Stephen Giang

Assignment PhasePort due 02/07/2020 at 05:00pm PST

math-337-mahaffy

1. (2 pts) Consider the differential equation given by

$$\frac{dy}{dt} = 10 - 0.2y,$$
 $y(0) = 10.$

a. Solve this differential equation,

 $y(t) = \underline{\hspace{1cm}}$

b. Find the equilibrium for this equation.

Equilibrium is $y_e = \underline{\hspace{1cm}}$.

The stability of the equilibrium point is Stable or Unstable

c. From the collection of phase portraits shown, find the letter (A-H) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are unstable and full circles represent stable.)

See the **Phase Portraits**

Answer(s) submitted:

- 50-40*exp(-(1/5)*t)
- 50
- Stable
- E

(correct)

Correct Answers:

- 50+(10-50)*exp(-0.2*t)
- 50
- STABLE
- E
- 2. (2 pts) Consider the differential equation given by

$$\frac{dy}{dt} = 0.1y - 12, \quad y(0) = 135.$$

a. Solve this differential equation,

$$y(t) = \underline{\hspace{1cm}}$$

b. Find the equilibrium for this equation.

Equilibrium is $y_e = \underline{\hspace{1cm}}$.

The stability of the equilibrium point is Stable or Unstable

c. From the collection of phase portraits shown, find the letter (A-H) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are unstable and full

circles represent stable.)

See the **Phase Portraits**

Answer(s) submitted:

- 120+15*exp((1/10)*t)
- 120
- Unstable
- H

(correct)

Correct Answers:

- 120+(135-120)*exp(0.1*t)
- 120
- UNSTABLE
- H
- 3. (2 pts) Consider the differential equation given by

$$\frac{dy}{dt} = 0.3y(4 - y^2).$$

a. Find the equilibria for this equation.

$$(y_{1e} < y_{2e} < y_{3e})$$

One equilibrium is $y_{1e} = \underline{\hspace{1cm}}$.

The stability of the equilibrium point is Stable or Unstable

Another equilibrium is $y_{2e} = \underline{\hspace{1cm}}$.

The stability of the equilibrium point is Stable or Unstable

Another equilibrium is $y_{3e} = \underline{\hspace{1cm}}$

The stability of the equilibrium point is Stable or Unstable

b. From the collection of phase portraits shown, find the letter (A-H) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are unstable and full circles represent stable.)

See the **Phase Portraits**

Answer(s) submitted:

- −2
- Stable
- 0
- Unstable2Stable
- A

(correct)

Correct Answers:

- −2
- STABLE
- 0

• UNSTABLE	b. From the collection of phase portraits shown, find the let-
• 2	ter (A-H) corresponding to the appropriate phase portrait for this
• STABLE	differential equation. (Note open circles are unstable and full
• A	circles represent stable.)
4. (2 pts) Consider the differential equation given by	See the Phase Portraits
(= 1)	Answer(s) submitted:
dy $(1 y)$	• -4
$\frac{dy}{dt} = 0.1y \left(1 - \frac{y}{20} \right).$	• Unstable
	• 2
	• Stable • B
a. Find the equilibria for this equation.	
$(y_{1e} < y_{2e})$	(correct)
One equilibrium is $y_{1e} = \underline{\hspace{1cm}}$.	Correct Answers:
The stability of the equilibrium point is Stable or Unstable	• -4 • UNICTABLE
	• UNSTABLE • 2
Another equilibrium is $y_{2e} = \underline{\hspace{1cm}}$.	• STABLE
The stability of the equilibrium point is Stable or Unstable	• B
	6. (2 pts) Consider the differential equation given by
	dv = 0.2v
b. From the collection of phase portraits shown, find the let-	$\frac{dy}{dt} = -\frac{0.2y}{1+y^2}$.
ter (A-H) corresponding to the appropriate phase portrait for this	ui = 1 + y
differential equation. (Note open circles are unstable and full	
circles represent stable.)	a. Find the equilibrium for this equation.
See the Phase Portraits	The equilibrium is $y_{1e} = \underline{\hspace{1cm}}$.
Answer(s) submitted:	The stability of the equilibrium point is Stable or Unstable
• 0	
• Unstable	
● 20 ● Stable	
• d	b. From the collection of phase portraits shown, find the let-
	ter (A-H) corresponding to the appropriate phase portrait for this
(correct) Correct Answers:	differential equation. (Note open circles are unstable and full
	circles represent stable.)
• 0	See the Phase Portraits
UNSTABLE20	Answer(s) submitted:
• STABLE	• 0
• D	• Stable
	• g
5. (2 pts) Consider the differential equation given by	(correct) Correct Answers:
dv	• 0
$\frac{dy}{dt} = 0.8 - 0.2y - 0.1y^2.$	• STABLE
uı	• G
a. Find the equilibria for this equation.	7. (2 pts) Consider the differential equation given by
$(v_1 < v_2)$	I

