Practice problem set #1 (18341371)

Question 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Description
order of an eqn, existence and uniqueness, separable

1. Question Details ZillDiffEQ9 1.1.001. [3745020]

State the order of the given ordinary differential equation.

$(1 - x)y'' - 3xy' + 9y = \cos x$

Determine whether the equation is linear or nonlinear by matching it with (6) in Section 1.1.

$$a_n(x)\frac{d^n y}{dx^n} + a_{n-1}(x)\frac{d^{n-1}y}{dx^{n-1}} + \cdots + a_1(x)\frac{dy}{dx} + a_0(x)y = g(x) \quad (6)$$

- linear
- nonlinear

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2. Question Details ZillDiffEQ9 1.1.003. [4568129]

State the order of the given ordinary differential equation.

$t^8 y^{(6)} - t^5 y'' + 9y = 0$

Determine whether the equation is linear or nonlinear by matching it with (6) in Section 1.1.

$$a_n(x)\frac{d^n y}{dx^n} + a_{n-1}(x)\frac{d^{n-1}y}{dx^{n-1}} + \cdots + a_1(x)\frac{dy}{dx} + a_0(x)y = g(x) \quad (6)$$

- linear
- nonlinear

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3. Question Details ZillDiffEQ9 1.1.037. [3744723]

Use the concept that $y = c$, $-\infty < x < \infty$, is a constant function if and only if $y' = 0$ to determine whether the given differential equation possesses constant solutions. (Enter all constant solutions below. If there are no constant solutions, enter NONE.)

$8xy' + 4y = 16$

$y =$

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4. Question Details ZillDiffEQ9 1.1.060. [3745065]

Consider the differential equation $dy/dx = 8 - y$.

(a) Either by inspection or by the concept that $y = c$, $-\infty < x < \infty$, is a constant function if and only if $y' = 0$, find a constant solution of the DE.

$y =$ [ ]

(b) Using only the differential equation, find the intervals on the y-axis on which a nonconstant solution $y = \varphi(x)$ is increasing. Find the intervals on the y-axis on which $y = \varphi(x)$ is decreasing. (Enter your answer using interval notation.)

increasing [ ]

decreasing [ ]

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5. Question Details ZillDiffEQ9 1.2.003.MI.SA. [4605498]

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

In this problem, $y = 1/(x^2 + c)$ is a one-parameter family of solutions of the first-order DE $y' + 2xy^2 = 0$. Find a solution of the first-order IVP consisting of this differential equation and the given initial condition.

$$y(4) = \frac{1}{12}$$

Give the largest interval I over which the solution is defined.

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6. Question Details ZillDiffEQ9 1.2.011. [4568075]

In this problem, $y = c_1e^x + c_2e^{-x}$ is a two-parameter family of solutions of the second-order DE $y'' - y = 0$. Find a solution of the second-order IVP consisting of this differential equation and the given initial conditions.

$y(0) = 1, \quad y'(0) = 7$

$y =$ [ ]

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7. Question Details ZillDiffEQ9 1.2.015. [3744975]

Determine by inspection two solutions of the given first-order IVP.

$y' = 3y^{2/3}, \quad y(0) = 0$

$y(x) =$ (constant solution)

$y(x) =$ (polynomial solution)

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8. Question Details ZillDiffEQ9 1.2.017.EP. [4603977]

Consider the following differential equation.

$$\frac{dy}{dx} = y^{4/5}$$

Let $f(x, y) = y^{4/5}$. Find the derivative of f.

$$\frac{\partial f}{\partial y} =$$

Determine a region of the xy-plane for which the given differential equation would have a unique solution whose graph passes through a point (x_0, y_0) in the region.

- There is a unique solution in any rectangular region where $|y| < 1$.
- There is a unique solution in the entire xy-plane.
- There is a unique solution in any rectangular region where $y \neq 0$.
- There is a unique solution in any rectangular region where $x \geq 0$.
- There is a unique solution in any rectangular region excluding the origin.

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9. Question Details ZillDiffEQ9 1.2.019.EP. [4603904]

Consider the following differential equation.

