

## Summer Assignment for DE Differential Equations

- 1) You may use reference materials to complete this assignment.
- 2) The assignment covers material you must know to be successful in DE Differential Equations.
- 3) Please take the assignment seriously.
- 4) The assignment is due the 1st Friday of the Academic Year 2024/2025.
- 5) The Assignment will be used graded as a quiz. It will be graded for accuracy.
- 6) Please email at [isaac.zawolo@apsva.us](mailto:isaac.zawolo@apsva.us) should you have any questions.
- 7) Please use a spiral notebook for this assignment. Loose-leaves papers will not be accepted.

### Week 1: Properties of Logarithms

Expand each of the following. Expanded form should only include linear factors.

$$1) \log_2 \sqrt{\frac{5x^4y^3}{x-3}}$$

$$2) \log_2 \sqrt[3]{\frac{3(x+2)}{x-1}}$$

$$3) \log_4 \frac{(x+5)^2(x-6)}{\sqrt{x+2}}$$

$$4) \log_6 \left( \frac{x}{\sqrt[5]{(y+z)^3}} \right)$$

$$5) \ln \left( x \sqrt{\frac{x}{1-x}} \right)$$

Condense each expression to a single logarithm with a coefficient of 1.

$$6) \log(3x - 1) + \log(x + 4) - 2 \log(3x^2 - 5x + 1)$$

$$7) \ln \sqrt[3]{(x + 4)(5 - 2x)^4 x^2}$$

$$8) \frac{2}{3} \log_4(x^2 - 1) - 3 \log_4(x - 2)$$

$$9) \log_5 x + \frac{\log_5 x}{3} + \frac{\log_5 y}{3}$$

$$10) \ln x - 3[\ln(x + 4) + \ln(x - 4)]$$

## Week 2: Finding Derivative - Basic

Find the derivative:

1)  $y = \frac{x^3 - 2x^2 - 4x}{x^3}$

2)  $y = (4x^5)(\sqrt[3]{x})$

3)  $g(x) = 5x^4 - 3x^3 - 8$

4)  $y = \sin(2x)$

5)  $y = e^{3x}$

6)  $y = \cos(x^2 - 5x)$

7)  $y = \ln(x^3 - 3x^2 + 2x - 1)$

8)  $f(x) = \cosh(2 - 5x)$

9)  $g(x) = 4x - \frac{3}{\sqrt{x}}$

10)  $f(y) = [\ln(6y^2 + 7)]^2$

### Week 3: Finding Derivative - Product, Quotient and Chain Rules

Find the derivative:

$$1) f(x) = \frac{\frac{2}{x^4} + 5x^3 - 9\sqrt[3]{x^8}}{4\sqrt[3]{x}}$$

$$2) g(t) = \sec^3(t^2 - 5)$$

$$3) y = 4x^{-5}\csc(x)$$

$$4) y = \frac{\cot(x)}{3x^3 - 7}$$

$$5) y = 4x^3 e^{5x-4}$$

$$6) y = \frac{2}{\sqrt[3]{x^3 - 4x^2 + 1}}$$

$$7) f(u) = \sqrt[4]{\frac{u^3 - 3}{u^3 + 8}}$$

$$8) f(x) = \sin(\cos(x))$$

$$9) y = 5^{\sin x^3}$$

$$10) y = \sqrt{x^2 + 1}(x^2 + 1)^3$$

## Week 4: Implicit Differentiation

Find  $\frac{dy}{dx}$

1)  $2x^3 + 3y^3 = 9$

2)  $x^3y^3 - x = y$

3)  $x = \cos(xy)$

4)  $y = \sin(3x + 5y)$

5)  $x^2\sin(x) + y^2\cos(y) = 1$

6)  $(3x + 2y)^3 = ye^{2x} + 7$

7)  $y = (3x)^{5x}$

8)  $x\ln y = 2x^3 - 2y$

Find  $\frac{d^2y}{dx^2}$

9)  $x^2 + y^2 = 49$

10)  $x^2 + 4y^2 = 1$

## Week 5: Anti Derivative

Find the general antiderivative and check your solutions by differentiation.

1)  $f(x) = \sqrt{e} + \pi - \ln 19$

2)  $y = e^{-3x}$

3)  $g(x) = \sin(5 - 3x)$

4)  $f(x) = e^x - 4x^2 + \cos x$

5)  $h(x) = x^{\frac{5}{3}} + (2x)^{\frac{1}{3}}$

6)  $y = 6\sec x(\sec x - 3\tan x)$

Solve the initial value problems.

7)  $y' = x^2 - 1, y(3) = 7$

8)  $\frac{dy}{dx} = \cos x - 2\sin x, y(0) = 5$

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

10)  $f'(x) = \cos(x) + \sec^2(x), f\left(\frac{\pi}{4}\right) = 2 + \frac{\sqrt{2}}{2}$

## Week 6: Integration

Integrate the indefinite integrals

1)  $\int (\sin x + \cos x)^2 dx$

2)  $\int \frac{x-1}{x^2-1} dx$

3)  $\int \sqrt{6-x^2} dx$

4)  $\int \frac{\sqrt{x^2-4x}}{x-2} dx$

5)  $\int \sin^3 x \cos^5 x dx$

6)  $\int \frac{x-3}{x^2-4} dx$

7)  $\int \frac{\sqrt{25x^2-1}}{x} dx$

8)  $\int e^{5x} \cos(4x) dx$

9)  $\int \sec x \tan^3 x dx$

10)  $\int \frac{e^{2x}}{1+e^x} dx$