

Section 1.1 - Definitions and Terminology

1. The differential equation $y'' + 2y' + 3y = 0$ is

Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: b

2. The differential equation $y'' + 2yy' + 3y = 0$ is

Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: e

3. The differential equation $y' + 3y = \sin x$ is

Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: a

4. The differential equation $y'' + 2y' + 3y = \sin y$ is

Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: e

5. The differential equation $y'''' + 2y''' + 3xy' - 4e^xy = \sin x$ is

Select the correct answer.

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- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: c

6. The values of m for which $y = e^{mx}$ is a solution of $y''' - 5y' + 6y = 0$ are
Select the correct answer.

- a. 2 and 4
- b. -2 and -3
- c. 3 and 4
- d. 2 and 3
- e. 1 and 5

ANSWER: d

7. The values of m for which $y = x^m$ is a solution of $x^2y'' - 5xy' + 8y = 0$ are
Select the correct answer.

- a. 2 and 4
- b. -2 and -4
- c. 3 and 5
- d. 2 and 3
- e. 1 and 5

ANSWER: a

8. The values of c for which $y = c$ is a constant solution of $y' = y^2 + 3y - 4$ are
Select the correct answer.

- a. 1 and 4
- b. -2 and -3
- c. 1 and -4
- d. -1 and 3
- e. 1 and 3

ANSWER: c

9. The values of m for which $y = e^{mx}$ is a solution of $y''' - 4y' - 5y = 0$ are
Select the correct answer.

- a. 1 and 4
- b. -1 and 4

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- c. 2 and 3
- d. -2 and -3
- e. -1 and 5

ANSWER: e

10. In the *LRC* circuit problem in the text, *C* stands for
Select the correct answer.

- a. capacitance
- b. resistance
- c. current
- d. inductance
- e. charge on the capacitor

ANSWER: a

11. In the *LRC* circuit problem in the text, the units of inductance, *L*, are
Select the correct answer.

- a. ohms
- b. farads
- c. amperes
- d. henrys
- e. coulombs

ANSWER: d

12. In the falling body problem, the units of acceleration might be
Select the correct answer.

- a. meters per second
- b. feet per second
- c. meters per second per second
- d. kilograms per meter
- e. kilograms per meter per second

ANSWER: c

13. The differential equation $y'''' + 2y''' + 3y'' + 7y' = 0$ is
Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

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ANSWER: c

14. The differential equation $y'' + 2yy' + 3y = 0$ is
Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: e

15. The differential equation $y' + 3y = \sin x$ is
Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: a

16. The differential equation $y'' + 2y' + 3y = \sin y$ is
Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: e

17. The differential equation $y'''' + 2y''' + 3xy' - 4e^xy = \sin x$ is
Select the correct answer.

- a. first order linear
- b. second order linear
- c. third order linear
- d. first order nonlinear
- e. second order nonlinear

ANSWER: c

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18. The values of m for which $y = e^{mx}$ is a solution of $y'' - 9y' + 20y = 0$ are
Select the correct answer.

- a. 4 and -5
- b. -4 and -5
- c. 3 and 6
- d. 4 and 5
- e. 3 and 5

ANSWER: d

19. The values of m for which $y = x^m$ is a solution of $x^2y'' - 7xy' + 12y = 0$ are
Select the correct answer.

- a. -3 and 4
- b. -2 and -6
- c. 3 and 4
- d. 2 and 6
- e. 3 and -4

ANSWER: a

20. The values of c for which $y = c$ is a constant solution of $y' = y^2 + 5y - 6$ are
Select the correct answer.

- a. 1 and 6
- b. -1 and 6
- c. 1 and -6
- d. -2 and 3
- e. 2 and 3

ANSWER: c

21. The values of m for which $y = e^{mx}$ is a solution of $y'' - 6y' - 7y = 0$ are
Select the correct answer.

- a. 1 and 7
- b. -1 and 6
- c. 1 and 6
- d. 1 and -6
- e. -1 and 7

ANSWER: e

22. In the **LRC** circuit problem in the text, R stands for
Select the correct answer.

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- a. capacitance
- b. resistance
- c. current
- d. inductance
- e. charge on the capacitor

ANSWER: b

23. In the *LRC* circuit problem in the text, the units for C , are
Select the correct answer.

- a. ohms
- b. farads
- c. amperes
- d. henrys
- e. coulombs

ANSWER: b

24. In the falling body problem, the units of acceleration might be
Select the correct answer.

- a. centimeters per second
- b. feet per second
- c. feet per second per second
- d. kilograms per centimeter
- e. kilograms per centimeter per second

ANSWER: c

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1. The solution of the initial value problem $y' = 3y, y(0) = 2$ is $y = ce^{3x}$, where $c =$
(Select the correct answer.)

- a. 2
- b. -2
- c. 3
- d. -3
- e. 1

ANSWER: a

2. The solution of the initial value problem $y' = 2y + x, y(1) = \frac{1}{4}$ is $y = -\frac{x}{2} - \frac{1}{4} + ce^{2x}$, where $c =$

Select the correct answer.

- a. 2
- b. e^{-2}
- c. e^{-1}
- d. $\frac{e^{-2}}{2}$
- e. 1

ANSWER: b

3. The initial value problem $y' = \sqrt{y^2 - 9}, y(x_0) = y_0$ has a unique solution guaranteed by Theorem 1.1 if
Select the correct answer.

- a. $y_0 = 3$
- b. $y_0 = -3$
- c. $y_0 = 5$
- d. $y_0 = 0$
- e. $y_0 = 1$

ANSWER: c

4. The solution of the initial value problem $y' = 5y, y(1) = 3$ is $y = ce^{5x}$, where $c =$
(Select the correct answer.)

