Student: ____________________

Date: ____________________

Instructor: Antonio PurdueMath

Course: MA262-Toy Course-Number 2

Assignment: Online Midterm 1

Print

1. A jug of buttermilk is set to cool on a front porch, where the temperature is 0°C. The jug was originally at 87°C. If the buttermilk has cooled to 15°C after 26 minutes, after how many minutes will the jug be at 8°C?

The jug of buttermilk will be at 8°C after **35** minutes.
(Round the final answer to the nearest whole number as needed. Round all intermediate values to six decimal places as needed.)

ID: 1.4.43

2. A large tank initially contains 20g of salt in 20L of water. A solution containing 6g/L salt flows into the tank at a rate of 4L/min, and the well stirred mixture flows out at the rate of 3L/min. Which of the following differential equations and initial conditions describe the amount of salt A = A(t) in the tank at time t before the tank is full.

○ A. $\frac{dA}{dt} + \frac{A}{5+t} = 24, \quad A(0) = 20$

○ B. $\frac{dA}{dt} + \frac{3A}{20+2t} = 20, \quad A(0) = 20$

○ C. $\frac{dA}{dt} - \frac{A}{20+4t} = 20, \quad A(0) = 20$

● D. $\mathbf{\frac{dA}{dt} + \frac{3A}{20+t} = 24, \quad A(0) = 20}$

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3. Assume that y = y(x) is a solution of the equation

$\left(3x^2 + y\right) dx + (x + 2y)\, dy = 0$

and y(1) = 2. What is the value of y(2)?

○ A. 1
○ B. 3
○ C. 2
● D. **-1**
○ E. -2

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4. If the function f(x,y) is continuous near the point (a,b), then at least one solution of the differential equation y′ = f(x,y) exists on some open interval I containing the point x = a and, moreover, that if in addition the partial derivative $\frac{\partial f}{\partial y}$ is continuous near (a,b) then this solution is unique on some (perhaps smaller) interval J. Determine whether existence of at least one solution of the given initial value problem is thereby guaranteed and, if so, whether uniqueness of that solution is guaranteed.

$\frac{dy}{dx} = \sqrt{x - y}$; y(1) = 1

Select the correct choice below and fill in the answer box(es) to complete your choice.
(Type an ordered pair.)

○ A. The theorem implies the existence of at least one solution because f(x,y) is continuous near the point ______. This solution is unique because $\frac{\partial f}{\partial y}$ = ______ is also continuous near that same point.

○ B. The theorem implies the existence of at least one solution because f(x,y) is continuous near the point ______. However, this solution is not necessarily unique because $\frac{\partial f}{\partial y}$ = ______ is not continuous near that same point.

● C. **The theorem does not imply the existence of at least one solution because f(x,y) is not continuous near the point (1,1).**

ID: 1.3.15

5. Let y = y(x) satisfy the following initial value problem

$\frac{dy}{dx} + \frac{2}{x} y = 8x^2 \sqrt{y}$

y(1) = 4.

What is the value of $y\left(\sqrt{2}\right)$?

● A. $\mathbf{y\left(\sqrt{2}\right) = \frac{25}{2}}$

○ B. $y\left(\sqrt{2}\right) = \frac{5}{8}$

○ C. $y\left(\sqrt{2}\right) = \frac{5}{2}$

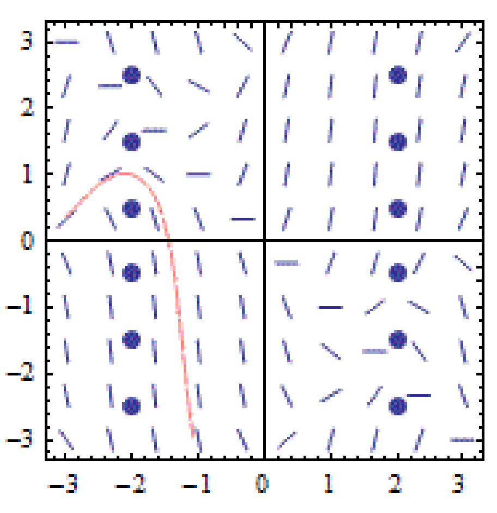
○ D. $y\left(\sqrt{2}\right) = \frac{25}{4}$

○ E. $y\left(\sqrt{2}\right) = \frac{25}{8}$

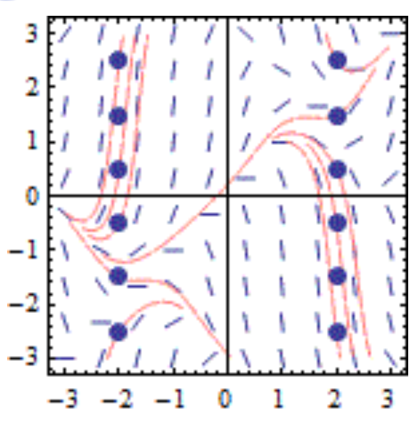
ID: Instructor-created question

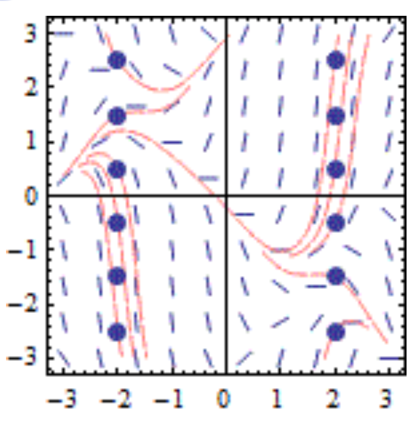
6. The slope field of the indicated differential equation has been provided, together with a solution curve. Sketch solution curves through the additional points marked in the slope field.

