Calculus

Chapter 7: Differential Equations and More Riemann Sums

Lesson 1: Differential Equations - An Introduction

Question #1

Reference Q.667

Solve the following differential equation with the given initial value.

$\frac{dy}{dx} = x^{\frac{2}{3}}, y(1) = 0$

Question #2

Reference Q.668

Solve the following differential equation with the given initial value.

$\frac{dy}{dx} = \cos x + 2x,\ y(0) = 2$

Question #3

Reference Q.669

Find the equation that has a slope at any point (x,y) equal to $y' = 3x + 4$, and that passes through the point $(0,\ -3)$.

Question #4

Reference Q.670

If the 2nd derivative of a function is equal to some constant "k" ($i.e\ f''(x) = k$), find $f(x)$ in general (i.e. leave any constants of integration as C_1" or "C_2", etc)

Question #5

Reference Q.671

Show that $y = 5e^x + 3\sin x + 2$ is a solution of the initial-value problem $y' = 5e^x + 3\cos x$, with $y(0) = 7$.

Question #6

Reference Q.672

Solve the following differential equation by separation of variables.

$\frac{dy}{dx} = \frac{\sec^2 2x - 3x^2}{\cos y - 8e^{3y}}$ with $y(0) = 0.$

Question #7

Reference Q.673

Solve the following differential equation by separation of variables.

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

Question #8

Reference Q.674

Solve the following differential equation by separation of variables.

$\frac{dy}{dx} = \frac{x+2}{3y+3},\ \ y(0) = 0$

Question #9

Reference Q.675

Solve the following differential equation by separation of variables.

$y' = 5(\sin x + 1)e^{3y}$

Question #10

Reference Q.676

Solve the following differential equation by separation of variables.

$\sin y(x^5 - 3\ln x)\frac{dy}{dx} = \frac{3}{x} - 5x^4$

Question #11

Reference Q.677

Solve the following differential equation by separation of variables.

$\sqrt{x}\frac{dy}{dx} = \frac{3e^{\sqrt{x}}}{(3\csc^2 y + \sec^2 2y)}$

Question #12

Reference Q.678

Solve the following differential equation by separation of variables.

$\frac{\sqrt{x^2+5}dy}{dx} = 2x(y+3)$

Question #13

Reference Q.679

A Petri dish of a certain bacteria grows at a rate of 3% per hour. If the dish contains 2000 bacteria to start with and $P(t)$ is the population of bacteria after t hours:

a. a) What is the formula for $P(t)$?

b. b) How long until the bacteria doubles to 4000?

c. c) How long will it take to reach a population of 7500?

Question #14

Reference Q.680

A new National Parks Reserve is estimated to be able to hold a maximum of $4,000$ deer. Assuming we have exponential growth at 2.5% per year in the reserve, and we begin with 200 deer, how long will it take until the Park is at capacity in terms of the number of deer?

Question #15

Reference Q.681

A type of bacteria with an initial population of 3000 divides in half every $3\ hours$ in a certain environment. Suppose $P(t)$ is the population after t hours. If the culture grows according to an exponential model:

a. a) What is the equation for $P(t)$.

b. b) How many cells are there after 1 day?

c. c) How many days would it take for 10 cells to be left?

Question #16

Reference Q.682

If the half-life of a substance is 12.21 hours, how many hours until this substance is reduced to 1% of its initial amount?

Question #17

Reference Q.683

The following question follows an exponential growth or decay model. Solve for y(t)

If $y\left(0\right)=2$ and the growth rate is $3.5\ \%$

Question #18

Reference Q.684

The following question follows an exponential growth or decay model. Solve for y(t)

If $y\left(0\right)=20$ and the rate of decay is 1.7%

Question #19

Reference Q.685

The following question follows an exponential growth or decay model. Solve for y(t) if $y\left(2\right)=4$ and the half-life is 2 years.

Question #20

Reference Q.686

The following question follows an exponential growth or decay model. Solve for y(t)

if $y\left(2\right)=4$ and in 10 yrs it doubles.

Question #21

Reference Q.9267

If $\frac{dy}{dx}=xy^2+x$, find the general solution for y.

Question #22

Reference Q.9269

A population P grows according to the equation $\frac{dP}{dt}=kP$, where k is some real number and t is time in years. If the population triples every 20 years, then what is the value of k?