Name: Key

$\frac{?}{16}$

Collaborative #9 – Spring 2011
Math 1a

Instructions: *In groups of 2 or 3 complete each of the following problems on antiderivatives. This is due by the next class period (Wed., 6/15) as an individual assignment if it is not completed and turned in as a group in class.*

1. Find the most general antiderivative of the function. (#2,4,10 &14 from p. 321 of *Calculus*, Stewart, Ed. 4)

a) $f(x) = 8x^9 - 3x^6 + 12x^3$

$F(x) = \frac{8}{10}x^{10} - \frac{3}{7}x^7 + \frac{12x^4}{4} + C$

$F(x) = \frac{4}{5}x^{10} - \frac{3}{7}x^7 + 3x^4 + C$

b) $f(x) = x(2-x)^2$

$f(x) = x(4 - 4x + x^2)$

$f(x) = 4x - 4x^2 + x^3$

$F(x) = 2x^2 - \frac{4}{3}x^3 + \frac{1}{4}x^4 + C$

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c) $f(x) = \frac{5 - 4x^3 + 2x^6}{x^6}$

$f(x) = \frac{5}{x^6} - \frac{4}{x^3} + 2$

$F(x) = -\frac{1}{x^5} + \frac{2}{x^2} + 2x + C$

d) $f(x) = 2\sqrt{x} + 6\cos x$

$F(x) = \frac{4}{3}x^{3/2} + 6\sin x + C$

2. Find the antiderivative F of f that satisfies the given condition. (#31 from p. 321 of *Calculus*, Stewart, Ed. 4)

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$$f''(x) = \sin\theta + \cos\theta, \quad f(0) = 3, f'(0) = 4$$

$F(\theta) = -\sin\theta - \cos\theta + 5\theta + 4$

$f'(x) = -\cos\theta + \sin\theta + C$ $\quad f'(0) = -\cos(0) + \sin(0) + C = 4$

$-1 + C = 4 \Rightarrow C = 5$

$f(x) = -\sin\theta - \cos\theta + 5\theta + D$

$f(0) = -\sin 0 - \cos 0 + 5(0) + D = 3$

$-1 + D = 3$

$D = 4$

3. The brakes of a car are applied to a car that had an initial velocity of 50 mi/h. The application of the brakes caused a deceleration of 22 ft/s². If you assume that the initial position of the car was zero at time zero, find the distance traveled before the car comes to a complete stop. Hint: The velocity is not in the correct units. Deceleration is negative. (Adapted from #50 p. 322 of *Calculus*, Stewart, Ed. 4). Don't round, use fractions to give an exact value for the distance in feet.

-1

$v(0) = 50\,\text{mi/hr}$ $\quad a(t) = -22\,\text{ft/s}^2$

but we need $50\frac{mi}{hr}$ in $\frac{ft}{sec}$

$v(0) = 50\frac{mi}{hr} \cdot \frac{1\,hr}{3600\,sec} \cdot \frac{5280\,ft}{1\,mi} = \frac{220}{3}\frac{ft}{sec}$

$v(t) = -22t + C \Rightarrow v(t) = -22t + \frac{220}{3}$

$\therefore v(0) = -22(0) + C = \frac{220}{3}$

so $C = \frac{220}{3}$

$s(t) = -11t^2 + \frac{220}{3}t + D$

& we assume $s(0) = 0 \therefore D = 0$

Collab #9 con'd

#3 con'd So now we know $s(t) = -11t^2 + \frac{220}{3}t$

A complete stop means that $v(t) = 0$

$$v(t) = -22t + \frac{220}{3} = 0 \Rightarrow -22t = \frac{-220}{3}$$

$$\Rightarrow t = \frac{-220}{3} \cdot \frac{-1}{22} = \frac{10}{3}$$

$$\therefore\ s\left(\frac{10}{3}\right) = -11\left(\frac{10}{3}\right)^2 + \frac{220}{3}\left(\frac{10}{3}\right)$$

$$= -\frac{1100}{9} + \frac{2200}{9} = \frac{1100}{9} = \boxed{122\tfrac{2}{9}\text{ ft.}}$$

or $= 122.\overline{2}$ ft.