Name: _____

PHYS2502 Mathematical Physics S23 Quiz #5 16 Feb 2023

You have fifteen minutes to complete this quiz. You may use books, notes, or computers you have with you, but you may not communicate with anyone other than the instructor.

Write your solution on this page, plus the back if necessary, and additional sheets if absolutely necessary. You must show the steps of your solution.

Solve the following differential equation and boundary condition for the function $y(x)$:

$$(2x + 3)\,dx - 2y\,dy = 0 \qquad \text{and} \qquad y(0) = 1$$

PHY2502 Mathematical Physics Quiz #5 Solution

Solve the following differential equation and boundary condition for the function $y(x)$:

$$(2x+3)\,dx - 2y\,dy = 0 \qquad \text{and} \qquad y(0) = 1$$

This equation is both exact and separable, but the simple way to solve it is just to integrate through. Just doing it with indefinite integrals, we get

$$\int (2x+3)\,dx - \int 2y\,dy = x^2 + 3x - y^2 = C$$

Setting $x = 0$ and $y = 1$ gives $C = -1$ so

$$y^2 = x^2 + 3x + 1 \qquad \text{and} \qquad y(x) = \sqrt{x^2 + 3x + 1}$$

where we take the positive sign of the square root in order to satisfy $y(0) = +1$.