$$\frac{dy}{dt} = 0.1y^2 - 4y.$$

a. Find the equilibria for this equation.

$$(y_{1e} < y_{2e})$$

One equilibrium is $y_{1e} = \underline{\hspace{1cm}}$.

The stability of the equilibrium point is Stable or Unstable

One equilibrium is $y_{1e} =$ _____.

Another equilibrium is $y_{2e} = \underline{\hspace{1cm}}$.

The stability of the equilibrium point is Stable or Unstable

The stability of the equilibrium point is Stable or Unstable

Another equilibrium is $y_{2e} = \underline{\hspace{1cm}}$. The stability of the equilibrium point is Stable or Unstable $\underline{\hspace{1cm}}$	pi/2Stable3pi/2Unstablec
b. From the collection of phase portraits shown, find the letter (A-H) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are unstable and full circles represent stable.) See the Phase Portraits Answer(s) submitted: • 0 • Stable • 40 • Unstable • f	(correct) Correct Answers:
(correct) Correct Answers: 0 STABLE 40	9. (3 pts) (Subcritical Pitchfork bifurcation) Consider the following differential equation $\frac{dy}{dt} = y^3 - \alpha y.$
• UNSTABLE • F 8. (2 pts) Consider the differential equation given by $\frac{dy}{dt} = \cos(y).$	a. Let $\alpha=4$. Find all the equilibria for this equation. ($y_{1e} < y_{2e} < y_{3e}$) One equilibrium is $y_{1e} = $ The stability of the equilibrium point is Stable or Unstable
a. Find the equilibria for this equation. $(-5 < y_{1e} < y_{2e} < y_{3e} < y_{4e} < 5)$ One equilibrium is $y_{1e} = $ The stability of the equilibrium point is Stable or Unstable The stability of the equilibrium point is Stable or Unstable of the stability of the equilibrium point is Stable or Unstable	Another equilibrium is $y_{2e} = $ The stability of the equilibrium point is Stable or Unstable Another equilibrium is $y_{3e} = $ The stability of the equilibrium point is Stable or Unstable
Another equilibrium is $y_{3e} = $ The stability of the equilibrium point is Stable or Unstable Another equilibrium is $y_{4e} = $ The stability of the equilibrium point is Stable or Unstable	b. From the collection of phase portraits shown, find the letter (A-F) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full circles represent stable.) Phase Portraits - Bifurcations
b. From the collection of phase portraits shown, find the letter (A-H) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are unstable and full circles represent stable.)	c. Let $\alpha=-4$. Find the equilibrium for this equation. The equilibrium is $y_{1e}=$ The stability of the equilibrium point is Stable or Unstable
See the Phase Portraits Answer(s) submitted: -3pi/2 Stable -pi/2 Unstable	d. From the collection of phase portraits shown, find the letter (A-F) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full circles represent stable.) Phase Portraits - Bifurcations

