

KEY

NAME = _____

Period = _____

Sheet # 652 : Impl. DIFF., DIFF. EQ., AVE. VAL.

1. Find y' for $(x+1)^2 + (y-2)^2 = 25$

$$2(x+1) + 2(y-2)y' = 0$$

$$y' = \frac{-2(x+1)}{2(y-2)} \quad \boxed{y' = \frac{-(x+1)}{y-2}}$$

2. Find y for $y' = \frac{-(x-2)}{(y+1)}$. What does C mean?

$$\int (y+1) dy = \int -(x-2) dx$$
$$\frac{(y+1)^2}{2} = -\frac{(x-2)^2}{2} + C$$

$(x-2)^2 + (y+1)^2 = C$
CIRCLE CENTERED AT $(2, -1)$
WITH $(RADIUS)^2 = C$.

3. Newton's Law: $T = 100 - 80e^{-0.01t}$ (Use $^{\circ}C$ And MIN.)

a, Cooling or heating? Heating.

b, What is initial temperature? $20^{\circ}C$

c, What is final temperature? $100^{\circ}C$

d, when is $T = 40^{\circ}C$?

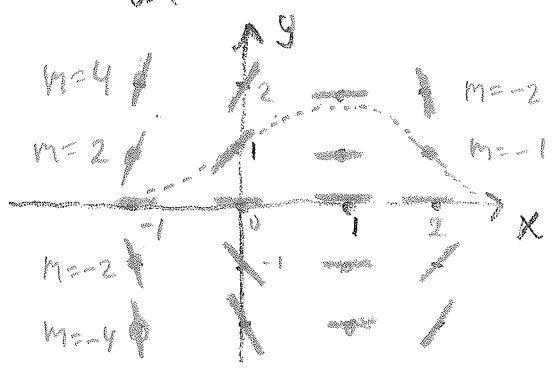
$$40 = 100 - 80e^{-0.01t}$$

$$\ln\left(\frac{60}{80}\right) = -0.01t \quad \boxed{t = \frac{\ln(3/4)}{-0.01} = 28.768 \text{ MIN.}}$$

$\approx 29 \text{ MIN.}$

4. Draw the slope/direction field.

$$\frac{dy}{dx} = y(1-x)$$



$$\int \frac{dy}{y} = \int (1-x) dx$$

$$\ln|y| = x - \frac{x^2}{2} + C$$

$$y = A e^{(x - x^2/2)}$$



5. Find the average value

a, over $[0, \pi/2]$ =

b, $f(x) = \sin(x)$

b, $g(x) = \sin(x) + 1$

$$f_{ave} = \frac{\int_0^{\pi/2} \sin(x) dx}{\pi/2 - 0} = \frac{-\cos(x) \Big|_0^{\pi/2}}{\pi/2} = \frac{-(0-1)}{\pi/2} = \frac{2}{\pi}$$

$$f_{ave} = \frac{2}{\pi} + 1 \quad (\text{AVERAGE GOES UP BY 1 UNIT.})$$