Homework 11 3/27: MATH 112 Prof. Maxwell Auerbach

Show all work. No credit will be given for answers without sufficient work. No calculators are allowed. Collaboration with classmates is allowed, but all work submitted must be written out and explained by you.

2 Homework 11 Problems: Taylor Series from Known Series

2.1 Find the Maclaurin series for $f(x)$. If you use a known Taylor Series or Maclaurin Series be sure to cite it.

2.1 a) (11.10.36) $f(x) = \sin(\pi x/4)$

2.1 b) (11.10.38) $f(x) = e^{3x} - e^{2x}$

2.1 c) (11.10.48) $f(x) = \arctan(x^3)$

2.1 d) (11.10.47) $f(x) = xe^{-x}$

2.1 e) (11.10.37) $f(x) = x\cos(2x)$

2.1 f) (11.10.40) $f(x) = x^2\ln(1+x^3)$

3 Homework 11 Problems: Differential Equations

3.1 (9.1.5) Which of the following functions are solutions of the differential equation $y'' + y = \sin(x)$? Show all work to come to your conclusions.

3.1 a) $y = \sin(x)$

3.1 b) $y = \cos(x)$

3.1 c) $y = 1/2\, x\sin(x)$

3.1 d) $y = -1/2\, x\cos(x)$

3.2 (9.1.7) Consider the differential equation $y' = -y^2$

3.2 a) Verify that all members of the family $y = 1/(x + C)$ are solutions of the equation above.

3.2 b) Can you think of a solution of the differential equation $y' = -y^2$ that is not a member of the family in part a)?

3.2 c) Find a solution of the initial-value problem

$$y' = -y^2, \quad y(0) = 0.5$$

3.3 (9.1.2) Verify that $y = -t\cos(t) - t$ is a solution of the initial value problem

$$t\frac{dy}{dt} = y + t^2\sin(t) \quad y(\pi) = 0$$

Extra Problems 3/27: MATH 112-1 Prof. Maxwell Auerbach

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4 Extra Problems: Taylor Series from Known Series

4.1 Find the Maclaurin series for $f(x)$. If you use a known Taylor Series or Maclaurin Series be sure to cite it.

4.1 a) (original) $f(x) = \sin(\pi x^3/2)$

4.1 b) (original) $f(x) = x^2 \sin(x^2) - \cos(x^2)$

4.1 c) (original) $f(x) = x\cos(x) + \sin(x)$

4.1 d) (original) $f(x) = e^{-x^2/2}$

4.1 e) (original) $f(x) = \ln(1 + 2x^2) - 2x^2$

4.1 f) (original) $f(x) = x^{-2}\arctan(x^2)$

4.1 g) (original) $f(x) = (1 + x^3)e^{x^2}$

4.1 h) (original) $f(x) = x^{-3}\ln(1 + x^3/3)$

4.1 i) (original) $f(x) = \dfrac{x^2}{1 + 4x}$

4.1 j) (original) $f(x) = (\arctan(2x) - 2x)x^{-3}$

4.1 k) (original) $f(x) = 1/2 + x^2 - \cos(x^{1/2})$

4.1 l) (original) $f(x) = \left(\dfrac{1}{3 - 7x} - \dfrac{1}{3} - \dfrac{7x}{9}\right)x^{-2}$

5 Extra Problems: Differential Equations

5.1 (original) Is $y = x^3$ a solution to the differential equation $xy' - 3y = 0$?

5.2 (original) Show that $y = \sin(2t)$ satisfies $\dfrac{d^2y}{dt^2} + 4y = 0$.

5.3 (original) Show that for ant constant P_0, the function $P = P_0e^t$ satisfies the equation

$$\frac{dP}{dt} = P$$

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5.4 (9.1.1) Show that $y = 2e^x/3 + e^{-2x}$ is a solution of the differential equation $y' + 2y = 2e^x$