- a. $3e^{-5}$
- b. 3
- c. $3e^5$

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d. $-3e^5$

e. -3

ANSWER: a

5. The solution of the initial value problem $y' = 2y + x$, $y(-1) = \frac{1}{2}$ is $y = -\frac{x}{2} - \frac{1}{4} + ce^{2x}$, where $c =$

(Select the correct answer.)

a. 2

b. $\frac{e^2}{4}$

c. e^2

d. $\frac{e^2}{2}$

e. 1

ANSWER: b

6. The initial value problem $y' = \sqrt{y^2 - 16}$, $y(x_0) = y_0$ has a unique solution guaranteed by Theorem 1.1 if

Select the correct answer.

a. $y_0 = 4$

b. $y_0 = -4$

c. $y_0 = 0$

d. $y_0 = 8$

e. $y_0 = 1$

ANSWER: d

1. The population of a town increases at a rate proportional to its population. Its initial population is 1000. The correct initial value problem for the population, $P(t)$, as a function of time, t , is

Select the correct answer.

a. $\frac{dP}{dt} = kP, P(0) = 1000$

b. $\frac{dP}{dt} = kP^2, P(0) = 100$

c. $\frac{dP}{dt} = kP, P(0) = 100$

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d. $\frac{dP}{dt} = kP(1 - P), P(0) = 100$

e. $\frac{dP}{dt} = kP^2, P(0) = 1000$

ANSWER: a

2. The temperature of a cup of coffee obeys Newton's law of cooling. The initial temperature of the coffee is $150^\circ F$ and one minute later, it is $135^\circ F$. The ambient temperature of the room is $70^\circ F$. If $T(t)$ represents the temperature of the coffee at time t , the correct differential equation for the temperature with side conditions is Select the correct answer.

a. $\frac{dT}{dt} = k(T - 135)$

b. $\frac{dT}{dt} = k(T - 150)$

c. $\frac{dT}{dt} = k(T - 70)$

d. $\frac{dT}{dt} = T(T - 150)$

e. $\frac{dT}{dt} = T(T - 70)$

ANSWER: c

3. In the previous problem, after a long period of time, the temperature of the coffee approaches Select the correct answer.

a. $120^\circ F$

b. $100^\circ F$

c. $70^\circ F$

d. $65^\circ F$

e. $0^\circ F$

ANSWER: c

4. A large mixing tank initially contains 100 gallons of water in which 30 pounds of salt have been dissolved. Another brine solution is pumped into the tank at the rate of 4 gallons per minute, and the resulting mixture is pumped out at the same rate. The concentration of the incoming brine solution is 2 pounds of salt per gallon. If $A(t)$ represents the amount of salt in the tank at time t , the correct differential equation for A is Select the correct answer.

a. $\frac{dA}{dt} = 8 - .02A$

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b. $\frac{dA}{dt} = 8 - .04A$

c. $\frac{dA}{dt} = 4 - .04A$

d. $\frac{dA}{dt} = 2 - .04A$

e. $\frac{dA}{dt} = 4 - .08A$

ANSWER: b

5. In the previous problem, over a long period of time, the total amount of salt in the tank will approach
Select the correct answer.

- a. 30 pounds
- b. 50 pounds
- c. 100 pounds
- d. 200 pounds
- e. 300 pounds

ANSWER: d

6. The population of a town increases at a rate proportional to its population. Its initial population is 5000. The correct initial value problem for the population, $P(t)$, as a function of time, t , is
Select the correct answer.

a. $\frac{dP}{dt} = kP, P(0) = 5000$

b. $\frac{dP}{dt} = kP^2, P(0) = 500$

c. $\frac{dP}{dt} = kP, P(0) = 500$

d. $\frac{dP}{dt} = kP(1 - P), P(0) = 5000$

e. $\frac{dP}{dt} = kP^2, P(0) = 5000$

ANSWER: a

7. The temperature of a cup of coffee obeys Newton's law of cooling. The initial temperature of the coffee is $140^\circ F$ and one minute later, it is $125^\circ F$. The ambient temperature of the room is $65^\circ F$. If $T(t)$ represents the temperature of the coffee at time t , the correct differential equation for the temperature is
Select the correct answer.

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a. $\frac{dT}{dt} = k(T - 125)$

b. $\frac{dT}{dt} = k(T - 140)$

c. $\frac{dT}{dt} = k(T - 65)$

d. $\frac{dT}{dt} = T(T - 140)$

e. $\frac{dT}{dt} = T(T - 65)$

ANSWER: c

8. In the previous problem, after a long period of time, the temperature of the coffee approaches

Select the correct answer.

a. $125^{\circ}F$

b. $100^{\circ}F$

c. $65^{\circ}F$

d. $50^{\circ}F$

e. $0^{\circ}F$

ANSWER: c

9. A large mixing tank initially contains 1000 gallons of water in which 40 pounds of salt have been dissolved. Another brine solution is pumped into the tank at the rate of 5 gallons per minute, and the resulting mixture is pumped out at the same rate. The concentration of the incoming brine solution is 3 pounds of salt per gallon.

If $A(t)$ represents the amount of salt in the tank at time t , the correct differential equation for A is

Select the correct answer.

a. $\frac{dA}{dt} = 3 - .005A$

b. $\frac{dA}{dt} = 5 - .05A$

c. $\frac{dA}{dt} = 15 - .005A$

d. $\frac{dA}{dt} = 3 - .05A$

e. $\frac{dA}{dt} = 15 + .05A$

ANSWER: c

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10. In the previous problem, over a long period of time, the total amount of salt in the tank will approach
Select the correct answer.

- a. 300 pounds
- b. 500 pounds
- c. 1000 pounds
- d. 3000 pounds
- e. 5000 pounds

ANSWER: d