Warmup 5.2

Determine (An identity crisis is not a good thing to experience at this point)

a)
$$\int e^{15x} dx$$

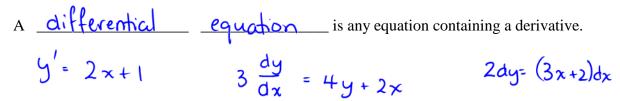
b)
$$\int \left(\frac{\sin 8x}{3} - x^{\frac{2}{3}}\right) dx$$

c)
$$\int \left(\sin^2 x + \cos^2 x\right) dx$$

d)
$$\int \left(\cos^2 x - \sin^2 x\right) dx$$

e) $\int \cot^2 x \, dx$

Initial Value Problems



An **initial value problem** is one where you are given the <u>derivative</u> and the value of the <u>______</u> at a given point, and are asked to find the <u>original function</u>. The value of y that is given to you is called the <u>initial value</u>. Solving the differential equation means to find **all** functions that satisfy the differential equation. Finding the solution that satisfies the initial condition means that we have <u>Solved</u> the <u>initial value</u> problem.

Previous Problem	Initial Value Problem	
Find the function $y = f(x)$ with a derivative of $\cos x + 3x$ and which passes through the point (0, 5).	Solve the initial value problem:	
	Differential equation: $\frac{dy}{dx} = \cos x + 3x$	
	Initial condition: $y(0) = 5$	

Solve the initial value problems

1. $\frac{dy}{dx} = 9 x^2 - 7 x$, $y(2) = 10$	$10 = 3(2)^3 - \frac{7}{2}(2)$	$(1)^{2} + C$
$y = \int 9x^2 - 7x dx$	10 = 24 - 14 -	+ C
$y = 3x^3 - \frac{7}{2}x^2 + C$	C=0	
y(2) = 10	$y = 3x^3 - \frac{7}{2}x^2$	
2. $\frac{d^2y}{dt^2} = -2\cos t$, $y(0) = 4$, $y'(0) = -2\cos t$		y (0)= 4
$\frac{dy}{dt} = \int -2\cos t dt$	$\frac{dy}{dt} = -2 \text{ sint } -3$	4 = 2cos(0) - 3(b) + C
	$y = \int -2 \sin t -3 dt$	4=2(1) +C C=2
$\frac{dy}{dt} = -2 \sin t + C$ $\frac{dy}{dt} = -2 \sin (0) + C = -3$	Y= 2 cost - 3t + C	Y=2cost -3++2

In
$$y = y' \cdot \frac{1}{9}$$

3. Solve the differential equations: a) $\frac{dy}{dt} = \frac{y}{1}$ b) $\frac{dy}{dt} = ky$
 $\frac{dy}{9} = 1 \cdot dt$ $\frac{dy}{9} = k \cdot dt$
 $\int \frac{1}{9} \cdot dy = \int 1 \cdot dt$ $\int \frac{1}{9} \cdot dy = \int k \cdot dt$
In $y = t + C$ In $y = kt + C$
 $g = e^{t+C}$ $g = e^{kt+C}$
 $y = e^{t+C}$ $y = e^{kt+C}$
 $y = e^{t+C}$ $y = e^{kt+C}$
 $y = e^{kt+C}$ $y = e^{kt+C}$
The solution to the differential equation, $\frac{dy}{dt} = ky$ is $y = c \cdot e^{kt}$
i. The solution to $\frac{dy}{dt} = .05y$ is $y = c \cdot e^{0.5t}$
4. An amount of money, y_0 , is invested at 6.9% compounded continuously. What does this mean?
 $y_0 = amount$ at the $y = 0$ $y = amount$

$$3b^{2} = \text{amount at time} = 0$$

$$y = \text{amount}$$

$$\frac{dy}{dt} = 0.069.y$$

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$$\frac{dy}{dt} = 0.069.y$$

$$\int \frac{dy}{dt} = 0.069.y$$

$$\int \frac{dy}{dt} = 0.069.dt$$

$$\int y = 0.069t + C$$

$$y = e^{0.069t + C}$$

$$y = e^{0.069t + C}$$

$$y = c \cdot e^{0.069t}$$

$$\int \frac{dy}{dt} = c \cdot e^{0.069t}$$