AMCS 201 (2023)

1. Solve the following first-order differential equations

   (1) $y'-2y=x^2$

   (2) $y'-2y=y^{-2}$

   (3) $y'-3xy=x$

   (4) $xy'=y+\sqrt{xy}$

   (5) $y'=\dfrac{x+2y+3}{2x-y+5}$

   (6) $y'=\dfrac{x+2y+3}{x+2y+5}$

   (7) $y'=-\dfrac{y\cos(x+y)+x+y}{\sin(x+y)+y\cos(x+y)+x+y}$

2. Consider the following ODE

   $$y'=2y/x$$

   a. Please state the condition on the initial values $y(x_0) = y_0$ that is sufficient to guarantee a unique solution that passing through (x_0, y_0).

   b. If the initial value is given by

      i. $y(0)=0$,

      ii. $y(0)=1$,

      iii. $y(1)=0$,

      Solve the problem and verify the conclusion drew from (a).