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

Let $f(x, y) = \frac{y}{x}$. Find the derivative of f.

$\frac{\partial f}{\partial y} =$ [ ]

Determine a region of the xy-plane for which the given differential equation would have a unique solution whose graph passes through a point (x_0, y_0) in the region.

- There is a unique solution in the region consisting of all points in the xy-plane except the origin.
- There is a unique solution in the region $x < 1$.
- There is a unique solution in the regions $x > 0$ and $x < 0$.
- There is a unique solution in the region $y \leq x$.
- There is a unique solution in the entire xy-plane.

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10. Question Details ZillDiffEQ9 1.2.021.EP. [4603958]

Consider the following differential equation.

$$(25 - y^2)y' = x^2$$

Let $f(x, y) = \frac{x^2}{(25 - y^2)}$. Find the derivative of f.

$\frac{\partial f}{\partial y} =$ [ ]

Determine a region of the xy-plane for which the given differential equation would have a unique solution whose graph passes through a point (x_0, y_0) in the region.

- A unique solution exists in the region consisting of all points in the xy-plane except (0, 5) and (0, −5).
- A unique solution exists in the region $y < 5$.
- A unique solution exists in the region $y > -5$.
- A unique solution exists in the entire xy-plane.
- A unique solution exists in the regions $y < -5$, $-5 < y < 5$, and $y > 5$.

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11. Question Details ZillDiffEQ9 1.2.025.EP. [4603954]

Consider the differential equation $y' = \sqrt{y^2 - 16}$.

Let $f(x, y) = \sqrt{y^2 - 16}$ Find the partial derivative of f.

$\frac{\partial f}{\partial y} =$ [ ]

Determine a region of the xy-plane for which the given differential equation would have a unique solution whose graph passes through a point (x_0, y_0) in the region.

- A unique solution exits in the regions $y < -4$, $-4 < y < 4$, and $y > 4$.
- A unique solution exits in the entire xy-plane.
- A unique solution exists in the region $y < -4$ or $y > 4$.
- A unique solution exits in the region consisting of all points in the xy-plane except (0, 4) and (0, −4).
- A unique solution exists in the region $-4 < y < 4$.

Determine whether Theorem 1.2.1 guarantees that the differential equation possesses a unique solution through (1, 5).

- Yes
- No

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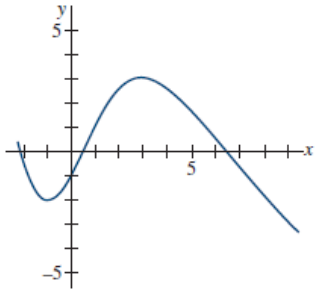
12. Question Details ZillDiffEQ9 1.2.037. [3745195]

The graph of a member of a family of solutions of a second-order differential equation $d^2y/dx^2 = f(x, y, y')$ is given. Match the solution curve with at least one pair of the following initial conditions. (Select all that apply.)



- $y(1) = 1, y'(1) = -2$
- $y(-1) = 0, y'(-1) = -4$
- $y(1) = 1, y'(1) = 2$
- $y(0) = -1, y'(0) = 2$
- $y(0) = -1, y'(0) = 0$
- $y(0) = -4, y'(0) = -2$

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13. Question Details ZillDiffEQ9 1.2.039. [4568239]

In this problem, $y = c_1 \cos(4x) + c_2 \sin(4x)$ is a two-parameter family of solutions of the second-order DE $y'' + 16y = 0$. If possible, find a solution of the differential equation that satisfies the given side conditions. The conditions specified at two different points are called boundary conditions. (If not possible, enter NOT.)

$y(0) = 0, y(\pi/8) = 8$

$y =$

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14. Question Details ZillDiffEQ9 1.R.015. [3876593]

Interpret the statement as a differential equation. (Use yp for y' and ypp for y''.)

On the graph of $y = \varphi(x)$, the slope of the tangent line at a point $P(x, y)$ is the square of the distance from $P(x, y)$ to the origin.

