Question one: Solve the following ODE.

1. $xdy = \left(xe^{\frac{y}{x}} + y + x\right)dx$.

2. $\frac{dy}{dx} = \frac{xy + 3x - y - 3}{xy - 2x + 4y - 8}$, $y \neq 2,\ y \neq -3$.

3. $x^2 \sin\left(\frac{y^2}{x^2}\right) - 2y^2 \cos\left(\frac{y^2}{x^2}\right) dx + 2xy \cos\left(\frac{y^2}{x^2}\right) dy = 0$.

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

5. $(6x+1)y^2 y' + 2y^3 + 3x^2 = 0$.

6. $y' = \tan^2(x+y)$. (**Hint:** Let $u = x+y$)

7. $(t^2+1)y' - 4t(y + \sqrt{y}) = 0$. (Try by two methods!)

8. $y' = 2 + \sqrt{y - 2x + 3}$. (**Hint:** Let $u = y - 2x + 3$)

9. $(x\sin y + \cos y)y' + (x+y)\sin y = 0$.

10. $\frac{1}{z}\frac{dz}{dx} + \frac{1}{x}\ln z = 3x$. (**Hint:** Let $u = \ln z$)

11. $(x^2+1)y' + 3x^3 y = 6xe^{-\frac{3}{2}x^2}$, $y(0) = 1$.

12. $x(x^2+4)\ln y\, y' = 12y^{-2}$.

Question Two: An object with temperature $108°F$ was placed outside where the temperature is $-20°F$. At $00:00$ the temperature of the object is $60°F$ and at $00:02$ the temperature of the object is $30°F$. At what time was the object placed outside?

Good Luck