

## Ch. 4 Sec. 5

## Differentiation

In #1 – 9 for each relation between  $t$  and  $y(t)$ , use implicit differentiation to find the numerical value for  $y'(t_0)$  at the given point  $(t_0, y_0)$ .

1.  $(2t + 1)^4 + y + (5y + 1)^3 = 3$  at  $(0, 0)$

2.  $(t + 1)^5 + y + (y^2 + 1)^3 = 10$  at  $(0, 1)$

3.  $(t^2 + 1)^3 + 2y + (y + 1)^5 = 9$  at  $(1, 0)$

4.  $(2t + 1)^3 + ty + (y + 1)^3 = 36$  at  $(1, 1)$

5.  $t^2y + (y + 1)^3 = 17$  at  $(3, 1)$

6.  $y^5 + 3y + t = 8$  at  $(4, 1)$

7.  $ty^5 + 2y = 5$  at  $(3, 1)$

8.  $t + y + e^y = 4$  at  $(3, 0)$

9.  $3t + y + y^2 + e^y = 13$  at  $(4, 0)$

In #10 – 24 for each relation between  $t$  and  $y(t)$ , use implicit differentiation to find a differential equation

$$y' = f(y, t)$$

10.  $2t^3 + 3y - 2y^5 = 1$

11.  $3t - 2y^2 + y^7 = 5.96 \cdot 10^8$

12.  $5e^y + y - t^2 = 0$

13.  $ty - 5y^3 = 7$

14.  $ty^2 - e^y = 1$

15.  $5t^2y + e^{ty} = 73$

16.  $te^y + t + y = 1$

17.  $ye^t + t + y = 1$

18.  $te^y + ty = 1$

19.  $e^{t+y} + t + y = 1$

20.  $\ln(y) + y + t = 1$

21.  $y \ln(y) + t = 1$

22.  $y(y + 1)^{2.7} + t = 1$

23.  $ty + e^{ty} = 1$

24.  $ty + e^y = 1$

# Implicit Differentiation

**Answers:**

1.  $y' = -8/16$

2.  $y' = -5/25$

3.  $y' = -24/7$

4.  $y' = -55/13$

5.  $y' = -6/21$

6.  $y' = -1/8$

7.  $y' = -1/17$

8.  $y' = -1/2$

9.  $y' = -3/2$

10.  $y' = \frac{-6t^2}{3 - 10y^4}$

11.  $y' = \frac{-3}{-4y + 7y^6}$

12.  $y' = \frac{2t}{5e^y + 1}$

13.  $y' = \frac{-y}{t - 15y^2}$

14.  $y' = \frac{-y^2}{2yt - e^y}$

15.  $y' = \frac{-10ty - ye^{ty}}{5t^2 + te^{ty}}$

16.  $y' = \frac{-e^y - 1}{te^y + 1}$

17.  $y' = \frac{-1 - ye^t}{e^t + 1}$

18.  $y' = \frac{-y - e^y}{te^y + t}$

19.  $y' = \frac{-1 - e^{t+y}}{e^{t+y} + 1} = -1$

20.  $y' = \frac{-1}{\frac{1}{y} + 1} = \frac{-y}{1+y}$

21.  $y' = \frac{-1}{1 + \ln(y)}$

22.  $y' = \frac{-1}{2.7y(y+1)^{1.7} + (y+1)^{2.7}}$

23.  $y' = \frac{-ye^{ty}}{1 + te^{ty}}$

24.  $y' = \frac{-y}{t + e^y}$