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15. Question Details ZillDiffEQ9 1.R.017. [3876612]

(a) Give the domain of the function $y = x^{2/3}$. (Enter your answer using interval notation.)

(b) Give the largest interval I of definition over which $y = x^{2/3}$ is a solution of the differential equation $3xy' - 2y = 0$. (Enter your answer using interval notation.)

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16. Question Details ZillDiffEQ9 1.R.019. [3876537]

The function $y = x - \frac{6}{x}$ is a solution of the DE $xy' + y = 2x$. Find x_0, given the first-order IVP

$$xy' + y = 2x, \quad y(x_0) = 5.$$

Enter your answers as a comma-separated list.

$x_0 =$

Find the largest interval I for which $y(x)$ is a solution of the IVP for the smaller value of x_0. (Enter your answer using interval notation.)

Find the largest interval I for which $y(x)$ is a solution of the IVP for the larger value of x_0. (Enter your answer using interval notation.)

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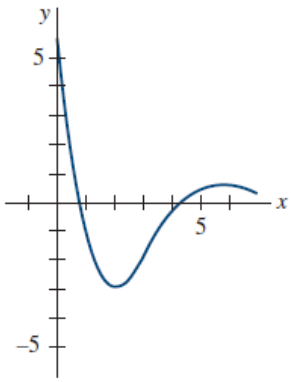
17. Question Details ZillDiffEQ9 1.R.039. [3745342]

The graph of a solution of a second-order initial-value problem $\frac{d^2y}{dx^2} = f(x, y, y')$, $y(2) = y_0$, $y'(2) = y_1$, is given in the figure. Use the graph to estimate the values of y_0 and y_1.

$y_0 =$

$y_1 =$



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18. Question Details ZillDiffEQ9 2.2.001.EP. [4903667]

The following differential equation is separable as it is of the form $\frac{dy}{dx} = g(x)\,h(y)$.

$$\frac{dy}{dx} = \sin(9x)$$

Find the following antiderivatives.

$\int \frac{dy}{h(y)} =$ [ ]

$\int g(x)\,dx =$ [ ]

Solve the given differential equation by separation of variables.

[ ]

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19. Question Details ZillDiffEQ9 2.2.005. [4568098]

Solve the given differential equation by separation of variables.

$$x\frac{dy}{dx} = 6y$$

[ ]

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20. Question Details ZillDiffEQ9 2.2.007.EP. [4903605]

The following differential equation is separable as it is of the form $\frac{dy}{dx} = g(x)\,h(y)$.

$$\frac{dy}{dx} = e^{6x + 5y}$$

Find the following antiderivatives.

$\int \frac{dy}{h(y)} =$ [ ]

$\int g(x)\,dx =$ [ ]

Solve the given differential equation by separation of variables.

[ ]

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21. Question Details ZillDiffEQ9 2.2.021. [3876585]

Solve the given differential equation by separation of variables.

$$\frac{dy}{dx} = x\sqrt{1 - y^2}$$

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22. Question Details ZillDiffEQ9 2.2.023. [4568338]

Find an explicit solution of the given initial-value problem.

$$\frac{dx}{dt} = 6(x^2 + 1), \quad x\left(\frac{\pi}{4}\right) = 1$$

$x =$

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23. Question Details ZillDiffEQ9 2.2.017.EP. [4603974]

The following differential equation is separable as it is of the form $\frac{dP}{dt} = g(P)h(t)$.

$$\frac{dP}{dt} = P - P^2$$

Find the following antiderivatives. (Use C for the constant of integration. Remember to use absolute values where appropriate.)

$$\int \frac{dP}{g(P)} =$$

$$\int h(t)\, dt =$$

Solve the given differential equation by separation of variables.

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24. Question Details ZillDiffEQ9 2.2.025.MI. [4568017]

Find an explicit solution of the given initial-value problem.

$$x^2\frac{dy}{dx} = y - xy, \quad y(-1) = -2$$

$y =$

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25. Question Details ZillDiffEQ9 2.2.055. [3748812]

Find a function whose square plus the square of its derivative is 1.

$y =$

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Assignment Details