

## Math 202 - Quiz # 4c

Name: Solution

Ser. # \_\_\_\_\_

Use a suitable substitution to solve the following differential equation:

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

Put  $u = x - y$ 

$$du = dx - dy \implies dy = dx - du$$

Substitute in the given DE:

$$\frac{dx - du}{dx} = \frac{1}{u+2} - (u+1)$$

$$1 - \frac{du}{dx} = \frac{1}{u+2} - u - 1$$

$$\begin{aligned} \frac{du}{dx} &= 2 + u - \frac{1}{u+2} &= \frac{2u+4+u^2+2u-1}{u+2} \\ & &= \frac{u^2+4u+3}{u+2} \end{aligned}$$

$$\therefore dx = \frac{u+2}{u^2+4u+3} du$$

$$\int dx = \int \frac{u+2}{u^2+4u+3} du$$

$$\begin{aligned} x &= \frac{1}{2} \ln |u^2+4u+3| + C \\ &= \frac{1}{2} \ln |(x-y)^2+4(x-y)+3| + C \end{aligned}$$

The solution is:

$$x = \ln \sqrt{(x-y)^2+4(x-y)+3} + C$$