9.1 + 9.3 Even Answers

9.1 (2) Plug into D.E. and show LHS = RHS.  
Check that initial condition works in solution.

(4) (a) 
$$\left. \begin{aligned} y &= \cos kt \\ y' &= -k \sin kt \\ y'' &= -k^2 \cos kt \end{aligned} \right\} \rightarrow \begin{aligned} 4y'' &= -25y \\ -4k^2 \cos kt &= -25 \cos kt \\ k^2 &= \frac{25}{4} \Rightarrow \underline{\underline{k = \pm 5/2}} \end{aligned}$$

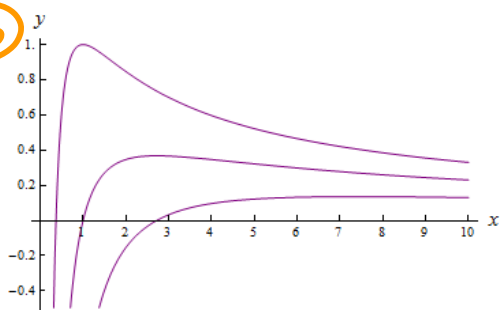
(b)  $y = A \sin kt + B \cos kt$   
use  $k = \frac{5}{2} \rightarrow 4y'' = -25y$   
show LHS = RHS  
again with  $k = -\frac{5}{2}$

(6)  $y = (\ln x + C)/x \Rightarrow x^2 y' + xy = 1$

(b)  $(a) \text{ LHS} = \text{RHS}$

(c)  $C = 2 \Rightarrow y = \frac{\ln x + 2}{x}$

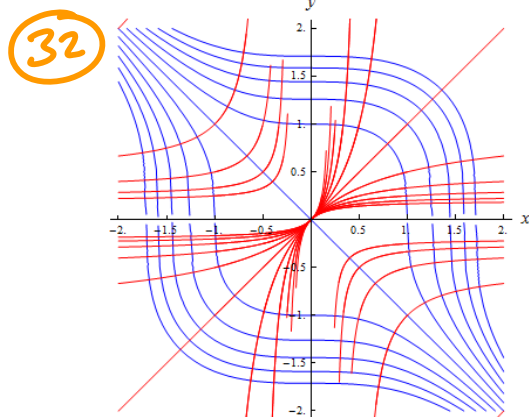
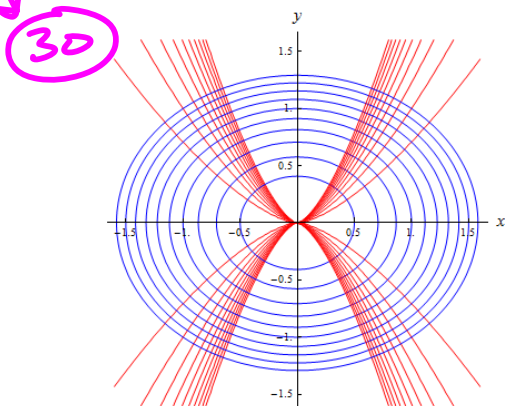
(d)  $C = 2 - \ln 2 \Rightarrow y = \frac{\ln x + 2 - \ln 2}{x}$



## 9.3

(30)  $y^2 = kx^3 \rightarrow$  orth. traj. :  $2x^2 + 3y^2 = C$

(32)  $y = \frac{x}{1+kx} \rightarrow$  orth. traj. :  $y = \sqrt[3]{C - x^3}$



## 3.8 Even Answers

② (a)  $k = \ln 8$

(b)  $P(t) = 60 \cdot 8^t$

(c)  $P(8) = 60 \cdot 8^8 = 1,006,632,960$

(d)  $\frac{dP}{dt} = kP \Rightarrow P'(8) = (\ln 8)P(8) \approx 2.093$   
billion cells/hr.

(e)  $P(t) = 20,000$

$$\rightarrow 60 \cdot 8^t = 20,000 \Rightarrow t = \frac{\ln(1000/3)}{\ln 8}$$

$$\approx 2.79 \text{ hr.}$$

④ (a)  $k = \frac{1}{2} \ln 5$

$y(0) = 120 \leftarrow$  Initial Population

(b)  $y(t) = 120 e^{(\frac{1}{2} \ln 5)t} = 120 \cdot 5^{t/2}$

(c)  $y(5) = 120 \cdot 5^{5/2} = 3000\sqrt{5} \approx 6708$  bacteria

(d)  $y'(t) = ky(t) \Rightarrow y'(5) = (\frac{1}{2} \ln 5) \cdot 3000\sqrt{5}$   
 $\approx 5398$  bacteria/hr.

(e)  $y(t) = 200,000$

$$t = \frac{\ln(\frac{5000}{3})}{\frac{1}{2} \ln 5} \approx 9.2 \text{ hr.}$$

## 9.5 Even Answers

$$\textcircled{6} \quad y = -\frac{1}{5}x - \frac{1}{25} + Ce^{5x}$$

$$\textcircled{14} \quad r = \frac{e^t + C}{\ln t}$$