e. You should determine what are the differences in behavior of these two cases. What value of α results in the change between these two behaviors? $\alpha = \underline{\hspace{1cm}}$.	The stability of the equilibrium point is Stable or Unstable Another equilibrium is $y_{2e} = $ The stability of the equilibrium point is Stable or Unstable
Answer(s) submitted:	
 -2 Unstable 0 Stable 2 Unstable c 0 Unstable e 0 	 d. From the collection of phase portraits shown, find the letter (A-F) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full circles represent stable.)
(correct) Correct Answers:	Answer(s) submitted:
10. (3 pts) (Transcritical bifurcation) Consider the following differential equation $\frac{dy}{dt} = \alpha y - y^2.$	(correct) Correct Answers: 0 UNSTABLE 3 STABLE
a. Let $\alpha=3$. Find all the equilibria for this equation. ($y_{1e} < y_{2e}$) One equilibrium is $y_{1e} = $ The stability of the equilibrium point is Stable or Unstable Another equilibrium is $y_{2e} = $ The stability of the equilibrium point is Stable or Unstable	• F • -3 • UNSTABLE • 0 • STABLE • A • 0 11. (3 pts) (Saddle-node or Blue sky bifurcation) Consider the following differential equation
b. From the collection of phase portraits shown, find the letter (A-F) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full circles represent stable.) Phase Portraits - Bifurcations c. Let $\alpha = -3$. Find the equilibrium for this equation. ($y_{1e} < y_{2e}$) One equilibrium is $y_{1e} =$	$\frac{dy}{dt} = \alpha - y^2.$ a. Let $\alpha = 4$. Find all the equilibria for this equation. If none exist, then type "None" in all blanks. $(y_{1e} < y_{2e})$ One equilibrium is $y_{1e} = \underline{\hspace{1cm}}$. The stability of the equilibrium point is Stable or Unstable $\underline{\hspace{1cm}}$

Another equilibrium is $y_{2e} = \underline{\hspace{1cm}}$. The stability of the equilibrium point is Stable or Unstable	• NONE • D
	12. (3 pts) (Allee effect) Suppose that a population, $P(t)$ (in
b. From the collection of phase portraits shown, find the letter (A-F) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full circles represent stable.)	thousands), is given by the model $\frac{dP}{dt} = P(4 - 0.01(P - 50)^2).$
Phase Portraits - Bifurcations	a. Find all the equilibria for this equation
c. Let $\alpha=-4$. Find the equilibrium for this equation. If none exist, then type "None" in all blanks. ($y_{1e} < y_{2e}$) One equilibrium is $y_{1e} = $	a. Find all the equilibria for this equation. ($P_{1e} < P_{2e} < P_{3e}$) One equilibrium is $P_{1e} = $ The stability of the equilibrium point is Stable or Unstable
The stability of the equilibrium point is Stable or Unstable ———————————————————————————————————	Another equilibrium is $P_{2e} = \underline{\hspace{1cm}}$. The stability of the equilibrium point is Stable or Unstable
Another equilibrium is $y_{2e} = \underline{\hspace{1cm}}$. The stability of the equilibrium point is Stable or Unstable $\underline{\hspace{1cm}}$	Another equilibrium is $P_{3e} = \underline{\hspace{1cm}}$. The stability of the equilibrium point is Stable or Unstable
	You should sketch the graph of the phase portrait.
d. From the collection of phase portraits shown, find the letter (A-F) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full circles represent stable.) Phase Portraits - Bifurcations	b. Find the carrying capacity for this particular population. Carrying capacity = Determine the critical threshhold number of animals required to avoid extinction. Threshhold value =
e. You should determine what are the differences in behavior	Threshhold value –
of these two cases. What value of α results in the change between these two behaviors? $\alpha = \underline{\hspace{1cm}}$	c. From the collection of phase portraits shown, find the letter (A-D) corresponding to the appropriate phase portrait for this differential equation. (Note open circles are Unstable and full
$\alpha = \underline{\hspace{1cm}}$.	circles represent stable.)
Answer(s) submitted:	Phase Portraits - Allee Effect
• -2	Answer(s) submitted:
• Unstable	• 0
• 2	• Stable
• Stable	• 30
bnone	• Unstable • 70
• none	• Stable
• none	• 70
• none	• 30
• d	• d
• 0	(correct)
(correct)	Correct Answers:
Correct Answers:	• 0
• -2	• STABLE
• UNSTABLE	• 30
• 2 • STABLE	• UNSTABLE • 70
• STABLE	• STABLE
• NONE	• 70
• NONE	• 30
• NONE	• D

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