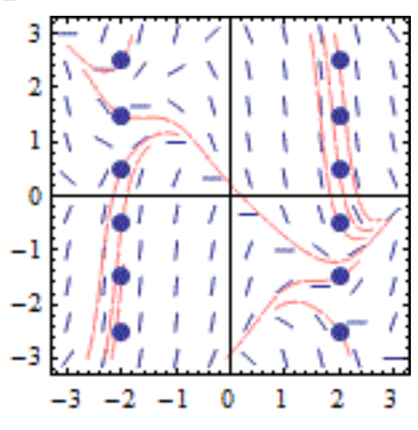
$\frac{dy}{dx} = 5 \sin x + 5 \sin y$

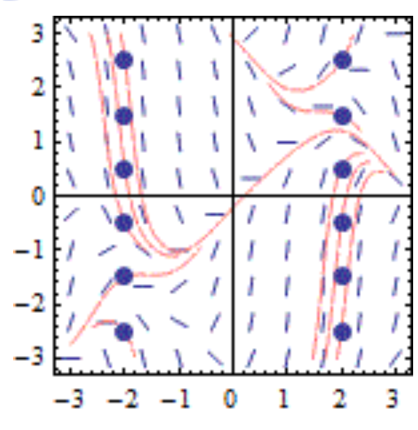


Choose the correct graph below.

○ A.


● B.


○ C.


○ D.


ID: 1.3.7

7. A Las Vegas casino tells their customers who want to play poker that C(t), the amount of cash a poker player has at time t after they start playing, satisfies the differential equaton

$\frac{dC(t)}{dt} = (C(t) - 300)(C(t) - 400)(600 - C(t))$

There are four players playing the game, P1, P2, P3 and P4. If C(0) is the amount of money the gambler brings to the table, P1 brings $50, P2 brings $650, P3 brings $390 and P4 brings $500, which of the following is correct if the players keep playing at the same poker game for a very long time?

● A. **P1 will win the most money and P3 will lose the most money**
○ B. P4 will win the most money and P3 will lose the most
○ C. Players P1 and P4 will win the same amount while P2 and P3 will lose the same amount.
○ D. P1 will win the most money and P2 will lose the most money
○ E. P4 will win the most money and P2 will lose the most money

ID: Instructor-created question

8. If y = y(t) is the solution of the initial value problem

$t y' - y = t^2 e^{-t}$,

y(1)=3,

what is the value of y(3)?

● A. $\mathbf{9 + 3e^{-1} - 3e^{-3}}$
○ B. $e^{-1} - 3e^{3}$
○ C. $3e^{-1} - 7e^{-3} + 5$
○ D. $2 + e^{-1}$
○ E. $3 - e^{-3} + 5e^{-1}$

ID: Instructor-created question

9. Find the explicit particular solution of the differential equation for the initial value provided.

$\frac{dy}{dx} = 5x^2 y - y, \; y(1) = -3$

The explicit particular solution of the differential equation is y = $\mathbf{-3e^{\frac{5}{3}x^3 - x - \frac{2}{3}}}$.

ID: 1.4.22

10. A population of tilapias in a pond, denoted by x=x(t), where t is counted in years, obeys the following differential equation

$\frac{dx}{dt} = 1200x - x^2$

If the initial population was x(0) = 2500 tilapias, what will be the time T until half of the tilapias die? What will be the population of tilapias in the pond after 10 years?

○ A. $T = \frac{1}{1200}$ **ln** (13) years and 10 years the population will be close to 1000 tilapias

○ B. $T = \frac{1}{1200}$ **ln** (37) years and after 10 years the population will be close to 1300 tilapias

○ C. $T = \frac{1}{1200}$ **ln** (12) years and after a long time the population will be close to 1200 tilapias

● D. **$T = \frac{1}{1200}$ ln (13) years and after 10 years the population will be close to 1200 tilapias**

○ E. $T = \frac{1}{1200}$ **ln** (15) years and after 10 years the population will be close to 1200 tilapias

ID: Instructor-created question

11. Consider the differential equation

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

which is satisfied for x > 0. Suppose a solution y(x) satisfies y(1) = 1. What is the value of $y\left(e^5\right)$?

● A. $\mathbf{2e^5}$
○ B. $\sqrt{3}\, e^5 - 6 \ln 3$
○ C. $e^5 + 3$
○ D. $-3e^{-5}$
○ E. $e^5\left(\sqrt{5} - 1\right)$

ID: Instructor-created question