

Name: Solutions

Math 105: Fall 2013

Quiz 4: October 11

Good Luck!

1. Calculate the derivative of

$$y = 0.1e^x - \frac{23^x}{4} + 5 \ln x - \frac{6}{x} + \frac{7}{x^8} + \cos 9$$

rewrite  $y = (0.1)e^x - \left(\frac{1}{4}\right)23^x + 5 \ln x - 6x^{-1} + 7x^{-8} + \cos 9$

$$y' = 0.1e^x - \frac{1}{4}(\ln 23)23^x + 5 \cdot \frac{1}{x} - 6(-1)x^{-2} + 7(-8)x^{-9} + 0$$

$$y' = 0.1e^x - \frac{(\ln 23)23^x}{4} + \frac{5}{x} + \frac{6}{x^2} - \frac{56}{x^9}$$

2. Calculate the antiderivative of

$$y = 0.1e^x - \frac{23^x}{4} + \sqrt[5]{x} - \frac{6}{x} + \frac{7}{x^8} + \cos 9$$

rewrite  $y = (0.1)e^x - \left(\frac{1}{4}\right)23^x + x^{1/5} - 6 \cdot \frac{1}{x} + 7x^{-8} + \cos 9$

$$Y = 0.1e^x - \frac{1}{4} \frac{23^x}{\ln 23} + \frac{x^{6/5}}{6/5} - 6 \ln|x| + 7 \frac{x^{-7}}{-7} + (\cos 9)x + C$$

$$Y = 0.1e^x - \frac{23^x}{4 \ln 23} + \frac{5}{6} x^{6/5} - 6 \ln|x| - \frac{1}{x^7} + (\cos 9)x + C$$

where  $Y' = y$

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3. Assume that the acceleration due to gravity is  $-9.8 \text{ m/sec}^2$ . A ball is thrown vertically upward from the ground with an initial velocity of  $20 \text{ m/sec}$ . How high will the ball go?

$$p(0) = 0$$

$$v(0) = 20$$

$$v'(t) = a(t) = -9.8$$

$$v(t) = -9.8t + C_1$$

$$20 = -9.8(0) + C_1$$

$$20 = C_1$$

$$p'(t) = v(t) = -9.8t + 20$$

$$p(t) = -\frac{9.8t^2}{2} + 20t + C_2$$

$$0 = -4.9(0)^2 + 20(0) + C_2$$

$$0 = C_2$$

$$p(t) = -4.9t^2 + 20t$$

To find how high the ball goes, we first need to find the time it takes the ball to reach its max height. At the max height, the velocity of the ball is 0. (We either know this physically: it's where the ball's movement changes from going up to going down - velocity changes from positive to negative. Or we know this b/c max  $p(t)$  occurs when  $p'(t) = v(t) = 0$ .)

$$-9.8t + 20 = 0$$

$$20 = 9.8t$$

$$t \approx 2.04 \text{ sec}$$

$$\text{then } p(2.04) = -4.9(2.04)^2 + 20(2.04) = \boxed{20.4 \text{ m}}$$