

Math 240 - Quiz 1
January 18, 2022

Name key Score _____

This quiz is available in Canvas. It is due January 25.

1. (1 point) Choose the word or phrase that does NOT describe the equation $(1 - x^2)y'' - 2xy' + 12y = 0$.

- (a) Ordinary
- (b) Nonlinear
- (c) 2nd-order
- (d) Dependent variable y

↑ IT'S LINEAR.

2. (1 point) Choose the word or phrase that does NOT describe the equation $\frac{\partial u}{\partial t} = \frac{4}{5} \frac{\partial^2 u}{\partial y^2}$.

- (a) Partial
- (b) Linear
- (c) 2nd-order
- (d) Dependent variable y

DEPENDENT VARIABLE IS u .

3. (1 point) Choose the word or phrase that does NOT describe the equation $y^3y' + xy'' = xe^x$.

- (a) Ordinary
- (b) Nonlinear
- (c) 3rd-order
- (d) Independent variable x

IT'S 2ND ORDER.

4. (1 point) Which one of these is NOT a solution of $e^{xy'} = 1$?

- (a) $y = \ln x$
- (b) $y = \ln x + 5$
- (c) $y = \ln(x + 5)$
- (d) None of the above

$$\left. \begin{aligned} y &= \ln x + 5 \\ \frac{dy}{dx} &= \frac{1}{x} \end{aligned} \right\} e^{\ln x + 5} \cdot \frac{1}{x} = (xe^5) \left(\frac{1}{x} \right) = e^5 \neq 1$$

5. (2 points) Solve the initial value problem, and then compute $y(\pi/4)$.

$$\frac{dy}{dx} = \frac{10}{x^2 + 1}, \quad y(0) = 0$$

(a) $y(\pi/4) = 4.8048$

(b) $y(\pi/4) = 2.4024$

(c) $y(\pi/4) = 10.0000$

(d) None of the above

$$y(x) = 10 \int \frac{1}{x^2 + 1} dx = 10 \tan^{-1} x + C$$

$$y(0) = 0 \Rightarrow 10 \tan^{-1}(0) + C = 0 \\ \Rightarrow C = 0$$

$$y(\pi/4) = 10 \tan^{-1}\left(\frac{\pi}{4}\right) \approx 6.65177$$

6. (2 points) Solve the initial value problem, and then compute $y(0)$.

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

(a) $y(0) = 4/9$

(b) $y(0) = 1/3$

(c) $y(0) = 0$

(d) None of the above

$$y(x) = \int 2x\sqrt{3x^2 + 1} dx = \frac{1}{3} \int \sqrt{u} du \\ = \frac{1}{3} \frac{u^{3/2}}{3/2} + C \\ = \frac{2}{9} (3x^2 + 1)^{3/2} + C$$

$$u = 3x^2 + 1$$

$$du = 6x dx$$

$$\frac{1}{3} du = 2x dx$$

$$y(x) = \frac{2}{9} (3x^2 + 1)^{3/2} + \frac{2}{9}$$

$$y(1) = 2 \Rightarrow \frac{2}{9} (4)^{3/2} + C = 2$$

$$\frac{16}{9} + C = 2 \\ C = \frac{2}{9}$$

7. (2 points) The line tangent to the graph of f at the point (x, y) passes through the origin. Which differential equation has $y = f(x)$ as one of its solutions?

(a) $dy/dx = xy$

(b) $dy/dx = y/x$

(c) $dy/dx = x/y$

(d) None of the above

$$\frac{dy}{dx} = \frac{y-0}{x-0} = \frac{y}{x}$$

↑
Slope through (x, y)
AND $(0, 0)$.