

HW #5

1. B $v(t) = 3t^2 + 6t$ $x(0) = 2$ $x(1) = ?$

$$\int_0^1 (3t^2 + 6t) dt = x(1) - x(0)$$

$$\left[3 \frac{t^3}{3} + 6 \frac{t^2}{2} \right]_0^1 = x(1) - x(0)$$

$$[t^3 + 3t^2]_0^1 = x(1) - 2$$

$$[(1^3 + 3(1)^2) - (0^3 + 3(0)^2)] = x(1) - 2$$

$$4 = x(1) - 2$$

$$6 = x(1)$$

2. omit - repeat from AW #3

3. E $\frac{dy}{dx} = \frac{y^2}{x}$ $y(3) = -2$

$$\int y dy = \int x^2 dx$$

$$y^2 = \frac{2}{3}x^3 - 14$$

$$\frac{1}{2}y^2 = \frac{1}{3}x^3 + C$$

$$y = -\sqrt{\frac{2x^3}{3} - 14}$$

$$y^2 = \frac{2}{3}x^3 + C$$

$$(-2)^2 = \frac{2}{3}(3)^3 + C$$

negative

$$4 = 18 + C$$

b/c initial condition

$$C = -14$$

has negative y-value.

4. E $x(t) = 2t^3 - 21t^2 + 72t - 53$

$$v(t) = 6t^2 - 42t + 72$$

$$v(t) = 6(t^2 - 7t + 12)$$

$$6(t-4)(t-3) = 0$$

$$t = 3, 4$$

5. C

6. D $v(t) = \frac{3}{\sqrt{1+t^2}}$ $\int_0^3 v(t) dt = x(3) - x(0)$

$$x(0) = 2$$

$$x(3) = ?$$

$$4.512 = x(3) - 2$$

7. C $v(t) = 3 + 4.1 \cos(0.9t)$
 $a(t) = v'(t) = 1.633$ calculator

8. A $v(t) = e^t + te^t$
 avg velocity on $[0, 3] = \frac{1}{3-0} \int_0^3 (e^t + te^t) dt$

9. E $a(t) = \ln(1+2^t)$
 $v(1) = 2$ $\int_1^2 \ln(1+2^t) dt = v(2) - v(1)$
 $v(2) = 2$

10. C $\frac{dq}{dt} = 5e^{0.2t} + 4t$ $\int_0^{10} (5e^{0.2t} + 4t) dt$
 $5 \int_0^{10} e^{0.2t} dt + 4 \int_0^{10} t dt$
 $u = \frac{1}{5}t$
 $du = \frac{1}{5} dt$
 $5 \cdot 5 \int_0^{10} \frac{1}{5} e^{0.2t} dt + 4 \int_0^{10} t dt$
 $25e^{0.2t} + \frac{4t^2}{2} \Big|_0^{10}$

$25e^{0.2t} + 2t^2 \Big|_0^{10} = 25e^2 + 2(10)^2 - [25e^0 + 0]$
 $25e^2 + 200 - 25$
 $25e^2 + 175$

11. B $\frac{dy}{dx} = y \sec^2 x$
 $\int \frac{1}{y} dy = \int \sec^2 x dx$
 $\ln|y| = \tan x + C$
 $y = e^{\tan x + C}$
 $y = Ce^{\tan x}$
 $-1 = Ce^{\tan(\pi/4)}$
 $-1 = Ce^1$
 $-e^{-1}$

$y = -e^{-1} \cdot e^{\tan x}$
 $y = -e^{-(1+\tan x)}$