

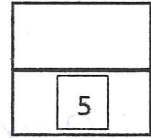


Quiz 3



MATH 172 Lab: Section 7

Lab Instructor (TA): Mohammed Kaabar

Student's Name: Mohammed KaabarStudent's ID: - Solution -*Note: This quiz covers only the differential equations and integration by parts.***Show your work and circle your answers. Neatness and organization count!****Question 1:** (2 points) Find the general solution of the given differential equation:

$$\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$$

(Hint: General solution means that you need to write it as $y(x)$ as we did in the Differential Equations Lab on Thursday)

$$\Rightarrow \frac{dy}{dx} \times \frac{1}{1+y^2} = \frac{1}{1+x^2} dx$$

$$\Rightarrow \frac{1}{1+y^2} dy - \frac{1}{1+x^2} dx = 0 \Rightarrow \int \frac{1}{1+y^2} dy - \int \frac{1}{1+x^2} dx = \int 0$$

$$\Rightarrow \boxed{\tan^{-1}(y)} - \tan^{-1}(x) = C \Rightarrow \tan^{-1}(y) = \tan^{-1}(x) + C$$

Take tan of both sides

$$\Rightarrow \tan(\tan^{-1}(y)) = \tan(\tan^{-1}(x) + C) \Rightarrow \boxed{y(x) = \tan(\tan^{-1}(x) + C)}$$

$$\Rightarrow \boxed{\therefore y(x) = x + C}$$

where C is a constant

Question 2: (3 points) Evaluate the following integral:

$$\int x \sec^2 x \, dx$$

(Hint: Remember $\int \tan(x) \, dx = \int \frac{\sin(x)}{\cos(x)} \, dx$)

By parts: $u = x$ \rightarrow $dv = \sec^2 x \, dx$
 $du = dx$ \leftarrow $v = \tan(x)$

$$\int x \sec^2 x \, dx = x \tan(x) - \int \tan(x) \, dx$$

$$= x \tan(x) - \int \frac{-\sin(x)}{\cos(x)} \, dx$$

$$= x \tan(x) + \ln|\cos(x)| + C$$

$$\text{Thus, } \int x \sec^2 x \, dx = x \tan(x) + \ln|\cos(x)| + C$$