Test 1A

ⓘ This is a preview of the published version of the quiz

Started: Feb 18 at 9:27am

Quiz Instructions

Choose the best answer for each problem. There is also a paper portion of the test that is posted and due Tuesday, Feb 15.

Question 1

2 pts

Choose the word or phrase that does NOT describe the equation

$$\frac{d^2y}{dx^2} + 7\left(\frac{dy}{dx}\right)^3 - 8y = x^2.$$

- X Linear
- ○ 2nd-order
- ○ Ordinary
- ○ Independent variable x

NOT LINEAR BECAUSE OF 3RD POWER OF $\frac{dy}{dx}$

Question 2

2 pts

Choose the word of phrase that does NOT describe the equation $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = 5z$

.

- X 2nd-order
- ○ Linear
- ○ Partial

IT'S A 1ST-ORDER EQUATION.

IT HAS ONLY 1ST-ORDER DERIVATIVES.

○ Independent variable y

Question 3

2 pts

Choose the word or phrase that does NOT describe the equation
$(x^2 + y^2)\,dx - 2xy\,dy = 0.$

☒ Linear   IT IS NEITHER LINEAR IN X NOR y.

○ Ordinary

○ 1st-order

○ It is not clear which variable is independent.

Question 4

6 pts

Solve the initial value problem. Then compute $y(3)$.

$$\frac{dy}{dx} = \frac{5x}{3x^2+1}, \quad y(0) = 7$$

$\int \frac{5x}{3x^2+1}\,dx = \frac{5}{6}\int \frac{1}{u}\,du = \frac{5}{6}\ln|u| + C$

$u = 3x^2+1$ $\qquad = \frac{5}{6}\ln(3x^2+1) + C$

$du = 6x\,dx$

$\frac{5}{6}\,du = 5x\,dx$ $\qquad y(0) = 7 \Rightarrow \boxed{C = 7}$

$y(x) = \frac{5}{6}\ln(3x^2+1) + 7 \Rightarrow y(3) \approx 9.7768$

☒ 9.7768

○ 4.1631

○ 7.5554

○ 10.3537

Question 5

8 pts

Use Newton's law of cooling to solve: An object that was outside overnight has an initial temperature of $13°$ F. The object is moved indoors where the temperature is

68°F. After 20 minutes, the temperature of the object is 50°F. When will the temperature be 62°F?

$T(t) = 68 - Me^{kt}$

X About 40 min

○ About 45 min

○ About 35 min

○ About 48 min

$T(0) = 13 \Rightarrow M = 55 \qquad T(t) = 68 - 55e^{kt}$

$T(20) = 50 \Rightarrow 50 = 68 - 55e^{20k}$

$\Rightarrow k = \dfrac{\ln \frac{18}{55}}{20}$

$62 = 68 - 55e^{kt} \Rightarrow t = \dfrac{\ln \frac{6}{55}}{k} \approx 39.67$ MIN

Question 6

3 pts

What is the slope of the solution curve through the point $(1, 3)$?

$xy\,dx + (y^4 - 3x^2)\,dy = 0$

$\dfrac{dy}{dx} = \dfrac{-xy}{y^4 - 3x^2}$

X $-3/78$

○ $3/26$

○ $-2/47$

○ $-1/30$

$\left.\dfrac{dy}{dx}\right|_{(1,3)} = \dfrac{-(1)(3)}{(3)^4 - 3(1)^2} = \dfrac{-3}{81-3} = -3/78$

Question 7

4 pts

Through which of these points should we expect a solution, but not necessarily a unique solution?

$(x^2 - 1)\dfrac{dy}{dx} = \sqrt[3]{y^2 - 4}$

$\dfrac{dy}{dx} = \dfrac{\sqrt[3]{y^2-4}}{x^2-1} \qquad f(x,y) = \dfrac{\sqrt[3]{y^2-4}}{x^2-1}$

f IS NOT CONT. AT $X = \pm 1$

SHOULD EXPECT A SOLUTION THROUGH ANY PTS WITH $X \neq \pm 1$.

○ $(0, 2)$

○ $(-1, 5)$

~~(2, 0)~~

○ (−1, 0)

$f_y(x,y) = \dfrac{2y}{3(x^2-1)(y^2-4)^{2/3}}$

f_y IS NOT CONT. AT $x = \pm 1$ OR $y = \pm 2$

SHOULD NOT EXPECT UNIQUE SOLUTION THROUGH $y = \pm 2$

Question 8

4 pts

Consider the following initial value problem. Which one of the following is the BEST conclusion we can draw from our existence/uniqueness theorems?

$$\sqrt{x}\,\frac{dy}{dx} - 4e^x y = \sin x, \quad y(1) = 2$$

$$\frac{dy}{dx} - \frac{4e^x}{\sqrt{x}}\,y = \frac{\sin x}{\sqrt{x}}$$

LINEAR WITH CONTINUOUS COEFFICIENTS FOR $x > 0$.

- ~~There is a unique solution for all $x > 0$.~~
- ○ A solution is not guaranteed.
- ○ A solution is guaranteed, but it might not be the only solution.
- ○ A unique solution is guaranteed, but we cannot say anything about the domain of the solution.

Question 9

7 pts

The quantity Q is growing in such a way that $\dfrac{dQ}{dt} = kQ$. Suppose that $Q(10) = 300$ and $Q(15) = 428$. Find $Q(0)$.

$Q(t) = Q_0 e^{kt}$

- ~~Approximately 147.4~~
- ○ Approximately 52.3
- ○ Approximately 126.8
- ○ Approximately 135.0

$Q(10) = 300 \Rightarrow 300 = Q_0 e^{10k}$

$Q(15) = 428 \Rightarrow 428 = Q_0 e^{15k}$

$\Downarrow$

$\dfrac{428}{300} = e^{5k} \Rightarrow k = \dfrac{\ln \frac{428}{300}}{5}$

$Q_0 = 300 e^{-10k} \approx 147.39$

Question 10

8 pts

Solve. Then determine $y(0.1)$.

$$\frac{dy}{dx} - 3y = 4e^{5x}, \quad y(0) = 5$$

- ☒ 7.3470
- ○ 5.5199
- ○ 6.2974
- ○ 4.1580

$\mu(x) = e^{\int -3\,dx} = e^{-3x}$

$e^{-3x} y = \int 4e^{5x} e^{-3x}\,dx = \int 4e^{2x}\,dx$

$= 2e^{2x} + C$

$y(x) = 2e^{5x} + Ce^{3x}$

$y(0) = 5 \Rightarrow C = 3$

$y(x) = 2e^{5x} + 3e^{3x}$

$y(0.1) = 2e^{0.5} + 3e^{0.3} \approx 7.3470$

Not saved

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