

Instructions: Multiple Choice Questions (50 points)

Q1 The differential equation $\frac{dy}{dx} = (x + y + 2)^2$ is

- (A) linear | (B) exact | (C) separable | (D) None

Q2 The order and degree of the $(y'')^3 + 6y' + 4y = 0$ are

- (A) (2, 4) | (B) (2, 3) | (C) (3, 2) | (D) None

Q3 The integral factor of $y' + \cos(x)y = \sin(x)$ is

- (A) $e^{\sin(x)}$ | (B) $e^{\cos(x)}$ | (C) e^{x^2} | (D) None

Q4 The graph of the solutions to $\frac{dy}{dx} = \frac{x}{y}$ are

- (A) parabolas | (B) circles | (C) hyperbolas | (D) None

Q5 The solution of: $xy' = 3y + x^4 \cos(x)$, $y(2\pi) = 0$ is

- (A) $y = x^2 \cos(x)$ | (B) $y = x^3 \sin(x)$ | (C) $y = xe^x$ | (D) None

Q6 For which values of k is the function $y = x^k$ a solution of a the differential equation

$$x^2 y'' - 5xy' + 8y = 0.$$

- (A) (2, 4) | (B) (2, 3) | (C) (4, 1) | (D) None

Q7 If $y = e^x$ is a solution to $y'' - 5y' + ky = 0$, what is the value of k ?

- (A) 2 | (B) 4 | (C) 6 | (D) None

Q8 Consider the constant coefficient ODE $y'' + ay' + by = 0$. If m_1 and m_2 are the roots of its characteristic equation, then what is $m_1^2 + m_2^2$?

- (A) 1 | (B) $a^2 - 4b$ | (C) $a^2 - 2b$ | (D) None

Q9 The Wronskian $W(y_1, y_2)(x)$ of the functions $y_1 = \sin x$, $y_2 = \cos x$ is

- (A) -1 | (B) 1 | (C) $\sin x$ | (D) None

Q10 For what value of c is $3x^2 + cxy + 2 + (6y^2 - x^2 + y)y' = 0$ exact?

- (A) -1 | (B) -2 | (C) 3 | (D) None

Circle True or False, but not both. If I cannot read your answer, it is wrong.(10pts)

Q11 The ODE $\frac{dy}{dx} + xy = xy^4$ is a Bernoulli equation.

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Q12 For a second order linear homogeneous ordinary differential equation with constant coefficients, if the characteristic equation has no real roots, then we cannot solve the equation.

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Classical Problems: Show all work. Your work must be clear and logical to receive full points. No work=No credit!

Q13 (20pts) Find the general solution of: $xy'' + 2y' = 6x$.

Solution:

Q14 (20pts) Find the general solution of the ODE:

$$y''' - 13y'' + 36y' = 0.$$

Solution: